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A CRITICAL THINKING ASPECT OF SYSTEMS THINKING VERSUS ANALYTICAL THINKING

Nicholas W. Twigg
Coastal Carolina University
ntwigg@coastal.edu

Janice A. Black
Coastal Carolina University
janblack@coastal.edu

Abstract

There seems to be many definitions of critical thinking in the literature depending upon the discipline if any definition at all. Many scholars never really define what they mean by critical thinking beyond, well I'll know it when I see it. In this presentation we take the view that critical thinking has a definition and from that definition a methodology based on systems thinking can be taught and applied in real world situations. We use two models of systems thinking, one from an Operations/Management Science perspective and another from Systems theory perspective (Senge, 1990). We then make the case for a personality component which designates whether one will have an analytical or a systemic approach to problems/issues (Myers & McCaulley, 1985, Quenk, 2009). Looking at a Jung style personality profile as a continuum between ESTJ and INFP we show one end will rely upon analytical thinking (ESTJ) whereas the other end (INFP) will apply a more systemic approach.

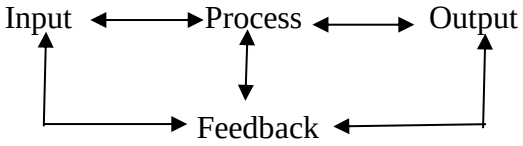
CRITICAL THINKING AND PERSONALITY

I use the MBTI where introversion and extroversion are where we get our energy from rather than our type A or B personality (Myers & McCaulley, 1985). I give a very animated 2 minute lecture on the joys of leadership and ask the audience (students) to comment on intrinsic or extrinsic behavior. Invariably they say extrovert. When I point out their behavior during the "lecture" was at best lethargic, I ask where did I get my energy? Certainly not from them. That is point one. Using personality theory based on Jung's work as extended by the Myers Briggs movement (Myers & McCaulley, 1985, Quenk, 2009), I define/describe the ESTJ as very analytical/linear (which is how most in the western world are taught from a young age) and the other end of the spectrum INFP as relational/global. I use the ESTJ model for a manager (plan, direct, organize, & control) and the INFP as a leader (coach, mentor, and facilitator). I then move to a Transformational Leadership model from Bass (1985) where a leader is only transformational to the extent they augment their transactional leadership behaviors. As you may already have concluded transformational leaders tend to have more relational behaviors (INFP) and Transactional managers, as the name applies, more linear (ESTJ) behaviors. I profess analytical/linear thinking is good for distinct types of problem solving where the problem is well defined (a fire in the kitchen), but most managers of today are not faced with simple problems. The problems of today are very complex with many unknown consequences. I profess Systems Thinking is the solution as it is relational, incorporates delays, and gives the opportunity to understand the data presented as a means to not only action, but also beliefs.

We will use a definition provided by Scriven and Paul in 2007.

> Critical thinking "is…*the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action"* (Scriven & Paul, 2007, p. 1)

or more simply Critical Thinking is a *process* of *evaluating information* as a *guide to belief and action* (italics are mine). Therefore if Critical Thinking is a process, then Operations/Management Science systems theory would imply there must be Inputs, Outputs, and Feedback.



"Loopy" Thinking

Businesses are collectives that operate within a boundary and with targeted goals and so business students need to learn to operate within goal boundaries as well. The purpose of a system is stated as a "given" with its attendant assumptions (Senge, 1990). Then, the identification of the parts that go into that system is delineated. These parts are then linked by their relationships. These relationships reveal the "causal" effect on a subsequent part of the system for each elemental part of the system (and they can be embedded sub-systems). There are two types of causal effects that we model with our "loopy" thinking: a reinforcing loop and a balancing loop (Sterman, 2000). The set of elemental parts and their relationships are the "structure" of the system (Senge, 1990). Integral to this understanding is to realize that people are inherently part of this system (Senge, 1990).

Systems Thinking and Critical Thinking

A first linkage between critical thinking and systemic thinking is that critical thinking represents a system of thought with relationships between parts or elements. The opposite is true too. Systemic thinking is a way of applying critical thinking.

Conclusion on Systems Thinking-Critical Thinking.

Critical thinking provides some basic elements of thinking and implies others. As taught in K-12 educational systems, it provides exposure to the basic elements of good thought and some problem solving. However, it does not help students to use a logical framework, clear reasoning (McCollister & Sayler, 2010), or, from this integration with systemic thinking, to address dynamic issues. The thinking elements as provided by Paul and Elder (2006) implies some dynamics with the inferences and implications elements but leaves out explicit time considerations and changes to the original elements of thought from the thought elements being a part of any system. Systemic

thinking provides a sequencing of using and reusing the thought elements in a reasoned way. However, the logic basis required by mature thinking and implied in the inferences and assumptions is still missing. Thus, we now turn to persuasive logic.

CONCLUSION

We have demonstrated how the base critical thinking model as presented by Paul and Elder (2006) has limitations as a tool for enabling business students to gain the level of critical thinking expected by employers (English, Manton, & Walker, 2007; Hines & Basso, 2008). Expanding the model by adding elements from both an Operational/Management Science perspective and a systems thinking perspective. We propose that colleges of business which have a program goal of enabling students to use critical thinking use the Input, Process, Output, and Feedback model to evaluate as much information as possible to arrive at a belief or action. Each time students use this method they are applying the critical thinking model in a customized fashion for its application in business settings. Each time a different faculty uses this same system and applies it in a slightly different fashion, students see how to adapt the model for their use in the future. This allows students to answer surveys and employers confidently that they know how to use critical thinking methods and to be confident in their use in multiple contexts.

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Biographies

NICHOLAS W. TWIGG is a Professor of Management and current editor of the Coastal Business Journal. He received his Doctorate (DBA) from Louisiana Tech University in 2004. Prior to working at Coastal, Twigg delivered undergraduate and graduate courses in leadership, organizational behavior, operations management, and other business related courses at various Higher Education Institutions in Louisiana and Texas. Twigg has worked as a Quality Manager at the Lawrence Berkeley Laboratory, University of California, Berkeley. Twigg spent 22 years in the U.S. Navy Nuclear Power Program rising to the rank of Master Chief Electronics Technician, Surface Warfare qualified (ETCMSW). Master Chief Twigg was responsible for directing a 5 week course in Career programs for career specialists with the Commander of Fighter Wing One in Oceana, Virginia. His main areas of specialization are leadership, organizational behavior, and entrepreneurship. Dr. Twigg is a volunteer for the Service Corps of Retired executives (SCORE) as a mentor and educator. He is the vice chairman of Create!Conway a nonprofit, 501c3, civic organization, and is on the Board of Directors for the Regional Transit Authority for the southeast coast region of the U.S. Dr. Twigg may be reached at ntwigg@coastal.edu.

JANICE A. BLACK is currently a Professor of Strategy and Entrepreneurship at Coastal Carolina University. She earned her B.S. from California State University, Sacramento, her MBA from Sonoma State University and her Ph.D. from Texas Tech University in Business Administration. Her dissertation and subsequent work is on the configurations of tangible and intangible resources that support a competitive advantage in changing environments. Based in Complexity Theory, she supports minimal external rules and basic internal values to guide actions in a variety of contexts. In this instance, she has been working on critical thinking skills for novice entrepreneurs to enhance their ability to start businesses. Her work has been presented in 14 different countries and in over 20 articles in journals ranging from The Strategic Management Journal, to Entrepreneurship Theory and Practice, to The Leadership Quarterly. Dr. Black may be reached at janblack@coastal.edu (mailto:janblack@coastal.edu>.

A GENERALIZATION OF THE GENERALIZED QUADRATIC ASSIGNMENT PROBLEM

Alan McKendall, Department of Industrial & Management Systems Engineering,
West Virginia University, Morgantown, WV 26506, alan.mckendall@mail.wvu.edu

ABSTRACT

The generalized quadratic assignment problem (GQAP) is stated as the problem of assigning a set of M facilities to a set of N locations ($M > N$), without exceeding the capacities of the locations, such that the sum of the assignment and transportation costs is minimized. In this paper, the GQAP with discrete time periods within the planning horizon is considered. This problem is called the dynamic GQAP (DGQAP) and is a generalization of the GQAP. Three formulations are presented for the DGQAP. Also, a problem instance is presented and solved using two of the formulations.

INTRODUCTION

The generalized quadratic assignment problem (GQAP) is stated as the problem of assigning a set of M facilities to a set of N locations ($M > N$), without exceeding the capacities of the locations, such that the sum of the assignment and transportation costs is minimized. The GQAP is similar to the quadratic assignment problem (QAP) where $M = N$. That is, N facilities are assigned to N locations where each facility is assigned to a location, and exactly one facility is assigned to each location. However, in the GQAP, more than one facility may be assigned to each location such that location capacities are not violated. Therefore, the GQAP is a generalization of the QAP and is more difficult to solve. **Lee and Ma (2004)** first introduced the GQAP to solve the problem of assigning a set of equipment to a set of locations. More specifically, they considered the GQAP where a manufacturing company decided to locate multiple equipment types at different manufacturing sites such that the sum of the costs of moving intermediate parts between sites, where a sequence of operations are performed on the parts, and the costs of assigning the equipment to the sites is minimized. **Lee and Ma (2004)** presented a mathematical programming formulation of the problem. The formulation of the GQAP is given below and is an adaptation of the model presented by **Lee and Ma (2004)**.

$$\text{Minimize } z = \sum_{i=1}^{M}\sum_{k=1}^{N} a_{ik}x_{ik} + \sum_{i=1}^{M}\sum_{j=1}^{M}\sum_{k=1}^{N}\sum_{l=1}^{N} c_{ijkl} f_{ij} d_{kl} x_{ik} x_{jl} \quad (1)$$

$$\text{s.t.} \quad \sum_{k=1}^{N} x_{ik} = 1, \qquad i = 1, \ldots, M \quad (2)$$

$$\sum_{i=1}^{M} r_i x_{ik} \le C_k, \quad k = 1, \ldots, N \quad (3)$$

$$x_{ik} = \{0, 1\}, \qquad i = 1, \ldots, M, k = 1, \ldots, N \quad (4)$$

where M is the number of facilities, N is the number of locations, a_{ik} is the cost of assigning facility i to location k, f_{ij} is the amount of materials transported from facility i to facility j, d_{kl} is the distance from location k to location l, c_{ijkl} is the unit cost per distance unit of moving materials from facility i (at location k) to facility j (at location l), r_i is the space requirement of facility i, and C_k is the amount of space capacity available at location k. The decision variables are defined as

$$x_{ik} = \begin{cases} 1, if \ \ facility\, i\, is\, assigned\, to\, location\, k, \\ 0, otherwise. \end{cases}$$

Objective function (1) minimizes the sum of the assignment and transportation costs. Constraints (2) ensure that each facility is assigned to only one location. Constraints (3) ensure that the capacity of each location is not exceeded, and the restrictions on the decision variables are given in (4). Since one of the terms in the objective function is quadratic (nonlinear), **Lee and Ma (2004)** presented three methods for the linearization of the formulation. They also presented a branch and bound algorithm to optimally solve the GQAP. Other exact methods were presented for the GQAP, see **Hahn et al. (2008)** and **Pessoa et al. (2010)**.

The nonlinear GQAP model (1) – (4) can be linearized using the standard linearization technique of substituting the variable w_{ijkl} for the quadratic term $x_{ik}x_{jl}$ in objective function (1). Then replace objective function (1) with

$$\text{Minimize } z = \sum_{i=1}^{M}\sum_{k=1}^{N} a_{ik}x_{ik} + \sum_{i=1}^{M}\sum_{j=1}^{M}\sum_{k=1}^{N}\sum_{l=1}^{N} c_{ijkl} f_{ij} d_{kl} w_{ijkl} \qquad (1')$$

and add the following constraints

$$x_{ik} + x_{jl} - 1 \le w_{ijkl} \qquad \text{for } i, j = 1, \ldots, M, k, l = 1, \ldots, N \text{ where } j \ne i \text{ and } l \ne k \qquad (5)$$

$$w_{ijkl} \ge 0 \qquad \text{for } i, j = 1, \ldots, M, k, l = 1, \ldots, N \text{ where } j \ne i \text{ and } l \ne k \qquad (6)$$

As a result, the linearized model (i.e., a mixed integer linear programming model) for the GQAP consists of objective function (1') subject to constraints (2) – (6). This model will be used later to solve a small GQAP instance.

Since the mathematical models presented for the GQAP can only be used to solve small-size problems in reasonable time, heuristic methods were developed for the GQAP. As a result, a different formulation, called a combinatorial optimization problem (COP) formulation, is presented for the GQAP.

COP Formulation for the GQAP

The solution for the GQAP can be represented as

$\boldsymbol{S}$ = ($s(1), s(2), \ldots, s(M)$) where $s(i) = k$, which is equivalent to assigning facility i to location k. Therefore, using the problem parameters defined earlier, the COP model for the GQAP is as follows.

$$\text{Minimize } TC(\boldsymbol{S}) = \sum_{i=1}^{M} a_{is(i)} + \sum_{i=1}^{M}\sum_{\substack{j=1 \\ j\ne i}}^{M} c_{ijs(i)s(j)} f_{ij} d_{s(i)s(j)} \qquad (7)$$

$$\text{s.t.} \quad \sum_{\forall i \ s.t. \ s(i)=k} r_i \le C_k \qquad \text{for } k = 1, \ldots, N \qquad (8)$$

Objective function (7) minimizes the sum of the assignment and transportation costs, and constraints (8) ensure that the capacity of each location is not exceeded. Heuristic methods were developed to solve large size GQAP models in reasonable time. **Cordeau et al. (2006)** presented a memetic heuristic for the problem and an application which uses the GQAP to manage containers in a storage yard (assign M container groups to N storage areas). **Mateus et al. (2011)** presented several greedy randomized adaptive search procedures (GRASP) with path-relinking heuristics using different construction, local search, and path-relinking

procedures. **McKendall (2016)** presented several construction algorithms and a simple tabu search heuristic for the GQAP.

A GQAP Instance

Consider a GQAP instance where 6 facilities are assigned to 3 locations (i.e., $M = 6$, $N = 3$). The unit cost per distance unit of moving materials between each pair of facilities is 1 (i.e., $c_{ijkl} = 1$). The space requirement for each facility i is r_i = (2, 1, 2, 1, 2, **3**), e.g. facility 6 requires 3 units of space (i.e., $r_6 = 3$). The space capacity for each location k is C_k = (3, 3, **6**), e.g. location 3 has 6 units of space available ($C_3 = 6$). See **Table 1** for additional input data. More specifically, the costs of assigning facilities to locations (a_{ik}), the flow of materials between each pair of facilities (f_{ij}), and the distances between each pair of locations (d_{kl}) are given in **Table 1**. For example, the cost of assigning facility 4 to location 1 is 10 (i.e., $a_{41} = 10$), and the amount of materials transported from facility 2 to facility 3 is 10 units (i.e., $f_{23} = 10$). Also, the distance from location 1 to location 2 is 2 distance units (i.e., $d_{12} = 2$).

a_{ik} =

	1	2	3
1	5	9	7
2	8	5	6
3	6	9	10
4	10	6	7
5	7	10	5
6	8	6	10

f_{ij} =

	1	2	3	4	5	6
1	0	5	10	2	0	0
2	0	0	10	0	0	0
3	0	0	0	5	0	0
4	0	0	0	0	10	0
5	0	0	0	0	0	5
6	0	0	0	0	0	0

d_{kl} =

	1	2	3
1	0	2	5
2	2	0	3
3	5	3	0

Table 1. Additional input data for the GQAP instance.

Using the input data presented above and the linearized mathematical formulation of the GQAP presented earlier, which consists of objective function (1') subject to constraints (2) – (6), the optimal solution is obtained for the problem instance using CPLEX 11.0 commercial solver. Since the variables w_{ijkl} are used only to linearize the objective function, the values of these variables do not give any useful information and are not given here. However, $x_{13} = x_{23} = x_{33} = x_{42} = x_{52} = x_{61} = 1$, and all other decision variables are assigned the value zero. The total cost of the solution (z^*) is 78 which is the sum of 47 (total assignment cost) and 31 (total material handling cost). More specifically, machine 6 is assigned to location 1, machines 4 and 5 are assigned to location 2, and machines 1, 2, and 3 are assigned to location 3.

Using the input data presented above, complete enumeration, and the COP formulation of the GQAP presented earlier, which consists of objective function (7) subject to constraints (8), the optimal solution is obtained for the problem instance using Matlab. Complete enumeration is an exact method which obtains the optimal solution by considering all possible solutions of a model. First, all possible solutions of the COP model are generated. Recall, the solution is represented as $\boldsymbol{S}$ = (*s(1), s(2), s(3), s(4), s(5), s(6)*) where *s(i)* = *k*, which is equivalent to assigning facility *i* to location *k*. Since each of the 6 facilities can be assigned to one of the three possible locations, there are $729 = 3^6$ possible solutions. See **Table 2** for the first 27 solutions, and the last 9 solutions.

1	(1, 1, 1, 1, 1, 1)	10	(1, 1, 1, 2, 1, 1)	19	(1, 1, 1, 3, 1, 1)	…	721	(3, 3, 3, 3, 1, 1)
2	(1, 1, 1, 1, 1, 2)	11	(1, 1, 1, 2, 1, 2)	20	(1, 1, 1, 3, 1, 2)	…	722	(3, 3, 3, 3, 1, 2)
3	(1, 1, 1, 1, 1, 3)	12	(1, 1, 1, 2, 1, 3)	21	(1, 1, 1, 3, 1, 3)	…	723	(3, 3, 3, 3, 1, 3)
4	(1, 1, 1, 1, 2, 1)	13	(1, 1, 1, 2, 2, 1)	22	(1, 1, 1, 3, 2, 1)	…	724	(3, 3, 3, 3, 2, 1)
5	(1, 1, 1, 1, 2, 2)	14	(1, 1, 1, 2, 2, 2)	23	(1, 1, 1, 3, 2, 2)	…	725	(3, 3, 3, 3, 2, 2)
6	(1, 1, 1, 1, 2, 3)	15	(1, 1, 1, 2, 2, 3)	24	(1, 1, 1, 3, 2, 3)	…	726	(3, 3, 3, 3, 2, 3)
7	(1, 1, 1, 1, 3, 1)	16	(1, 1, 1, 2, 3, 1)	25	(1, 1, 1, 3, 3, 1)	…	727	(3, 3, 3, 3, 3, 1)
8	(1, 1, 1, 1, 3, 2)	17	(1, 1, 1, 2, 3, 2)	26	(1, 1, 1, 3, 3, 2)	…	728	(3, 3, 3, 3, 3, 2)
9	(1, 1, 1, 1, 3, 3)	18	(1, 1, 1, 2, 3, 3)	27	(1, 1, 1, 3, 3, 3)	…	729	(3, 3, 3, 3, 3, 3)

Table 2. Some possible solutions for the GQAP instance.

Second, the feasibility of each possible solution is determined by using constraints (8). Consider the fourteenth solution generated (i.e., $\boldsymbol{S}$ = (1, 1, 1, 2, 2, 2)) where facilities 1, 2, and 3 are assigned to location 1 (i.e., $s(1) = s(2) = s(3) = 1$), and facilities 4, 5, and 6 are assigned to location 2 (i.e., $s(4) = s(5) = s(6) = 2$). Notice no facilities are assigned to location 3. For location 1 (i.e., $k = 1$), consider constraint (8).

$$\sum_{\forall i \text{ s.t. } s(i)=1} r_i \leq C_1 \qquad \text{or} \qquad \sum_{i=1,2,3} r_i = r_1 + r_2 + r_3 = 2 + 1 + 2 = 5 \leq 3 \text{ (not true)}$$

Recall, the space requirements for facilities 1, 2, and 3 are $r_1 = 2$, $r_2 = 1$, and $r_3 = 2$, respectively, and the space capacity of location 1 is $C_1 = 3$. Since the total amount of space required is 5 units, and the amount of space capacity at location 1 is 3 units, the capacity constraint for location 1 is violated. Therefore, the solution $\boldsymbol{S}$ = (1, 1, 1, 2, 2, 2) is not feasible (i.e., infeasible). Similarly, the feasibility of the solution $\boldsymbol{S}$ = (3, 3, 3, 2, 2, 1) is checked using constraints (8). Notice this is the optimal solution obtained using the mathematical model. Nevertheless, see **Table 3**, which shows that the space required by the facilities assigned to each location does not exceed the capacities of the locations. Thus, solution $\boldsymbol{S}$ = (3, 3, 3, 2, 2, 1) is feasible.

Location (k)	Space Capacity (C_k)	Facilities Assigned to Location k ($\forall i$ s.t. $s(i) = k$)	Total Space Required ($\sum r_i$)	Remaining Capacity ($C_k - \sum r_i$)
1	3	6	3	3 – 3 = 0
2	3	4, 5	1 + 2 = 3	3 – 3 = 0
3	6	1, 2, 3	2 + 1 + 2 = 5	6 – 5 = 1
Total	12		11	1

Table 3. Verification of the feasibility of solution $\boldsymbol{S}$ = (3, 3, 3, 2, 2, 1).

Once it has been determined which solutions are feasible, the third step of complete enumeration is to obtain the total cost of each feasible solution using objective function (7), and the solution with the lowest total cost (i.e., $\boldsymbol{S}^*$) is the best (or optimal) solution. Considering solution $\boldsymbol{S}$ = (3, 3, 3, 2, 2, 1), the total assignment cost is 47 and is obtained as follows using part of objective function (7).

$$\sum_{i=1}^{6} a_{is(i)} = a_{1s(1)} + a_{2s(2)} + a_{3s(3)} + a_{4s(4)} + a_{5s(5)} + a_{6s(6)} = a_{13} + a_{23} + a_{33} + a_{42} + a_{52} + a_{61}$$

$$= 7 + 6 + 10 + 6 + 10 + 8 = 47$$

The total material handling cost is 31 and is obtained by considering all nonzero flows (f_{ij}) as below (recall all $c_{ijkl} = 1$).

$$\sum_{i=1}^{M}\sum_{\substack{j=1\\ j\neq i}}^{M} f_{ij}d_{s(i)s(j)} = (f_{12}d_{s(1)s(2)} + f_{13}d_{s(1)s(3)} + f_{14}d_{s(1)s(4)}) + (f_{23}d_{s(2)s(3)}) + (f_{34}d_{s(3)s(4)}) + (f_{45}d_{s(4)s(5)}) + (f_{56}d_{s(5)s(6)})$$

$$= (f_{12}d_{33} + f_{13}d_{33} + f_{14}d_{32}) + (f_{23}d_{33}) + (f_{34}d_{32}) + (f_{45}d_{22}) + (f_{56}d_{21})$$

$$= (5*0 + 10*0 + 2*3) + (10*0) + (5*3) + (10*0) + (5*2) = 6 + 15 + 10 = 31$$

Since the total cost of solution $\boldsymbol{S}$ = (3, 3, 3, 2, 2, 1) is 78, which is the sum of the assignment and material handling costs (i.e., TC($\boldsymbol{S}$) = 47 + 31 = 78), and is the lowest possible cost, the solution $\boldsymbol{S}$ is the best or optimal solution (i.e., $\boldsymbol{S}^*$ = (3, 3, 3, 2, 2, 1)).

As stated earlier, the formulation which minimizes objective function (7) subject to constraint (8) is called the combinatorial optimization problem (COP) formulation. It has less variables (only variables *s(i)*), constraints, and solutions compared to the mathematical programming formulation presented earlier (objective function (1') subject to constraints (2) – (6)). See comparison of models in **Table 4** where M = 6 and N = 3, as in the GQAP instance. Notice the number of constraints in the mathematical model is based on the number of constraints for constraints (2), (3), and (5) where the restrictions on the variables, (4) and (6), are not considered. Also, the number of possible solutions for both models considers all possible sets of values for each variable, whether the solutions are feasible or infeasible. More importantly, the solution space is much smaller for the COP model, only 729 possible solutions, compared to the mathematical model, with 262,144 possible solutions. Therefore, it is much more efficient using the COP model, as opposed to the mathematical model, to solve the GQAP.

M = 6, N = 3	Math Model	COP Model
Number of Variables	$M(N) + M(M-1)(N)(N-1)$ = 198	M = 6
Number of Constraints	$M + N + M(M-1)(N)(N-1)$ = 189	N = 3
Number of Solutions	$2^{M(N)}$ = 262,144	N^M = 729

Table 4. Comparison of the models.

In this paper, the GQAP with discrete time periods within the planning horizon is considered. This problem is called the dynamic GQAP (DGQAP) and is a generalization of the GQAP. Details of the DGQAP are discussed, and three formulations are presented for the problem.

The paper is organized as follows. Next, the definition and assumptions of the DGQAP are presented and discussed. Afterwards, two mathematical models and a COP model is presented for the DGQAP. Then a DGQAP instance is presented and solved using some of the models presented in this paper. Then, concluding remarks are given.

THE DYNAMIC GENERALIZED QUADRATIC ASSIGNMENT PROBLEM

The DGQAP is defined as the problem of assigning a set of facilities to a set of locations over a multi-period planning horizon such that the location capacities are not violated, and the sum of the assignment/rearrangement and transportation costs is minimized. In the GQAP, the flow of materials between facilities are fixed during the planning horizon. However, when the flow of materials between facilities change during the planning horizon, the problem becomes dynamic (DGQAP). Some of the factors, presented by Shore and Tompkins (1980), which may change material flows between production facilities are as follows.

- Changes in the design of an existing product.
- The addition or deletion of products.

- Replacement of existing production equipment.
- Shorter product life cycles.
- Changes in the production quantities and associate production schedules.

DGQAP Assumptions

The assumptions of the DGQAP are as follows.
1) The planning horizon is divided into multiple time periods that may be defined as weeks, months, quarters, or years.
2) The units of materials transported between facilities for each period are deterministic and known.
3) The distances between locations for each period are determined a priori.
4) The space requirement of each facility for each period is deterministic and known.
5) The capacities of the locations for each period are given.
6) The cost of assigning/reassigning each facility to a location in each period is known.
7) The unit cost per distance unit of moving materials between each pair of facilities for each period is given.
8) For each period, each facility is assigned to a location that is large enough to accommodate that facility.
9) For each period, each location is able to house one or more facilities such that its capacity is not exceeded.
10) The objective is to minimize the sum of total material handling, assignment, and rearrangement costs.

In assumption (3), the distances between locations (or sites) may change during the planning horizon when existing manufacturing sites are replaced with other manufacturing sites that were not previously considered. Therefore, in assumption (5), the capacities of the locations may change during the planning horizon. Likewise, the cost of assigning/reassigning a facility to a location may change in assumption (6). Also, in assumption (5), the capacity of a location may change during the planning horizon when either more or less space is made available at an existing site. In assumption (4), the space requirements of a facility may change from one period to the next due to changes in production quantities or production equipment as well as the addition or deletion of a product from the product line. As a result, the cost of assigning/reassigning a facility to a location may change (see assumption (6)). In assumption (10), the objective is to minimize the sum of the material handling costs for each period, the costs of initially assigning the facilities to locations in the first period (total assignment cost), and the costs of reassigning facilities to different locations in consecutive periods (total rearrangement cost). The definitions of the input parameters and decision variables for the DGQAP are as follows.

Input Parameters (Data)

M = number of facilities.
N = number of locations or sites.
T = number of periods in the planning horizon.
a_{tik} = the cost of assigning facility i to location k at the beginning of period t.
f_{tij} = flow of materials from facility i to facility j in period t.
d_{tkl} = distance from location k to location l in period t.
c_{tijkl} = unit cost per distance unit of moving materials from facility i (at site k) to j (at site l) in period t.
r_{ti} = the space requirement of facility i in period t.
C_{tk} = the amount of space capacity available at location k in period t.

Decision Variables

$$x_{tik} = \begin{cases} 1, & \text{if facility } i \text{ is assigned to location } k \text{ in period } t, \\ 0, & \text{otherwise.} \end{cases}$$

$$y_{tikl} = \begin{cases} 1, \text{ if facility } i \text{ (at site } k\text{) is reassigned to site } l \ (l \neq k) \text{ at the beginning of period } t \ (t > 1), \\ 0, \text{ otherwise.} \end{cases}$$

Mathematical programming formulations for the DGQAP

Next, a nonlinear mathematical programming formulation is presented for the DGQAP.

$$\text{Minimize } z = \sum_{i=1}^{M}\sum_{k=1}^{N} a_{1ik}x_{1ik} + \sum_{i=1}^{M}\sum_{k=1}^{N}\sum_{\substack{l=1 \\ l\neq k}}^{N}\sum_{t=2}^{T} a_{til}y_{tikl} + \sum_{i=1}^{M}\sum_{j=1}^{M}\sum_{k=1}^{N}\sum_{l=1}^{N}\sum_{t=1}^{T} c_{tijkl}f_{tij}d_{tkl}x_{tik}x_{tjl} \quad (9)$$

$$\text{s.t.} \quad \sum_{k=1}^{N} x_{tik} = 1, \qquad i = 1, \ldots, M, \ t = 1, \ldots, T \quad (10)$$

$$\sum_{i=1}^{M} r_{ti}x_{tik} \leq C_{tk}, \quad k = 1, \ldots, N, \ t = 1, \ldots, T \quad (11)$$

$$y_{tikl} = x_{(t-1)ik}\, x_{til} \quad i = 1, \ldots, M, \ k, l = 1, \ldots, N \ (l \neq k), \ t = 2, \ldots, T \quad (12)$$

$$x_{tik} = 0 \text{ or } 1 \ \ \forall i,k,t \quad (13)$$

$$y_{tikl} \geq 0 \ \ \forall i,k,l \neq k,t \quad (14)$$

Objective function (9) minimizes the sum of the assignment, reassignment (or rearrangement), and transportation (or material handling) costs. Constraints (10) ensure that each facility is assigned to only one location in each period. Constraints (11) ensure that the space capacity of each location is not exceeded in each period. Constraints (12) are used to obtain reassignment (or rearrangement) costs, and the restrictions on the decision variables are given in (13) and (14).

Since (9) and (12) contain nonlinear terms, the standard linear programming transformation is utilized to linearize these terms. Let $w_{tijkl} = x_{tik}\, x_{tjl}$. Therefore, the linearized objective function,

$$\text{Minimize } z = \sum_{i=1}^{M}\sum_{k=1}^{N} a_{1ik}x_{1ik} + \sum_{i=1}^{M}\sum_{k=1}^{N}\sum_{\substack{l=1 \\ l\neq k}}^{N}\sum_{t=2}^{T} a_{til}y_{tikl} + \sum_{i=1}^{M}\sum_{j=1}^{M}\sum_{k=1}^{N}\sum_{l=1}^{N}\sum_{t=1}^{T} c_{tijkl}f_{tij}d_{tkl}w_{tijkl} \quad (9')$$

is substituted for objective function (9) where w_{tijkl} is a continuous variable which will take on the value zero or one, and the following constraints are added to the formulation.

$$w_{tijkl} \geq x_{tik} + x_{tjl} - 1 \ \ i, j = 1, \ldots, M \ (j \neq i), \ k, l = 1, \ldots, N \ (l \neq k), \ t = 1, \ldots, T \quad (15)$$

$$w_{tijkl} \geq 0 \ \ \forall i, j \neq i, k, l \neq k, t \quad (16)$$

Considering nonlinear constraints (12), replace with the following linear constraints.

$$y_{tikl} \geq x_{(t-1)ik} + x_{til} - 1 \qquad i = 1, \ldots, M, \ k, l = 1, \ldots, N \ (l \neq k), \ t = 2, \ldots, T \quad (12')$$

As a result, the linearize DGQAP formulation, called a mixed integer linear programming model, consists of objective function (9') subject to constraints (10), (11), (12'), (13) – (16). Later, a DGQAP instance is solved using the linearized DGQAP formulation and the commercial solver CPLEX. Next, a COP formulation is presented for the DGQAP.

COP formulation for the DGQAP

Using a COP formulation, the solution for the DGQAP is represented as $\boldsymbol{S} = \{\boldsymbol{S}_1, \boldsymbol{S}_2, \ldots, \boldsymbol{S}_T\}$ where $\boldsymbol{S}_t$ is used to represent the assignment of facilities to locations in period t (where $t = 1, \ldots, T$) and $\boldsymbol{S}_t = (s_t(1), s_t(2), \ldots, s_t(M))$ where $s_t(i) = k$ is equivalent to assigning facility i to location k in period t. Therefore, the solution $\boldsymbol{S}$ is given as follows.
$\boldsymbol{S} = \{\boldsymbol{S}_1, \boldsymbol{S}_2, \ldots, \boldsymbol{S}_T\} = \{(s_1(1), s_1(2), \ldots, s_1(M)), (s_2(1), s_2(2), \ldots, s_2(M)), \ldots, (s_T(1), s_T(2), \ldots, s_T(M))\}$

Calculating total assignment and total transportation costs are straightforward and was illustrated on the single period GQAP instance presented earlier. However calculating total reassignment (or rearrangement) cost needs to be considered. More specifically, if the location of a facility changes between two consecutive periods, the reassignment cost for that facility needs to be considered. Recall, a_{tik} = the cost of assigning facility i to location k at the beginning of period t. Define a variable ra_{ti} that ensures if facility i assigned to location k in period t – 1 (i.e., $s_{t-1}(i) = k$) is reassigned to location l at the beginning of period t (i.e., $s_t(i) = l$ where $s_{t-1}(i) = k \neq l = s_t(i)$), then reassignment cost is incurred. This is considered by defining

$$ra_{ti} = \begin{cases} 1, & \text{if facility } i, \text{ at site } k \text{ in period } t-1, \text{ is reassigned to site } l \text{ at the beginning of period } t \ (l \neq k), \\ 0, & \text{otherwise.} \end{cases}$$

Therefore, total reassignment cost is obtained as follows.

$$\sum_{t=2}^{T} \sum_{i=1}^{M} a_{tis_t(i)} ra_{ti}$$

Therefore, the COP formulation for the DGQAP is given as follows.

$$\text{TC}(\boldsymbol{S}) = \sum_{i=1}^{M} a_{1is_t(i)} + \sum_{t=2}^{T} \sum_{i=1}^{M} a_{tis_t(i)} ra_{ti} + \sum_{t=1}^{T} \sum_{i=1}^{M} \sum_{j=1}^{M} c_{tijs_t(i)s_t(j)} f_{tij} d_{ts_t(i)s_t(j)} \tag{17}$$

$$\text{s.t.} \quad \sum_{\forall i \ \ s.t. \ s_t(i)=k} r_{ti} \leq C_{tk} \quad t = 1, \ldots, T, \ k = 1, \ldots, N \tag{18}$$

ILLUSTRATIVE EXAMPLE

Consider a DGQAP instance where 6 facilities are assigned to 3 locations, and there are 2 periods in the planning horizon (i.e., $M = 6$, $N = 3$, $T = 2$). The unit cost per distance unit of moving materials between each pair of facilities in each period is 1 (i.e., $c_{tijkl} = 1$). See **Table 5** for all other input data (i.e., a_{tik}, f_{tij}, d_{tkl}, r_{ti}, and C_{tk}). For example, the cost of assigning facility 2 to location 3 in period 1 is 6 (i.e., $a_{123} = 6$), and the cost of reassigning facility 2 (at either location 1 or 2 in period 1) to location 3 in period 2 is also 6 (i.e., $a_{223} = 6$). This occurs when the locations (or manufacturing sites) and facilities (i.e., production equipment) do not change during the planning horizon; therefore, assignment/reassignment costs do not change for periods 1 and 2 (i.e., $a_{1ik} = a_{2ik}$ for all i and k). Also, the distances between locations do not change for periods 1 and 2 ($d_{1kl} = d_{2kl}$ for all k and l). However, the space requirement for facility 1 in period 1 is 2 (i.e., $r_{11} = 2$), and in period 2 facility 1 requires 3 units of space (i.e., $r_{21} = 3$). This may be due to an increase in production quantities (demands) at facility 1 in period 2. In addition, the space capacity at location 1 in period 1 is 3 units (i.e., $C_{11} = 3$), but its capacity in period 2 is 5 units (i.e., $C_{21} = 5$), which may be due to additional space becoming available at the manufacturing site.

Solving the DGQAP instance as two GQAPs

Notice for period 1 (i.e., $t = 1$), the input data are the same for a_{ik}, f_{ij}, d_{kl}, r_i, and C_k as in the GQAP instance given earlier. Recall, the optimal assignment is to assign facilities 1, 2, and 3 to location 3, facilities 4 and 5 to location 2, and facility 6 to location 1 (i.e., $\boldsymbol{S_1^*} = (3, 3, 3, 2, 2, 1)$) which gives a total cost of 81 (total assignment cost of 47 and total material handling cost of 31). Often times in the real-world, the DGQAP is solved as a series of GQAPs. Following this trend, the optimal assignment for period 2 is obtained by using the CPLEX 11.0 commercial solver, the linearized GQAP model (objective function (1') subject to constraints (2) – (6)), and the input data f_{2ij}, d_{2kl}, r_{2i}, and C_{2k} for f_{ij}, d_{kl}, r_i, and C_k (notice reassignment cost is not considered or is ignored). Thus, the optimal values of the decision variables are $x_{11} = x_{23} = x_{31} = x_{43} = x_{52} = x_{63} = 1$, and all other x_{ik} decision variables are assigned the value zero where the total material handling cost is 55. In other words, the optimal assignment is to assign facilities 1 and 3 to location 1, facility 5 to location 2, and facilities 2, 4, and 6 to location 3 (i.e., $\boldsymbol{S_2^*} = (1, 3, 1, 3, 2, 3)$). Hence, the solution obtained from solving the DGQAP instance as two independent GQAP instances produce the solution $\boldsymbol{S} = (\boldsymbol{S_1^*}, \boldsymbol{S_2^*}) = \{(3, 3, 3, 2, 2, 1), (1, 3, 1, 3, 2, 3)\}$ where the total cost of the solution is 161 (i.e., TC($\boldsymbol{S}$) = 161). More specifically, for this assignment, total assignment and transportation costs for period 1 are 47 and 31, and total reassignment and transportation costs for period 2 are 28 and 55.

a_{tik} =

	1	2	3
1	5	9	7
2	8	5	6
3	6	9	10
4	10	6	7
5	7	10	5
6	8	6	10
1	5	9	7
2	8	5	6
3	6	9	10
4	10	6	7
5	7	10	5
6	8	6	10

f_{tij} =

	1	2	3	4	5	6
1	0	5	10	2	0	0
2	0	0	10	0	0	0
3	0	0	0	5	0	0
4	0	0	0	0	10	0
5	0	0	0	0	0	5
6	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	10	10	0
3	0	0	0	0	5	0
4	0	0	0	0	0	10
5	0	0	0	0	0	5
6	0	0	0	0	0	0

d_{tkl} =

	1	2	3
1	0	2	5
2	2	0	3
3	5	3	0
1	0	2	5
2	2	0	3
3	5	3	0

r_{ti} =

	1	2	3	4	5	6
1	2	1	2	1	2	3
2	3	2	2	1	2	3

C_{tk} =

	1	2	3
1	3	3	6
2	5	3	6

Table 5. Input data for a DGQAP illustrative example.

Solving the DGQAP instance efficiently

Using the data given in **Table 5** and the linearized mathematical formulation for the DGQAP presented earlier, which consists of objective function (9') subject to constraints (10), (11), (12'), (13) – (16), the

optimal solution is obtained for the problem instance using CPLEX 11.0 commercial solver. The values of the x_{tik} and y_{tikl} variables are $x_{113} = x_{123} = x_{133} = x_{141} = x_{151} = x_{162} = x_{213} = x_{221} = x_{233} = x_{241} = x_{251} = x_{262} = y_{2231} = 1$ where all other x_{tik} and y_{tikl} variables are assigned the value zero. In other words, in period 1 assign facilities 4 and 5 to location 1, facility 6 to location 2, and facilities 1, 2, and 3 to location 3 (i.e., $\boldsymbol{S_1}$ = (3, 3, 3, 1, 1, 2)). In period 2, assign facilities 2, 4, and 5 to location 1, facility 6 to location 2, and facilities 1 and 3 to location 3 (i.e., $\boldsymbol{S_2}$ = (3, 1, 3, 1, 1, 2)). Notice at the beginning of period 2, facility 2 (assigned to location 3 in period 1) is reassigned to location 1 (i.e., $y_{2231} = 1$) where total rearrangement cost for period 2 is 8 = a_{221}. Total assignment cost for period 1 is 46, and total material handling costs for periods 1 and 2 are 45 and 55. Thus, the total cost of the optimal solution/assignment $\boldsymbol{S^*} = (\boldsymbol{S_1}, \boldsymbol{S_2})$ = {(3, 3, 3, 1, 1, 2), (3, 1, 3, 1, 1, 2)} is 154 (i.e., TC($\boldsymbol{S^*}$) = 154). Recall, solving the DGQAP instance as two independent GQAP instances produced the solution $\boldsymbol{S} = (\boldsymbol{S_1^*}, \boldsymbol{S_2^*})$ = {(3, 3, 3, 2, 2, 1), (1, 3, 1, 3, 2, 3)} where the total cost of the solution is 161 (i.e., TC($\boldsymbol{S}$) = 161). Therefore, optimizing the assignment of facilities to locations independently for each period does not produce the overall optimal assignment. Thus, solving the integrated problem (DGQAP) is necessary to obtain the solution with the lowest total cost.

Comparison of the mathematical and COP models for the DGQAP

The COP formulation which minimizes objective function (17) subject to constraint (18) can also be used to solve the illustrative example presented above for the DGQAP. It has less variables (only variables $s_t(i)$), constraints, and solutions compared to the mathematical programming formulation presented earlier (objective function (9') subject to constraints (10), (11), (12'), (13) – (16)). See comparison of models in **Table 6** where $M = 6$, $N = 3$, and $T = 2$, as in the DGQAP instance in **Table 5**. Notice the number of constraints in the mathematical model is based on the number of constraints for constraints (10), (11), (12'), and (15) where the restrictions on the variables, (13), (14), and (16), are not considered. Also, the number of possible solutions for both models considers all possible sets of values for each variable, whether the solutions are feasible or infeasible. More importantly, the solution space is much smaller for the COP model, only 531,441 possible solutions, compared to the mathematical model, with 68,719,476,736 possible solutions. Therefore, it is much more efficient using the COP model, as opposed to the mathematical model, to solve the DGQAP.

$M = 6, N = 3, T = 2$	Math Model	COP Model
Number of Variables	$M(N)(T) + M(N)(N-1)T + M(M-1)(N)(N-1)T = 432$	$MT = 12$
Number of Constraints	$MT + NT + M(N)(N-1)(T-1) + M(M-1)(N)(N-1)T = 414$	$NT = 6$
Number of Solutions	$2^{M(N)T} = 68{,}719{,}476{,}736$	$N^{M(T)} = 531{,}441$

Table 6. Comparison of the models.

CONCLUSION

The DGQAP is a multi-period generalization of the GQAP over discrete time periods. The GQAP is applicable for assigning a set of facilities to a set of locations such that the capacity of the locations are not exceeded, and the sum of the assignment and transportation costs is minimized. Also, **Lee and Ma (2004**) used the GQAP to assign production equipment to manufacturing sites and **Cordeau et al. (2006**) to assign a set of container groups to storage areas within storage yards. The DGQAP can be directly applied to these problems due to the following changes during the planning horizon.

- Changes in the flow of materials between production equipment (or container groups).
- Changes in space capacities at manufacturing sites (or storage areas).
- Changes in the space requirements of the facilities (or container groups).

Other related GQAPs could benefit from the DGQAP as well. For instance, **Cordeau et al. (2007)** considered the service allocation problem as a GQAP with side constraints, and **Unal and Uysal (2014)** used the GQAP to design a curriculum at a university. Therefore, there are many applications for the DGQAP.

In this paper, three formulations are presented for the DGQAP. The first formulation provides a straightforward generalization of the single-period GQAP into the discrete, multi-period setting. Since this formulation, a mixed nonlinear program, contains two nonlinear terms, the second formulation, a mixed integer linear program (MILP), is a straightforward linearization of the first. However, the third formulation considers the combinatorial structure of the problem, and a COP model is presented for the DGQAP. A problem instance was presented and solved using the proposed MILP for the DGQAP. Also, the DGQAP problem instance was solved using the traditional approach. That is, a series of GQAP instances were solved using the MILP available in the literature for the GQAP. As a result, it was shown that solving the DGQAP instance as multiple GQAP instances, based on the number of periods in the planning horizon, produced optimal assignments/solutions for each period. However, the overall assignment/solution for the DGQAP instance was suboptimal. Therefore, the DGQAP formulations presented in this paper are necessary for obtaining optimal assignments/solutions for the DGQAP.

Because the COP model reduces the solution space as well as the number of variables and constraints, it is the most efficient model. Nevertheless, solving large-size DGQAPs is computationally intractable using even the COP model formulation. As a result, for future research, exact methods can be developed which utilizes the COP model. Furthermore, construction algorithms and improvement algorithms can be developed which utilizes the COP model. Also, when developing these improvement algorithms, allowing the search to remain within the feasible solution space or go outside the feasible solution space can be studied. Most heuristics methods for the GQAP allows the search to go outside the feasible solution space, but methods are needed to “fix” or “repair” the infeasible solutions to make them feasible. The general assumption is that limiting the search to only the feasible solution space may restrict the search too much such that good solutions may be difficult to obtain. Therefore, experiments need to be performed to test the two approaches (i.e., having the search remain within the feasible solution space or not).

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A GREEDY ALGORITHM ASSIGNMENT OF CAPSTONE COURSE STUDENTS TO TEAMS AND PROJECTS USING SKILL HEURISTICS

Robert D. Plumley, Seidenberg School of CSIS at Pace University, rplumley@pace.edu
Charles C. Tappert, Seidenberg School of CSIS at Pace University, ctappert@pace.edu

ABSTRACT

Collaborative project work is an increasingly prevalent pedagogy across nearly all academic and vocational disciplines. However, there are many variables involved in the formation of teams when choosing from a pool of students with widely varied skills and levels of experience, leaving many instructors no choice but to use time consuming superficial grouping methods or simply allow students to self-group for team projects. This paper describes a comparative analysis of the skill distributions of teams formed conventionally and teams formed programmatically, using target skill distribution heuristics and a greedy assignment algorithm. Test populations for this comparison came from two courses that utilize group project work as the primary course deliverable – an information systems graduate Capstone Project course of 40 students and an Introduction to Computing for Non-Computing Majors undergraduate course of 105 students.

INTRODUCTION

In an ever evolving professional work environment which is skewing increasingly toward freelance contactors and remote workforces, the ability for newly minted graduates to effectively communicate with unfamiliar team members and contribute positively to group projects is a must [4]. Project Based Learning (PBL) courses are a means by which many higher education institutions are instilling these skills in their students while also increasing the overall effectiveness of the course itself with respect to increasing student competence in the respective skills targeted [5]. However, in most academic settings the number of students and/or a lack of information about the students in a class prevent any means other than random assignment or self-segmentation from being utilized because other methods such as manual assignment by the instructor assignment are time prohibitive [2].

Although, random team assignments may provide benefits with respect to simplicity and avoiding the formation of cliques there is the risk that teams may be unwittingly being setup for failure if a randomly selected team does not possess team member skills required to properly execute on the project. To address these skill-related concerns, we developed a program that collects the customer's expectation of the skills needed to complete a project and the skills of the potential team members, and then uses a scoring heuristic and a greedy assignment algorithm to produce teams that should be a better fit for the project's needs than a randomly selected team.

This paper provides an analysis of five unique team assignment approaches where the resulting team skill heuristics and their fit to their respective projects' needed skills are compared. These approaches are evaluated with data from two courses.

CAPSTONE PROJECT COURSE

At Pace University the Computer Science and Information Technology Capstone Project course is a semester long group project based course. Those enrolled in the capstone course are tasked with working with teammates and project customers to conduct technical research and/or develop customized technical solutions to address the customer's specified problem. Group members are expected to meet with customers

to evaluate product specifications, provide weekly updates, make mid-semester and end-of-semester presentations, and ultimately provide a deployable solution and user manual [3].

COMPUTING FOR NON-COMPUTING MAJORS

Introduction to Computing for Non-Computing Majors (CIS 101) at Pace University is a three credit course designed for freshman and sophomore non-computing major undergraduate students. With both personal assignments and a semester-long group project, the course maintains two parallel tracks throughout the semester where the students' individual assignments are designed to prepare them to contribute to the group project deliverables. The primary focus of the first half of the course to teach student the concepts of variables, functions, and conditional statements using Microsoft Excel for the eventual development of personal and project budgets. The second half of the course focuses on web design using HTML, CSS, and JavaScript, with the development of a project webpage as the final goal [1].

METHODOLOGY

The primary goal of the software program is to optimize the grouping of students into teams. Currently, the Capstone Project course instructor reviews students' skill assessment surveys and assigns students to projects, while the Introduction to Computing for Non-Computing Majors course instructor allows the students to form the teams.

DATA COLLECTION

Collecting data with a consistent format and data range are essential components to the program, allowing it to score student skill levels and assign students to groups of evenly distributed skill levels or matching project needs.

CAPSTONE PROJECT SKILL NEEDS ASSESSMENT

Utilizing an online survey, capstone project customers were prompted to rank twelve areas of expertise and nine computer programming languages with respect to their importance to the successful completion of respective project, using a 0-10 scale with zero meaning "Not Applicable" and ten "Mission Critical". Project customers were also asked to indicate the minimum and maximum number of team members they anticipate needing for their project.

CAPSTONE PROJECT STUDENT SURVEY

Also utilizing an online survey tool, the students enrolled in the capstone project course were asked to provide a self-assessment, ranking their level of competence for the same areas of expertise and programming languages that the project customers provided, using a 0-10 scale with zero indicating no experience and ten expert level knowledge. Additionally, the students were asked to select their top five project choices. Pages 1 and 2 of the survey collected personal contact information and communication preference data not used in team assignment, however pages 3 and 4, seen in Fig1, contain the critical data used for the team assignment algorithm such as student's technical self-assessments and project preferences.

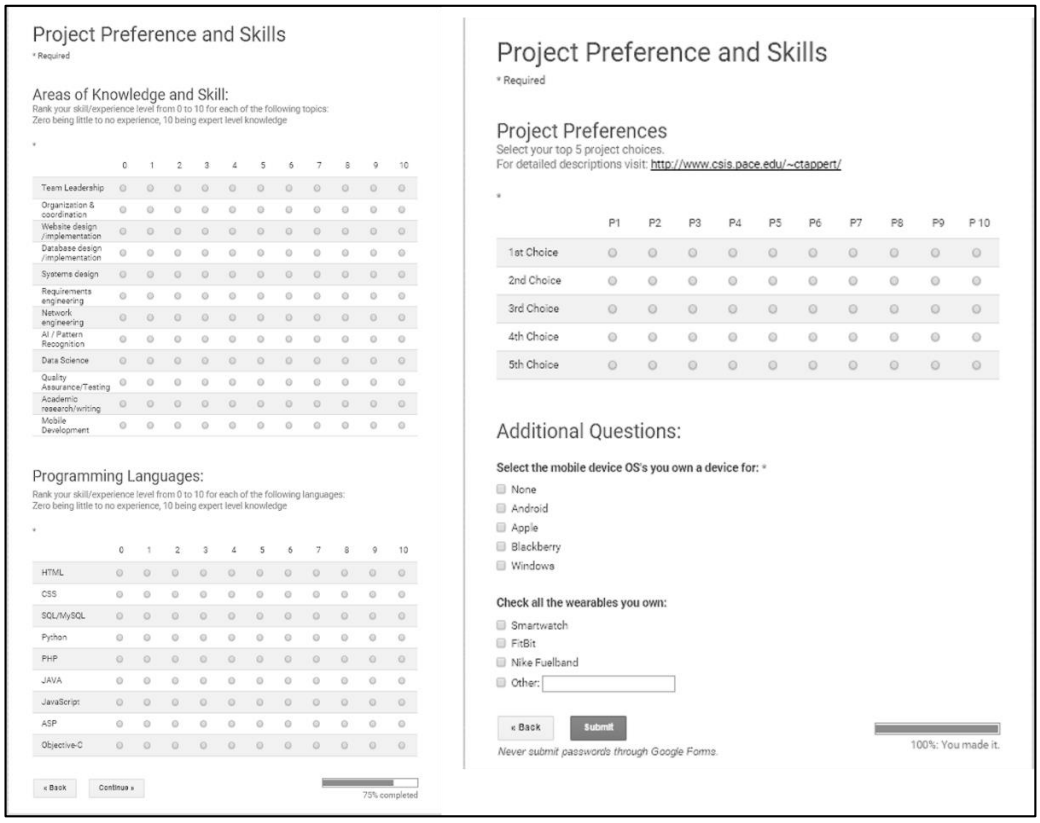

Fig1. Capstone Student Skills Survey – pg3 & pg4.

INTRODUCTION TO COMPUTING STUDENT SURVEY

Finally, a third online survey was deployed to the students of the Introduction to Computing class. These students were asked to rank their level of experience for a list of knowledge domains, using the same no experience to expert level knowledge, 0 to 10 scale. These students were not asked for their project preferences because there are not predetermined projects for the course, instead each team is tasked with developing their own unique project idea.

TEAM ASSIGNMENT METHODS

In total five methods of team creation were analyzed, but only four methods were applied to each respective course. Both courses had pre-existing teams created manually by different methods, in the case of CIS101 self-selection was used while the professor created the teams for the capstone course. Additionally, the two programmatic approaches and a truly random method were used on both courses.

MANUAL UNSYSTEMATIC ASSIGNMENT PROCESSES

The actual working teams for both fall 2015 course populations analyzed were created using two distinct manual processes.

Manual instructor assignment. The Capstone Project course teams used for this analysis were the result of manual assignment by the instructor, considered an informed expert since he had been doing this for 15 years. The students of the course were asked to provide a one-page word document survey where students were asked questions regarding their location, years of experience and skills, as well as their preference for projects from a list provided by the instructor (Fig. 1). Those documents were then evaluated and team assignments made manually by the instructor based on his knowledge of the projects' needs and the preference of the students.

Student Information and Project Preferences

Name: Expected degree completion (month/year):

Employment (job title + company + work location, or full/part-time student):

Number of years work experience in information technology:

Where you live (city, state, country):

Preferred email address:

Phone numbers:

Will you attend the three classroom meetings? (y/n):

Can you meet instructor/customer occasionally as recommended for team leaders? (y/n):

Project preference choices:

1st _____ 2nd _____ 3rd _____ 4th _____ 5th _____

Mode choices for project communication (face-to-face, email, conf. calls, IM, etc.):

1st _____ 2nd _____ 3rd _____ 4th _____ 5th _____

Availability choices for project communication (day of week + morning/afternoon/evening):

1st _____ 2nd _____ 3rd _____ 4th _____ 5th _____

Project skills (requirements engineering, system design, programming, databases, website design/implementation, networking, communication/leadership skills, etc.):

1st _____ 2nd _____ 3rd _____ 4th _____ 5th _____

Comments:

Fig. 2. Student Information Preference Form.

Team member self-selection. The section of Introduction to Computing that was used for this analysis was prompted to self-segment into groups of five, with students who were absent being assigned to existing teams as a sixth member. Since the teams were formed early in the semester and the vast majority of the students were freshman, very few intrapersonal relations existed prior to team formation, leaving general proximity in the class room as the primary factor used for group formation.

PROGRAMMATIC ASSIGNMENT PROCESS

The program for systematic team member assignment utilizes a greedy algorithm approach by which a student's fit for each of the respective projects was scored and the highest ranking students were assigned to projects by looping though the list of projects sorted in ascending order by minimum team members needed. Once each project has reach its minimum team member needs, the process is continued for the remaining students using the maximum number of team members for each project.

```
'Meeting minimum team members needed
 Sort projects ascending order by minimum team members needed
    students = count of student
    minMembers = sum of project minimums
    While minMembers > zero
      For each project sort  students by fit score
        If minimum members - current team member count  > 0
          Assign student with highest fit score to team
          minMembers = minMembers -1
          students = students - 1
        Else do nothing
      Next project

'With minimums met assign remaining students
 Sort projects in ascending order by maximum team members
    While students > zero
      For each project sort  students by fit score
        If maximum members - current team member count  > 0
          Assign student with highest fit score to team
          students = students - 1
        Else do nothing
      Next project
```

Fig. 3. Greedy Assignment Pseudocode.

Static project needs heuristic fit scoring. Each project's skill needs survey response was used to generate a percentage array which is applied to each student's skill assessment response to calculate a weighted project fit score (this percentage array will remain unchanged throughout the team assignment process). Then to account for project preference, the project fit scores for those projects indicated by the students as preferred projects are increased by the respective percentages while non-preferred project fit scores are set to zero.

Preference	Multiplier
1st Choice	1.25
2nd Choice	1.20
3rd Choice	1.15
4th Choice	1.10
5th Choice	1.05
Not preferred	0.00

Fig. 4. Project Preference Multipliers.

DYNAMIC PROJECT NEEDS HEURISTIC FIT SCORING.

Each project's skill needs survey response was used to generate a percentage array and applied to each student's skill assessment response to calculate a weighted project fit score. Subsequently as the team assignment process proceeds the addition of each team member to a project team the respective project's percentage array is inversely adjusted based on the skill distribution of the current team. This adjusted percentage array is used to dynamically recalculate the student pools' project fit scores before assigning new team members. Then project preference multipliers seen in Fig. 4. Project Preference Multipliers. are applied to the new project fit scores.

Team leader scoring and assignment. Although the Intro to Computing course does not need a declared team leader in the case of the Capstone project course the first member assigned for each project is the team leader. To qualify as a potential team leader, the student must be able to attend three on campus meeting and have experience in the tech industry.

Qualifying students are then given a team leader score on a scale from 0 to 25 based on their self-assessments of their leadership and organizational skills, availability, and years of experience where up to 10 points is granted for every year of experience. Qualifying students then have their project fit scores increased by up to 50% based on the student's leadership score relative to the minimum and maximum leadership scores of all qualifying students.

Leadership Score Category	Max Points
Leadership Assessment	5
Organization Assessment	5
Availability	5
Years of Experience	10
Total	**25**

Leadership Multiplier Formula

= 0.5 * ((Student LeaderScore - minLS)/(maxLS - minLS))

Fig. 5. Leadership score.

The greedy assignment process is then used to fill the team leader role by selecting the leadership qualified student with the highest project heuristic score, for each project sorted in ascending order by the minimum number of project team members, ensuring that the smallest teams get the best fitted, most experienced leaders.

Additionally, because the team leader is the first team member assigned to a project, both the static and dynamic heuristic scoring methods result in the same team leader assignments, with the skills of the team leader thus having a significant impact on the dynamic scoring of the remaining team members to be assigned to a project.

RANDOM ASSIGNMENT

To produce truly unbiased benchmarks for comparison both courses' student populations were randomly assigned to groups. Each student was given a random score from 1 to 10 for each project which were then used by the greedy assignment process.

ASSIGNMENT METHOD COMPARISON & SCORING

Two metrics were used to measure and compare the relative success of each assignment method applied to the Capstone Project. The frequency with which a team creation method generates the highest cumulative team score for a respective project after the scores are adjusted to zero out skills indicated by project customers as un-needed. For the second success metric the Euclidian distance between the desired skill distribution and that of the resulting teams were measured and compared with the goal of generating the lowest distance possible.

For the Introduction to Computing course, the goal heuristic is a perfectly balanced team where skill rankings are distributed evenly to ensure a variety of skills are present on each team. For the capstone course the goal is to create teams that closely match the desired/needed project skills to help ensure a successful project.

RESULTS

With respect to the capstone course, it became apparent that the availability of student expertise is the largest hurdle to overcome when assigning students to teams with a specific mix of skills and knowledge as the final goal. When multiple projects have ranked the same skills as high priority, the ability to allocate limited skill resources to both of them in the enough concentration to meet the goal heuristic is become challenging.

CAPSTONE PROJECT COURSE

STUDENT SURVEY RESPONSES

Below in Fig. 6 are the frequency with which students of the capstone course described themselves as a particular skill level for a respective skill or programming language.

Ranking	0	1	2	3	4	5	6	7	8	9	10
Team Leadership	0	1	1	2	1	8	3	6	8	7	4
Organization & coordination	0	0	2	2	1	4	5	5	6	12	4
Website design /implementation	6	3	4	4	4	3	1	5	2	9	0
Database design /implementation	2	3	3	5	5	6	4	5	3	4	1
Systems design	7	6	1	2	4	6	4	7	1	2	1
Requirements engineering	11	3	1	2	4	4	4	7	2	2	1
Network engineering	8	5	3	2	4	4	4	1	4	3	3
AI / Pattern Recognition	16	3	3	6	6	2	1	1	0	3	0
Data Science	14	2	3	2	3	8	2	3	2	2	0
Quality Assurance/Testing	6	5	4	0	2	4	4	8	4	3	1
Academic research/writing	2	3	4	3	2	6	5	4	9	3	0
Mobile Development	14	1	3	2	3	4	8	3	1	1	1

Ranking	0	1	2	3	4	5	6	7	8	9	10
HTML	4	3	3	5	1	2	2	2	7	5	7
CSS	7	4	3	2	2	2	2	4	7	2	6
SQL/MySQL	4	2	2	4	2	5	3	5	8	2	4
Python	22	3	1	6	3	2	0	3	1	0	0
PHP	15	4	2	6	4	1	5	0	2	2	0
JAVA	5	2	1	7	1	5	4	7	5	4	0
JavaScript	9	3	4	3	4	2	2	9	4	1	0
ASP	18	4	3	7	3	1	4	0	0	1	0
Objective-C	21	3	5	4	3	1	0	1	1	1	1

Fig. 6. Student self-assessment ranking frequency.

In Fig. 7 the self-assessed skill levels of the average capstone student are shown. These figures combined with Fig. 6 illustrate how difficulties creating teams for projects that center on skills with limited availability such as AI and Python could arise limiting the project's chances for success.

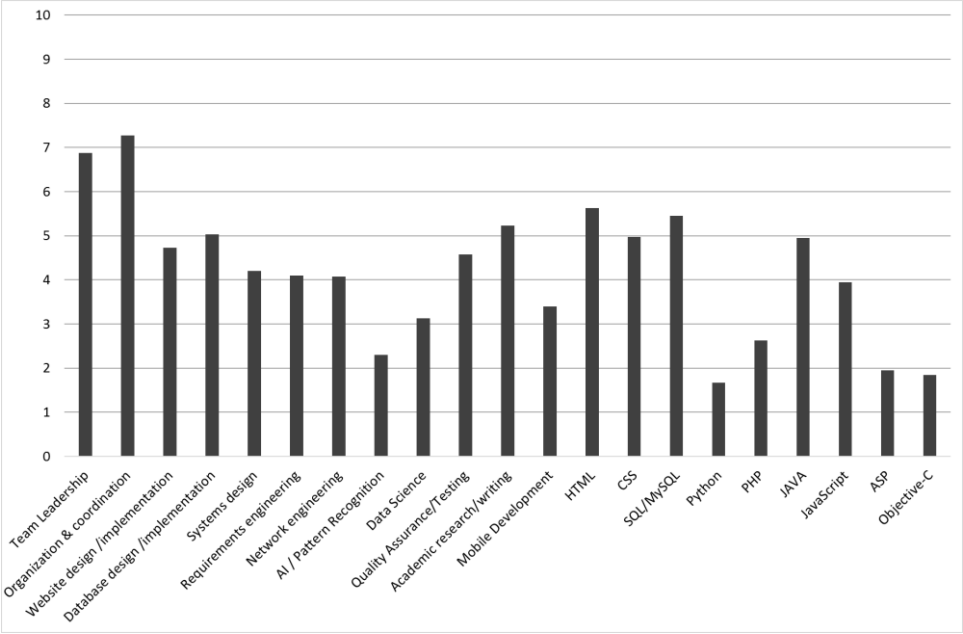

Fig. 7. Average student skill assessment score.

TEAM CREATION METHOD COMPARISON

In Fig. 8 the frequency with which a respective team creation methodology generated the highest scoring team for a particular capstone project is presented. Although with such a small number of groups no result can be considered definitive, the table shows that the current teams created manual by the professor out rank those teams of other creation methods more often. Also of note is the two-way tie for project 10 between the static and dynamic heuristic methods as both methods selected the same team leader for the one-person team.

Method	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Max Ct
Manual	0	1	0	0	1	1	1	0	0	0	4
Static	0	0	0	0	0	0	0	0	1	1	2
Dynamic	1	0	0	1	0	0	0	0	0	1	**3**
Random	0	0	1	0	0	0	0	1	0	0	2

Fig. 8. Frequency of maximum team skill score.

In Fig. 9 and Fig. 10 the Euclidian distance between each project's targeted skill and language heuristics and the skill distribution of each team creation method are compared. Here it is seen that the process of using a team's current skill levels to dynamically adjust the scoring heuristic applied to the pool of potential team members generates teams that more closely match the goal heuristic a significant portion of the time.

Method	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Sum
Current	0.22	0.25	0.26	0.25	0.27	0.29	0.25	0.36	0.34	0.37	2.86
Static	0.19	0.35	0.28	0.20	0.33	0.32	0.25	0.26	0.22	0.18	2.57
Dynamic	0.14	0.35	0.27	0.20	0.26	0.27	0.26	0.24	0.29	0.18	**2.44**
Random	0.31	0.31	0.22	0.25	0.34	0.34	0.31	0.24	0.19	0.88	3.38

Fig. 9. Euclidian distance of skill level distribution vs goal heuristic.

Method	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Sum
Current	0.20	0.22	0.00	0.29	0.44	0.47	0.25	0.42	0.00	0.56	2.86
Static	0.18	0.32	0.00	0.24	0.46	0.53	0.26	0.24	0.00	0.18	2.40
Dynamic	0.17	0.28	0.00	0.13	0.51	0.47	0.22	0.17	0.00	0.18	**2.13**
Random	0.33	0.19	0.00	0.33	0.40	0.57	0.29	0.24	0.00	1.07	3.44

Fig. 10. Euclidian distance of programing language distribution vs goal heuristic.

INTRODUCTION TO COMPUTING

STUDENT SURVEY RESPONSES

As would be expected for an introductory course, the CIS section surveyed had a very limited number of student who considered them-selves proficient in the domains of knowledge the course is designed to address. As seen in Fig. 11 and Fig. 12, respondents reported very low levels of exposure to Web Design, HTML and CSS, and only moderate knowledge of Microsoft Excel.

Ranking	0	1	2	3	4	5	6	7	8	9	10
Team Leadership	0	0	1	1	6	5	14	18	21	14	19
General Computer Literacy	1	1	3	4	5	15	16	17	28	4	5
Organization & coordination	0	1	1	3	2	9	12	12	24	21	14
Presentation Creation	0	1	0	3	6	8	8	10	29	18	16
Public Speaking	2	1	4	8	6	14	3	6	13	20	22
Video Creation /Editing	7	6	4	13	7	10	8	13	9	14	8
Website design	19	13	4	8	11	8	14	10	11	0	1
HTML	20	14	15	8	6	3	12	9	7	3	2
CSS	29	11	14	5	8	12	3	8	6	2	1
Budget Creation /Management	14	6	10	5	14	11	10	14	8	4	3
MS Excel	5	8	14	7	10	11	5	17	11	7	4
Mathematics	1	4	6	6	13	9	15	22	12	7	4

Fig. 11. CIS 101 Student skill ranking frequency.

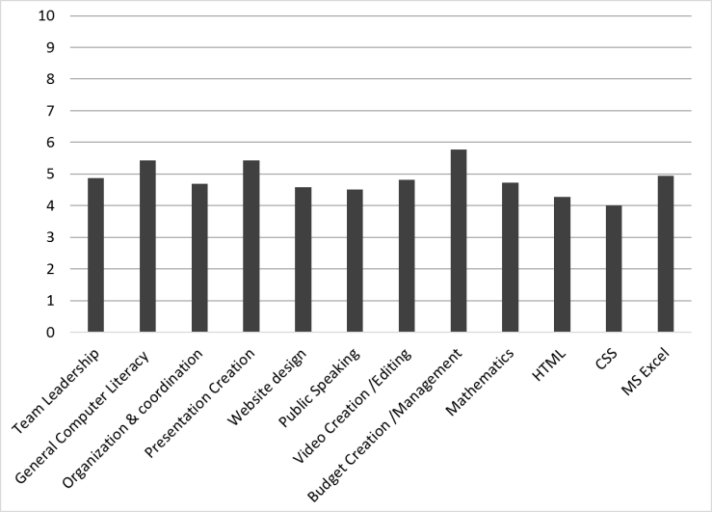

Fig. 12. Average CIS101 student skills assessment scores.

TEAM CREATION METHOD COMPARISON

As can be seen in Fig. 13 manual team creation, in the case of CIS the students self-selected to form project groups, once again has the highest frequency of maximum team skills scores in comparison to the other team formation models.

Method	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	Max Ct
Manual	0	0	0	0	1	1	0	0	0	0	1	0	1	1	1	**6**
Static	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Dynamic	0	1	0	1	0	0	1	1	0	0	0	0	0	0	0	4
Random	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	4

Fig. 13. Frequency of maximum team skill score.

Method	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	Sum
Manual	0.22	0.20	0.11	0.07	0.08	0.13	0.15	0.23	0.18	0.19	0.25	0.11	0.14	0.12	0.21	**2.39**
Static	0.22	0.34	0.13	0.17	0.13	0.11	0.14	0.20	0.18	0.15	0.21	0.26	0.17	0.11	0.20	2.73
Dynamic	0.17	0.37	0.15	0.16	0.17	0.08	0.16	0.20	0.18	0.15	0.21	0.26	0.17	0.11	0.20	2.75
Random	0.18	0.37	0.13	0.21	0.18	0.19	0.14	0.22	0.22	0.15	0.16	0.11	0.10	0.18	0.18	2.70

Fig. 14. CIS Euclidian distance of skill level distribution vs goal heuristic.

The results shown in Fig. 13 are further supported by the data in Fig. 14 where it is shown that the manually formed groups also have the lowest Euclidian distance when compared to the evenly distributed goal heuristic.

CONCLUSION

Although manually formed groups have proven to be just as effective and diverse in their skill distribution as the informed selection algorithms tested, the process of forming groups manually can be very time consuming and exposes student to a number of potential issues driven by clique behavior among class goers.

Additionally, if the goal is to form multiple project groups, all of which requiring a unique mix of skill and expertise levels, utilizing a process of assessing the student pool's skill sets and programmatically assigning them to projects using a scoring heuristic based the required skills will yield teams who are more closely aligned with projects desired skill mix.

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A LOOK AT TOURISM RAIL OPTIONS FOR THE GRAND STRAND

Mark Mitchell, Coastal Carolina University
Henry Lowenstein, Coastal Carolina University
Dennis Rauch, Coastal Carolina University

ABSTRACT

The railroad originally delivered visitors to Myrtle Beach over 115 years ago. In 2011, rail service disappeared along the Grand Strand. A new owner has re-established freight rail service to serve area employers. This manuscript looks at the possibility of developing short-haul rail as a tourist attraction for the over 16 million visitors annually to the Grand Strand.

INTRODUCTION

This meeting of Southeast infORMS is taking place in Myrtle Beach, SC. The Grand Strand (a 60-mile stretch of beaches running from Little River, SC to Georgetown, SC) welcomes approximately 16 million visitors annually. Consistent with its positioning as a family destination, 61% of visitors are families that stay, on average, 6 days in the area. During their stays, these visitors dine in over 1,900 restaurants, stay in some 100,000 hotels and condo rooms, and enjoy 100+ golf courses, 46 mini-golf courses, 9 musical theaters, 6 major indoor or outdoor shopping areas, as well as a large and complex assortment of nationally-known attractions and amusements [17].

That's the Myrtle Beach of today. A key driver in the development of the Myrtle Beach area is (and has been) what is now called "The Burroughs & Chapin Company." If we go back in time, we find the following description of the founding of the company [2]:

> *The history of Burroughs & Chapin Company in Horry County and Myrtle Beach began more than 150 years ago with the arrival of Franklin G. Burroughs in nearby Conway. An enterprising young man, he soon established successful building, mercantile, turpentine and other business ventures there. And as his businesses grew, the town flourished as a primary destination on the Waccamaw River.*
>
> *After service in the Civil War, Burroughs returned to Conway and with his new partner, Benjamin Grier Collins, expanded the company's commercial interests into timber, farm credit, consumer goods and riverboats. His turpentine manufacturing business grew to be one of the largest in the country, and riverboats such as the "F.G. Burroughs" linked Horry County to the rest of the world.*
>
> *A true visionary, Franklin Burroughs foresaw that one day the beaches of the Grand Strand would grow to rival the then-famous northern resort destinations of Coney Island and Atlantic City. He died in 1897 before his efforts to link the beach, via railroad, to the rest of the world were realized. In pursuit of their fathers' dreams, the sons of Burroughs and Collins completed the railroad and built the Seaside Inn in 1901, the first oceanfront hotel in Myrtle Beach. It was followed by a bathhouse and a wooden pavilion around which beach houses were constructed. By 1907, the "New Town" by the sea, as Myrtle Beach was then called, had become a popular vacation spot. Beachfront cottage lots sold for $25 each. When a contest was eventually held to name the new beach resort, Burroughs' widow, Miss Addie, suggested "Myrtle Beach" for its proliferation of wild wax myrtle bushes.*

As noted above, the presence of the railroad originally provided access to the Beach in 1900 with the first hotel opened in 1901 (The Seaside Inn). Today, over 90% of visitors travel by automobile to the Grand Strand [17]. And, ironically, these visitors often enter Myrtle Beach via Highway 501 … which parallels the original railroad line that delivered visitors to the region over 115 years ago.

Myrtle Beach, like many communities, has seen the de-emphasis of rail as a means of personal travel in recent years. The purpose of this manuscript is to explore the possibility of re-introducing personal rail service to the Grand Strand. Specifically, the opportunity to develop train service as an entertainment attraction in-and-of-itself will be explored. First, the importance of the railroad in the founding and development of the Grand Strand is discussed. Second, the recent purchase of Carolina Southern Railroad by the R.J. Corman Company is outlined, along with the opportunity for Corman to develop tourist rail services similar to some the company operates in other markets. Finally, the common categories of such trains are reviewed and their possible fit along the Grand Strand is evaluated.

RAIL SERVICE ALONG THE GRAND STRAND

As noted above, the development of rail service was instrumental in the development of Myrtle Beach as a vacation destination. The rail line allowed the traversing of rivers and swamps to reach the beach. Grimshaw [7], writing in ***Grand Strand Magazine***, describes the development in the following way:

> *If the railroad settled the West, it also spawned the growth of the Grand Strand. In 1899, construction began on the first rail line from Conway's well-established inland rail system to what would become Myrtle Beach. On May 1, 1900, the steam locomotive Black Maria made its inaugural run to the beach and would start hauling families from Conway to the oceanfront. The historic Myrtle Beach Train Depot at 851 Broadway Street was not built until 1937 and was saved from the wrecking ball around 2000, reopening as a renovated community center and meeting hall in 2004.*
>
> *The arrival of the first large groups of tourists, made up of the families and employees of the Burroughs & Collins Company, would come for a day of fishing and the sunny seashore, heading home again in the evening. In the early 1900s, because the railroad could also deliver construction materials, some of these first tourists decided to build summer cottages along the dunes at that magical place where the ocean meets the sand.*

The rail, a single track (Class III) short-line, would continue to be an important means of moving large freight in-and-out of the Grand Strand. Passenger rail service, both locally and nationally, declined with the growth of a national highway system, the automobile, and low-cost air travel. Consequently, rail companies put their primary resources into freight service.

CSX provided freight rail service in the area until approximately 90 miles of track were sold to newly-created Mid-Atlantic Railroad in 1987. The company was later purchased by Carolina Southern Railroad in 1995. The line operated with a connection to CSX in Mullins, SC with service North and East to Chadbourn, NC, and South to Conway and Myrtle Beach, SC [16]. During its full operations, the principal commodities carried included coal, aggregates, wallboard steel and lumber. And, its principal shippers included Santee Cooper, Martin Marietta, Canfor Southern Pine, Metglas, Atlantic Paper, Idaho Timber, Georgia-Pacific and Southern States Cooperative [4]. At that time, these firms employ nearly 2,000 local workers [10].

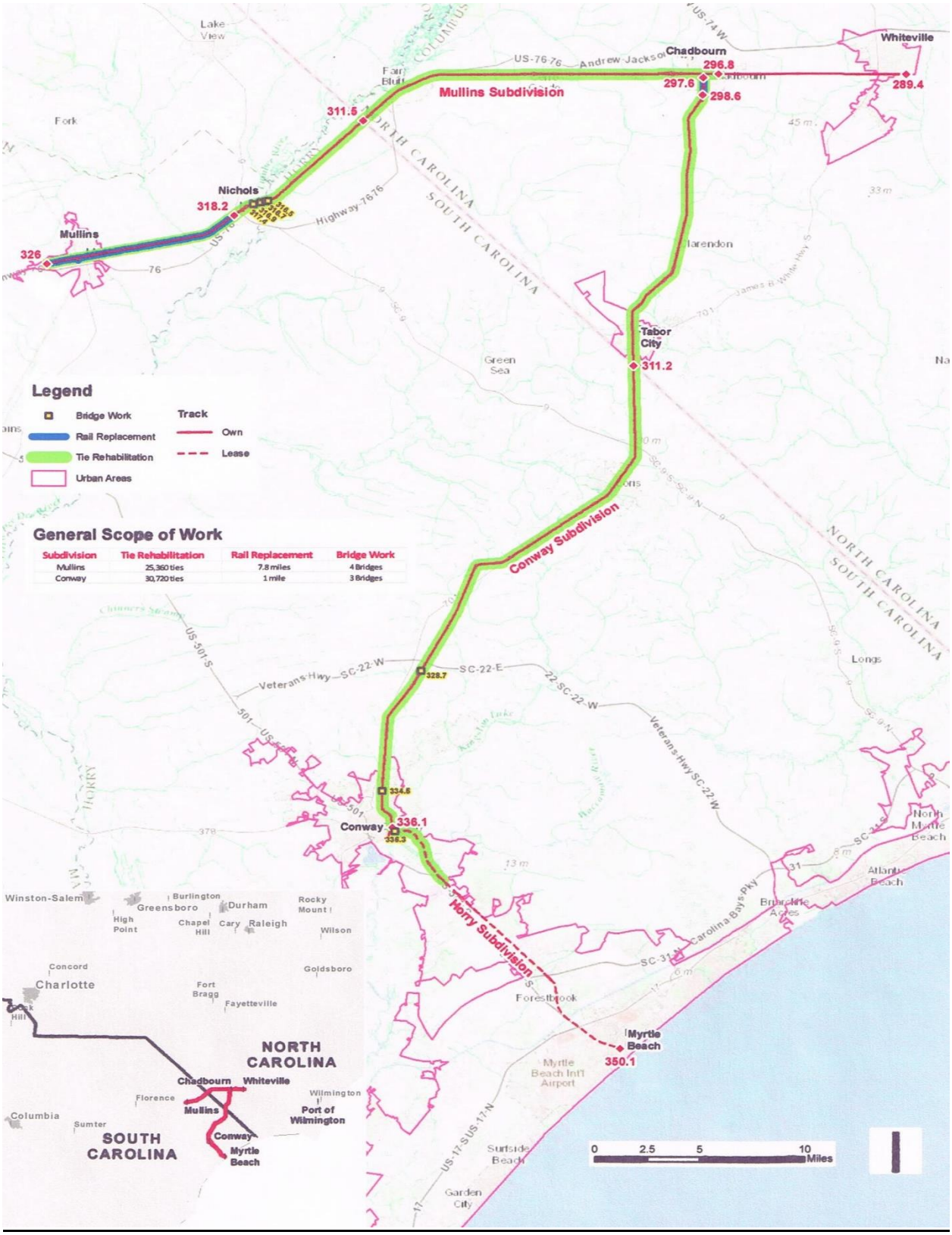
In 2011, the Federal Railroad Administration declared some of the bridges used by Carolina Southern Railroad to be unsafe. At that time, the owners said they could not afford to make the necessary investments in line upgrades. After efforts to secure grant funding were unsuccessful, the rail line ceased to operate. Fearful of the impact that the loss of rail service would have on their communities, officials in Marion and Horry (SC), and Columbus (NC) counties began a legal fight to force the owners to abandon the line to make possible its sale or transfer. The newly-formed two-state rail committee worked was then tasked with finding a possible buyer [9].

R.J. CORMAN PURCHASES CAROLINA SOUTHERN RAILROAD

R.J. Corman purchased the assets of the Carolina Southern Railroad in Summer 2015. The company is one of the nation's premier rail operators. Founded in 1973 in Nicholasville, Kentucky by the late Richard J. Corman, the company operates divisions in 24 states as far west as Arizona with over 1,600 employees. R.J. Corman serves seven North American Class I (main line) railroads; owns and operates eleven (11) short-line (Class II) railroads nationwide. R. J. Corman has turned 10 light density lines into successful commercial operations that provide service to hundreds of industries. Furthermore, the company has repaired or rebuilt thousands of miles of railroad across the U.S. and expects to accomplish the same on the Carolina Southern line [11].

Among the unique features of the company, R.J. Corman is a fully vertically-integrated rail group including its own rail construction, maintenance, locomotive/rail car development, emergency derailment and signals, and virtually every aspect of necessary railroad materials and service. It has one of the best safety records in the industry and received the Jake Award of the American Short Line Railroad Association for distinguised record in safety [11]. **Figure One** shows a map of the Corman's Carolina Line (formerly known as the Carolina Southern Railroad).

Figure One – Map of R.J. Corman's Carolina Line Footprint



The Opportunity to Develop Tourist Rail Services along the Grand Strand

R.J. Corman currently maintains a Dinner Train Excursion division. This aspect of the company is an adjunct to the more profitable freight operations and is done much as a public service on essentially a break-even to slight loss basis. Among the theme trains include: Mystery Night, My Old Kentucky Dinner Train, and the Bourbon Excursion [11]. While R.J. Corman's primary focus is on restoring full freight service at Class III levels (which allows freight trains to travel up to 40 miles per hour) and developing additional business through economic development, it has pledged to eventually bring in limited dining/tourism-related train runs to the region, especially during the high tourist season (May – October).

POSSIBLE FORMATS FOR TOURISM RAIL SERVICE:
LOOKING OUTWARD, LOOKING INWARD

Collectively, all tourist trains offer a nostalgic experience, a connection to the past, and the opportunity to experience breathtaking scenery [1]. In addition to the actual railway and locomotive equipment, the focus of such attractions can be divided into five categories:

1. Highlighting Local Scenery
2. Highlighting Local Food and Beverages
3. Celebrating Local History
4. Showcasing Theater and Performance Art
5. Special Occasion Rail Excursions

Illustrative examples of each tourist rail category are provided below.

Highlighting Local Scenery

The Cape Cod Central Railroad describes its excursion trains in the following way [3], "This classic two-hour train ride brings passengers up close and personal with the beauty of the Cape including woodlands, sand dunes, cranberry bogs, salt marshes and the famous Cape Cod Canal. On board narration adds another dimension, keeping guests informed and entertained throughout the duration of their journey." Similarly, the Eureka Springs and North Arkansas Railroad [6] offers "Scenic Ozark Hills excursions and an active rail yard that bring Arkansas's railroading heritage to life." And, the Strasburg Rail Road [18] prides itself as 'America's Oldest Short-line Railroad' as it "steams along amid the Amish farmlands of Pennsylvania Dutch Country." To be clear, most such tourist trains provide some sort of food and beverage service. However, the scenery is the 'main show.'

Highlighting Local Food and Beverages

Arguably, one of the most well-known tourist trains is the Napa Valley Wine Train. For the past 25 years, guests have been treated to food and wine parings that showcase the cuisine and wines of the Napa Valley during its 36-mile round trip which takes about 3 hours [23]. While the train passes historic wineries such as Robert Mondavi, Beringer, and V. Sittui, the food and wine highlight the travel experience.

R.J. Corman operates the "My Kentucky Dinner Train" based in Bardstown, KY. Bardstown is the capital of "Bourbon Country", a collection of bourbon-related distilleries, tours, and museums. In fact, the train route includes passing the Jim Beam Distillery in Clermont, KY. A full bar service is available while diners enjoy such Kentucky favorites as Kentucky Hot Brown Sandwiches for lunch and Bourbon Pecan Pie for desert [8].

Celebrating Local History

The Verde Canyon Railroad (Clarksdale, AZ) follows Arizona's "Wilderness Route" while showcasing local history in the form of Indian ruins, rare wildlife and rugged canyon landscapes [21]. Visitors to Oak Ridge, TN can board the Secret City Scenic Excursion Train and see the once secret complex where the atomic bomb was developed (i.e., the Manhattan Project) [14]. Not far away in Chattanooga, TN, rail riders pass through a Civil War era tunnel [19].

Showcasing Theater and Performance Art

The Seminole Gulf Railway (Fort Myers, FL) provides the Murder Mystery Dinner Train. Here, guests enjoy a 5-course meal while trying to "unravel a comical mystery before your eyes. It is up to you to decide just who the killer is and why they would do such a dastardly deed." [16].

In May 2016, the Western Maryland Scenic Railroad partnered with WAMU (Public Radio Station, American University) to provide a scenic tour of Western Maryland hosted WAMU's Bluegrass Country radio hosts and music by the DelFest All-Stars [22]. The Rio Grande Scenic Railroad does seasonal trips to Fir Summit Amphitheater, an outdoor concert venue in Fort Garland, Colorado. The Mountain Rails Live tour for July 2016 is described as follows, "Our family-friendly festivities begin with train rides through rugged mountain passes to capture views of panoramic pines and blue skies or spot Colorado wildlife in meadows. The train stops at Fir Summit Amphitheatre for BBQ, local craft beer, vendors, kid activities and, of course, plenty of toe-tapping tunes featuring Suzy Bogguss and some very special guests" [12].

Special Occasion Rail Excursions

Many of the aforementioned tourist trains run special occasion rail excursions to provide a unique experience for Valentine's Day, Easter, Halloween (including ghosts, haunted stories, etc.), Fall Foliage, Polar Express (Christmas), Thomas the Tank Engine, and other events. For example, the Chehalis-Centralia Railroad (in Chehalis, Washington) ran a Mother's Day Brunch Train in 2016 [5]. The Sacramento RiverTrain provided a similar experience for Father's Day [13].

A review of tourist trains currently operating in the Southern United States (Alabama, Arkansas, Florida, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia) is provided in **Table One**.

Table One – Tourist Rail Lines in the American South

Name and Location	Description
Arkansas and Missouri Rail Springdale, Arkansas	The A&M hosts daytrippers on roundtrips to historic Van Buren. A second excursion continues from Van Buren to Winslow, clearing high trestles and a mountain tunnel on its awesome Ozark run.
Eureka Springs and North Arkansas Railroad Eureka Springs, Arkansas	Scenic Ozark Hills excursions and an active rail yard bring Arkansas's railroading heritage to life. A popular dining excursion is also scheduled. Highlights include exhibits of railroad memorabilia and a working roundtable.
Orange Blossom Cannonball Tavares, Florida	Florida's only operating steam train rolls through Central Florida's Lake Country. The Sunshine State's "movie train" has been featured in over 20 films and TV shows.
Seminole Golf Railway Fort Myers, Florida	A Gulf Coast favorite, this 3½-hour excursion treats guests to a five-course dinner prepared by an on-board chef, plus a live performance of a comical murder mystery, and scenic Caloosahatchee River crossing.
Blue Ridge Scenic Railway Blue Ridge, Georgia	Tracking the Toccoa River through the Chattahoochee National Forest, the train makes a sightseeing layover at the twin Appalachian villages of McCaysville, Georgia and Copperhill, Tennessee.
SAM Shortline Excursion Line Cordele, Georgia	Traveling through the rural countryside, stops include Georgia Veterans State Park, historic Americus, Habitat for Humanity Global Village and Plains... home of President Jimmy Carter.
Stone Mountain Scenic Railway Stone Mountain, Georgia	Open-air coaches offer excellent views of the Civil War Memorial relief carved into the mountain face. The railway is part of a theme park that features rides, entertainment and other attractions.
Big South Fork Scenic Railway Stearns, Kentucky	Within the Big South Fork National River and Recreation Area, along trackage once dedicated to hauling lumber and coal, trains descend the river gorge to the restored Blue Heron Mining Community.
Bluegrass Scenic Railroad Versaillies, Kentucky	Coaches from rail's golden age take passengers on a romantic excursion through the gorges and horse farms of Central Kentucky's Bluegrass Region. Railroadiana exhibits include a rare watchman's shanty and a working telegraph set.
My Old Kentucky Home Dinner Train Bardstown, Kentucky	Luncheon and dinner excursions depart historic Bardstown for a two-hour jaunt through the Kentucky heartland. Southern hospitality abounds aboard restored circa 1940s dining cars where fine cuisine and gracious service are standard.

Table One continued …

Name and Location	Description
Great Smoky Mountains Railway Bryson City, North Carolina	Vintage trainsets cross soaring Fontana Trestle with some continuing to spectacular Nantahala River Gorge. Separate Tuckasegee River excursions pass through historic Cowee Tunnel.
Tweetsie Railroad Blowing Rock, North Carolina	Named for the "tweet tweet" of its whistle and pulled by historic steam engine No. 12, the train does a 3mi (4km) turn through a wild west theme park. Highlights include rides, shows and a locomotive shop.
Secret City Excursion Train Oak Ridge, Tennessee	Departing a former Manhattan Project facility, this 12-mi (19-km) ride brings passengers face-to-face with the once secret complex where the atomic bomb was developed.
Tennessee Valley Railroad Chattanooga, Tennessee	In under an hour, guests ride through a Civil War tunnel and see a turntable rotate the locomotive for the return trip. A half-day round-trip to Chickamauga, Georgia includes a layover in the historic town.
Three Rivers Rambler Knoxville, Tennessee	Beyond Downtown Knoxville, the Rambler skirts farmland and abandoned quarry works to reach the “Three Rivers Trestle” where the French Broad and Holston Rivers join to form the Tennessee River.
James River Rambler Dillwyn, Virginia	Through the rolling hills and deep forests of Central Virginia, the Rambler's vintage diesels haul classic coaches along a heritage route. Highlights include open-air sightseeing cars.
Cass Scenic Railroad State Park Cass, West Virginia	Popular 1½-hour steam excursions include a layover at a traditional loggers' camp. Separate half-day sightseer trips transport visitors to the top of Bald Knob, the third-highest summit in the Allegheny range.
Durbin and Greenbriar Valley Railroad Durbin, West Virginia	Several DGV trains explore the Cheat Mountain region. A 40's streamliner heads for High Falls via a remarkable S-curve tunnel... a unique rail bus scales "Cheat" to reach the falls... and a rare gear-driven steamer meanders through the valley below.
Potomac Eagle Scenic Railway Romney, West Virginia	Excursions follow the South Branch Potomac River past farm and forest and into "The Trough," a narrow and secluded mountain valley where, high above their natural habitat, American bald eagles soar.

Source: [20].

MATCHING THE GRAND STRAND TO THE EXISTING EXCURSION TYPES

The previous section highlighted 'generic' options for tourist rail excursions. Now, we'll take a look at how the attributes of the Grand Strand mesh with this list to determine the more-feasible train excursion types for the area.

Highlighting Local Scenery

The R.J. Corman Carolina Line runs the following course:

- **Myrtle Beach – Carolina Forest – Conway – Loris – Tabor City – Chadbourn – Whiteville**

And, at this time, the line is not yet operational from Carolina Forest to Myrtle Beach (but that could change in the future). The current footprint can best be described as a mix of commercial / residential /agricultural. A tourist rail could follow the Strasburg Rail Road model and highlight the agricultural region (Conway, Loris, Tabor, City, etc.) and open spaces. More likely, the scenery will not be the primary experiences for the visitor.

Highlighting Local Food and Beverages

The Napa Valley Wine Train highlights wines and cuisine that are well-identified with the Valley. Key foods in this area of the Carolinas include:

- Seafood Dishes
- Low Country Boil / Frogmore Stew (shrimp, sausage, corn, and potatoes)
- Shrimp and Grits
- Chicken Bog (rice, chicken, and sausage)
- Barbeque (pulled pork, ribs)

It is possible to highlight these dishes in a tourist rail dining experience. Further, the area boasts a number of wineries, breweries/brew pubs, and distilleries, including:

- **Wineries**: LaBelle Amie, Duplin, Carolina Vineyards Winery
- **Breweries**: Liberty Grill and Brew Pub, Gordon Biersch, and New South Brewing
- **Distilleries**: Palmetto Moonshine

So, there is the opportunity to showcase the local cuisine.

Celebrating Local History

As noted earlier, the rail footprint can best be described as a mix of commercial / residential / agricultural. Now, visitors could see first-hand cotton and tobacco growing in the fields. And, to be clear, the agricultural past is an important part of the region. However, the local history may not lend itself to being the focus of a tourist rail excursion for the area. But, clearly a tourist rail experience does evoke a sense of nostalgia for its guests.

Showcasing Theater and Performance Art

Beach music, dancing (particularly, the 'Shag'), and musical theater are important elements of the local culture. Shows such as "Murder Mystery" or "Ghost Trains" may be well-received. And, with musical theaters (Carolina Opry, Alabama Theater, Legends in Concert) and Dinner Shows (Pirates Voyage, Medieval Times) in the region, there may be ample talent and partnerships available to develop applicable shows for a tourist rail excursion.

Special Occasion Rail Excursions

Myrtle Beach is a family destination frequented by over 16 million visitors per year. It is believed that children's excursions (such as Thomas the Tank Engine) and family-friendly themed trains (Mother's Day, Father's Day), could work well here. And, special events (New Year's Eve, Valentine's Day, etc.) could be fruitful for development as well.

CONCLUDING REMARKS

R.J. Corman has experience in operating tourist trains in other markets. They have committed to examining the potential for such a train excursion in their newly-acquired Carolina Line once track improvements are made and industrial freight clients have their immediate needs addressed. In the pages above, the potential for such a tourist rail line has been examined. On the surface, it appears an interesting opportunity may exist for the company. Consider the following relationships:

- Tourist rail excursions offer **family-friendly entertainment**. Myrtle Beach is a family beach destination with 16 million visitors per year.
- Tourist rail excursions can be done as **seasonal offerings**. Myrtle Beach sees an uptick in visitor numbers in summer months.
- Tourist rail excursions offer a **nostalgic experience.** Myrtle Beach is home to many retirees (grandparents with grandchildren) and snowbirds (winter visitors) who are prime markets for such nostalgia tourist offerings.

It is hoped that this research can aid decision-makers as they contemplate the development of a tourist rail attraction for the Grand Strand. With Myrtle Beach being the long-time host of the Southeast infORMS meeting, we will be able to see what happens in this regard. In fact, this may be a Southeast infORMS faculty development exercise in the future! Let's see what happens …

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A WAY TO PREDICT STAFF TURNOVER IN QUICK SERVICE RESTAURANTS- A PILOT STUDY

DENNIS V. BURKE, WALDEN UNIVERSITY
MICHAEL LATTA, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

ABSTRACT

According to the National Restaurant Association [6], the restaurant industry as a whole has one of the highest employee turnover rates in the U.S. labor force, at 62.6% compared to a 42.2% overall turnover rate in the private sector companies. Mirman [4] cited the following three most often mentioned factors that are keeping turnover rates high across the restaurant industry, from quick service to fine dining establishments:

1. Student Workers: There are a high percentage of workers in school, many of them in college or university programs (41% for servers).
2. Seasonal Changes: The restaurant industry is one of the greatest sources of seasonal jobs making it difficult to retain trained workers from season to season.
3. Few Opportunities for Upward Mobility: Quick service restaurants have lower paying jobs and fuel higher turnover. In fact, some quick service restaurants face turnover rates far beyond the 63% average - much closer to 150%-400% [9].

This research effort proposes that other factors within the soft-skill category predict turnover rates. A pilot Internet survey among workers in a franchise company of a national quick service restaurant chain was conducted using measures of emotional intelligence (EI), self-perception, operations performance, self-expression, interpersonal skills, stress management, happiness, and goodness-of-fit (GOF) among the EI sub-scales. Based on the results of a stepwise regression, two measures predicted turnover rate: operations performance and self-perception.

BACKGROUND

According to National Restaurant Association Educational Foundation (NRAEF) [7], Quick Service Restaurant (QSR) workers should bring 5 core competencies to their employment. The first category in the competency model includes adaptability and flexibility, interpersonal skills, and the ability and willingness to learn (Tier 1). The second category includes academic capabilities such as effective communication skills and interpersonal skills (Tier 2). The ability to work in teams, establish customer relationships, solve problems, and make decisions define the next category (Tier 3). Technical related skills define the next two categories (Tier 4 & 5), and the last category includes leadership skills and a reinforcement of communication and interpersonal abilities (Tier 6). According to Batt, Lee, and Lakhani

[1], developing a fully productive QSR employee requires approximately two months of work-related experience. Batt et al. [1] argued that the costs of turnover include the cost to replace the employee, lower productivity, reduced operational efficiency, negative impact on customer service, and decreased profitability.

METHODS

Measures used in this research included the following validated scales:

The operational definition of Emotional Intelligence (EI) is "the subset of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them, and to use this information to guide one's thinking and actions" [8].

The current study involves measuring Total Emotional Intelligence (EI) using the EQ-i 2.0 online self-assessment instrument. The Emotional Quotient Inventory (EQ-i) was developed by Bar-On, (1997) and revised by Multi-Health Systems, Inc. (2011) and is a trait-based measure of EI. Another widely used measure of EI is the MSCEIT V2.0, which is an ability based EI measure of EI competencies [3]. The EQ-i 2.0 is a valid and reliable measure of the internal success factors [12] and generates a universal EI score, five composite measures, and 15-subscales in a 1-5-15 factor structure [5]. Trait EI assesses the skills associated with awareness, understanding, regulating, and expressing emotions in interpersonal interactions [2]. The EQ-i 2.0 produces scores in the following ranges; 70-90 falls within the low-range, 90-110 falls within the mid-range, and 110-130 falls within the high-range [5]. MHS [3] provides the following definitions for the composite and subscale in the EQ-i 2.0 EI competencies:

Intrapersonal Self-Awareness and Self-Expression (Self-Perception and Self-Expression)

- Self-regard - accurately perceive, understand, and accept self
- Emotional self-awareness - be aware of and understand one's emotions
- Assertiveness -effectively and constructively express one's emotions and oneself
- Independence - be self-reliant and free of emotional dependency on others
- Self-actualization -strive to achieve personal goals and actualize one's potential [3].

Interpersonal Social Awareness and Interpersonal Relationship (Interpersonal)

- Empathy -be aware of and understand how others feel
- Social responsibility -identify with one's social group and cooperate with others
- Interpersonal relationship -establishes mutually satisfying relationships and relate well with others [3].

Stress Management Emotional Management and Regulation (Stress Management)

- Stress tolerance -effectively and constructively manage emotions
- Impulse control -effectively and constructively control emotions [3].

Adaptability Change Management (Decision Making)

- Reality-testing -objectively validate one's feelings and thinking with external reality
- Flexibility -adapt and adjust one's feelings and thinking to new situations
- Problem-solving -effectively solve problems of a personal and interpersonal nature [3].

General Mood Self-Motivation (Happiness)

- Optimism -be positive and look at the brighter side of life
- Happiness -feel content with oneself, others and life in general [3].

Operations Performance Score (OP): This assessment instrument was used to measure customer experience at the time of the restaurant visit regardless of the circumstances (staffing issues and new products initiatives) in the restaurant at the time. The OP score represents 30% of customer experience and measures quality, service, cleanliness, food safety, and leadership. The OP score reflects the average of annual assessments by the Multi-unit Manager (MUM) and the corporate inspector.

Turnover and Turnover Rate: Turnover comes from the U.S. Department of Labor (DOL) definition. The DOL defines turnover as the "Separation of an employee from an establishment." For the purpose of turnover calculation, employee separation includes voluntary, involuntary, or other causes [11]. Turnover Rate represents, "The number of total separations during a month divided by the number of employees who worked during or received pay for the pay period that includes the 12th of the month (monthly turnover); the number of total separations for the year divided by average monthly employment for the year (annual turnover)" [11].

The pilot survey involved a self-administered Internet survey to evaluate the Emotional Intelligence of 20 QSR managers at Brand Z company. Brand Z franchise operates approximately 20 business units in the Southeastern United States. Operational Performance (OP) scores and turnover rate data were collected from company historical records. The target population for the current study was quick service restaurant (QSR) general managers from brand Z franchise organization. The participants were QSR general manager who serve as the senior manager in each restaurant. The goal of the pilot survey was to identify potential predictors of Turnover Rate. As such, it was an exploratory study with a small sample of QSR unit general managers.

ANALYSIS AND RESULTS

A stepwise multiple regression analysis was completed using Turnover Rate as the dependent variable and Emotional Intelligence, Operations Performance, Self-Perception, Self-Expression, Interpersonal, Stress Management, Decision Making, and Happiness as independent variables.

The descriptive statistics for all variables are in Table 1 below.

TABLE 1: DESCRIPTIVE STATISTICS OF ANALYTIC VARIABLES

	Mean	Std. Deviation
Turnover Rate	3.28	1.10
Total EI Score	112.95	10.72
Operations Performance Score	83.58	4.23
Self-Perception	114.50	8.78
Self-Expression	107.25	11.06
Interpersonal	110.35	11.89
Stress Management	109.25	13.26
Decision Making	114.20	10.58
Happiness	105.15	12.43

The correlations among the variables are presented in Table 2 below.

TABLE 2: CORRELATIONS OF ANALYTIC VARIABLES

Variable Name	2	3	4	5	6	7	8	9
Turnover Rate (1)	.263	.558	.367	.250	.260	.099	.161	.261
Total EI Score (2)	1.00	-.309	.810	.866	.738	.834	.912	.666
Operations Performance Score (3)		1.00	-229	-214	-175	-376	-315	-.011
Self-Perception (4)			1.00	.610	.543	.638	.661	.701
Self-Expression (5)				1.00	.472	.693	.820	.579
Interpersonal (6)					1.00	.493	.546	.300
Decision Making (7)						1.00	.707	.473
Stress Management (8)							1.00	.695
Happiness (9)								1.00

A Stepwise Regression analysis was completed using Turnover Rate as the dependent variable and the other eight analytic variables as independent variables. The results of that analysis are presented below in Tables 3-4.

TABLE 3: MODEL SUMMARY FOR STEPWISE REGRESSION ANALYSIS

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.558[a]	.311	.273	.94079071	.311	8.120	1	18	.011
2	.754[b]	.569	.518	.76559781	.258	10.180	1	17	.005
a. Predictors: (Constant), OP Score									
b. Predictors: (Constant), OP Score, Self-Perception									

TABLE 4: COEFFICIENTS AND COLLINEARITY STATISTICS FOR STEPWISE REGRESSION ANALYSIS

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-8.880	4.274		-2.078	.052		
	OP Score	.146	.051	.558	2.849	.011	1.000	1.000
2	(Constant)	-19.007	4.708		-4.037	.001		
	OP Score	.177	.043	.677	4.140	.001	.947	1.056
	Self-Perception	.066	.021	.522	3.191	.005	.947	1.056
a. Dependent Variable: Turnover Rate								

Since the Variance Inflation Factors were low for both Operational Performance Score and Self-Perception, the model equation is as follows:

Turnover Rate = -19 + (.68 * Operational Performance Score) + (.52 * Self-Perception) + Error (1)

DISCUSSION

There are some limitations to this pilot study. The most obvious limitation is only 20 QSR managers participated to date. In addition, the Operational Performance scores may reflect evaluator's biases. The study did not control for organizational culture, the gender of participants, the level of education, and physical work environments, which are possible moderating variables within the context of the research. In addition, the use of online self-assessment instruments to collect Self-Perception and other Emotional Intelligence data may include participant biases. Finally, the use of a correlational design is ideal for examining relationships between variables and allow for regression analysis; however, the regression model does not guarantee that causation has been identified [10].

CONCLUSIONS AND IMPLICATIONS

Most restaurant workers are not inherently competent at using the soft-skills as measured by the EQ-i 2.0 assessment instrument and increasing employee retention might improve operations performance scores. Teaching both new hires and business students the soft skills and abilities needed to perform well in QSR jobs might help to reduce turnover rate in the industry. For example, an organizational focus on improving the factors, demonstrated by using the mean Operational Performance Score and the mean Self-Perception value to produce an equation

98 = -19 + 57 + 60 (2)

shows retention increasing from an average loss of 19 employees to retaining 98 employees.
This improvement in employee retention rate or reduction in employee turnover rate would enhance QSR operations and business success. The generalizability of the conclusions is limited due to the small sample size.

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Academic Support Services for Undergraduate Business Majors

KATHLEEN WHITCOMB

Moore School of Business, University of South Carolina

Introduction

The percentage of undergraduate students enrolled as business administration students nationwide was approximately 19% in 2013-2014[1]. At the University of South Carolina, the percentage of entering freshman in 2016-17 is roughly 25%. For the first time at the University of South Carolina, the number of freshman students entering the Darla Moore School of Business will exceed the number of students entering the College of Arts and Sciences. While the general increase in business majors follows a national trend, the enrollment increase in the Moore School can also be attributed to high visibility undergraduate programs, notably the number one ranked undergraduate major in International Business[2].

Along with the marked increase in the number of students enrolled at the Moore School, the academic qualifications of entering students have also increased. The number of Moore School students enrolled in the Honors College and the Capstone Scholars Program exceeds all other colleges at the University. Numerous programs including study abroad, internships, and capstone projects with multinational corporations are available to the academically exceptional students in the Darla Moore School.

Although the increased popularity of the undergraduate business major has attracted more highly qualified students, it also has resulted in an increase in the number of students who struggle with the academic workload. There are many reasons that students encounter difficulty completing

their coursework on schedule or even within an extended period of time. One major cause is simply that they are not adequately prepared for the academic requirements for many of their courses. Most schools have tutoring programs in place to assist students with courses that are "stumbling blocks". Peer tutors are selected based on their performance in these class and are trained for one-on-one as well as group tutoring sessions.

Academic Support Services for The Darla Moore School.

Academic support outside the classroom for business students needing remediation and tutoring services is available, but it can be expanded to better meet the needs of its students. Insufficient support in these areas has costs beyond the individual struggles of students who fail to progress in the program. When students receive a "low pass" in prerequisite courses, this has consequences in subsequent courses, and not just for the students who barely scrape by. Instructors in upper level classes have reported that they must review material taught in "core" or prerequisite classes before they can begin to cover their own course content. Furthermore, these instructors have found that it is not just the "bottom third" of their class that needs review. It appears that many more students have not mastered the core content of pre-requisite courses. This has been an ongoing subject of concern at the Moore School. A marked increase in the number of students entering the program in conjunction with the initiation of a redesigned and more rigorous undergraduate business administration program beginning in 2016-2017 has pushed the need for student support services—tutoring, remediation, and emphasis of improved study skills—to the forefront.

In order to assist students to better understand difficult course material, all students should have access to free services in the form of: tutoring, supplemental instruction, academic coaching, and encouraging better study skills.

Tutoring. Currently, peer tutoring is available for several core business courses. However, the availability of these tutors is not adequate to cover the number of students needing their assistance. For example, two peer tutors are assigned for 10 hours per week to cover the needs of approximately 500 undergraduates enrolled in the introductory business course each semester. Additionally, peer tutors for these courses currently receive no training or oversight from the instructors teaching these courses. Clearly, the number of peer tutors needs to be increased and core course instructors need to work with peer tutors to ensure that they are adequately trained.

Supplemental Instruction. Because freshman requirements are the same across all majors at the University of South Carolina, it is not uncommon for students entering the Moore School to have deficits in academic areas necessary to progress through the program. This is especially true as it pertains to quantitative skills. This sometimes come to light when students meet with faculty to discuss problems they are having with coursework. Although they have successfully completed high school mathematics courses required for university admission they may need to review a core set of quantitative skills before they can master more advanced concepts taught in their courses. This is not "remediation" in the formal sense. Students may "catch up" by completing an informal online course designed to review core quantitative and analytical concepts.

Academic Coaching. At the University of South Carolina, The Academic Success Coaching (ACE) program offers all undergraduate students at the University an opportunity to examine their strengths (and weaknesses) to construct a plan for success in college. Coaches meet one-on-one with undergraduate students to create an academic and engagement plan, set goals, and share resources to help undergraduate students achieve their academic goals within and beyond the classroom environment. During a meeting the following areas may be discussed:

- General Academic Advising
- Academic Planning & Success Strategies
- Strengths Identification
- Engagement Planning & Campus Involvement
- Navigating Campus Resources

Study Strategies. As mentioned above, many instructors who teach upper-level classes have noted that students, even those with a high GPA, have not retained material taught in pre-requisite courses. Consequently, a significant portion of class time is used to review previously learned material. What strategies can be employed in core courses to encourage mastery of course material? Research in memory, cognition, and learning have found that the most popular study strategies employed by students are suboptimal[3,4,5]. Cramming, mass learning, and re-reading course material may give students the illusion of learning, and may even work in the short run, but do not promote deep learning. Recent publications on the science of learning confirms much of what veteran teachers believe about effective study skills, but also provides some new insights and practical strategies for encouraging students to employ effective study skills. A few of these strategies are briefly described :

1. Require students to read material that will be covered in class prior to class. This "primes" students for learning and may increase engagement and comprehension.
2. Construct assignments so that students are encouraged to attempt the assignment multiple times.
3. Space practice out. For example, require a time lapse of two or more days between assignment attempts. This encourages forgetting and forces student to work harder to

retrieve previously learned material. The increased effort engages long term versus short term memory processes and increases retention.

4. Mix it up. The interleaved practices should not present problems in the same order.
5. Interleaved practice. Assignments should contain a variety of problem types. While we teach topics "one chapter at a time", it has been shown that learning is more effortful and deeper when the problems students encounter are varied.
6. Frequent low stakes testing. While frequent testing is unpopular with students and draws from valuable class time, students appear to retain the material longer with frequent testing. The tests should be cumulative—any topic previously covered is fair game. Test dates should be announced (no "pop" quizzes).

Strategies 2, 3, 4, and 5 can be implemented relatively easily using online homework managers. Strategy 1 can be encouraged using clicker technology. Strategy 6 seems burdensome for both teachers and students, but the tests are short duration and less stressful for students since they are lower stakes. Students should be informed why the instructor is employing these strategies. Though these study strategies require more effort from the students, they promote deeper understanding of the material and greater retention.

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ADVANCED USES OF FILM IN BUSINESS CLASSES: MEETING THE EXPECTATIONS OF VIDEO QUALITY AND LEARNING EXPERIENCES OF UNDERGRADUATE STUDENTS

DR. JANICE BLACK
Coastal Carolina University
DR. LEANN MISCHEL
Coastal Carolina University
DR. JESSICA DOLL
Coastal Carolina University
MR. P R (DICK) DRASS
Coastal Carolina University

Many faculty in colleges of business are just as passionate about teaching as they are about their areas of research. They truly desire to help their students acquire the skill sets that they will need to be able to practice sound business practices (Aronnson, 2004; Benjamin & O'Reilly, 2011; Chia & Holt, 2008; Hernandez-March, Martin del Paso, & Leguey, 2009; Schramm, 2012; Smith & Clark, 2010). Yet our teaching practices often continue to lag the level of technology available and that students expect (Gabriel, Campbell, Wiebe, MacDonald, & McAuley, 2012) resulting in needing new pedagogical needs. Indeed, one could argue that an institution with roots over a thousand years old was never designed to teach such students as those currently entering (Cope & Kalantzis, 2009; Tapscott & Williams, 2010). Our current set of rising first time freshmen have grown up in a world of technology mediation (Gabriel, Campbell, Wiebe, MacDonald, & McAuley, 2012) and some may experience a "digital dissonance" (Clark, Logan, Luckin, Mee, & Oliver, 2009) where their preferred use of a particular technology or technology interface (e.g. a cell phone) may even be banned by some institutions of higher education in a classroom setting by some professors.

Professors are open to the idea of using new technologies in their teaching efforts but have raised concerns ranging from the lack of knowing who is doing the work when it is accessible and submitted through most online learning management systems to the in appropriate use of web surfing, texting, and other smart phone use in the classroom (Gabriel, Campbell, Wiebe, MacDonald, & McAuley, 2012). We can conclude from the earlier work that students are accustomed to using a variety of technological means to both communicate and learn and instructors are also using more and more pedagogies that are mediated by technology. In fact, faculty have used films to help show students how specific aspects of their course occur in a different and often "real world" setting beginning back in the 1950s (Anderson, 1950). So the question arises as to how the newer digital media enables new uses of a traditional medium, film or as it is now referred to, video. We begin our paper with a review of the use of film in higher education and college of business in particular. We then share three new uses of video to help in the educational processes that directly address needs evidenced by our traditional-aged undergraduate student.

VIDEO AND HIGHER EDUCATION

Film[1] and television[2] tapes (video) have been used in higher education from the 1950s but even twenty years after that, it was viewed with skepticism (Harvey, 1976). The price of commercial products and the time and skill involved in creating one's own products were two factors that made its extensive use problematic (Harvey, 1976). Video has been used in the classroom to illustrate and support lectures (Anderson, 1950). It has been used to record lectures and broadcast them at

[1] Content produced on a cellulose tapes that was recorded, edited, produced, then projected onto a large screen for mass viewings.

[2] Content produced on video tapes that were recorded, edited, produced and then displayed on a television screen for mass viewings.

later dates and sometimes distant locations (Rich & Luckey, 1970). They have been used to provide instruction for the deaf through the ability to provide textual information simultaneously with visual information (Shurtz, 1968). Even the use of commercially produced and mass marketed movies has made it into the classroom (Sprinkle & Urick, 2016). Over time, the availability of videos and their ease of use in a classroom setting have enabled professors to use them more frequently. This was particularly valuable for traditionally-aged undergraduate students whose age and stage of life gave them few experiences to which they could link concepts that they were learning in business classes (Golden-Biddle, 1993; Hunt, 2001; Bodemer, Ploetzner, Feuerlein, & Spada, 2004). We conclude that video has been widely used as a medium of conveying instruction and supporting instruction. We will focus this paper on the latter. The support of instruction through the use of video.

VIDEO IN THE CLASSROOM

The real world is often messy and complex, video has continued to be used as a means to introduce students to such settings and provide a vicarious experience for students (Sprinkle & Urick, 2016). As mentioned earlier traditional-aged students often lack experiences in which to contextualize textbook concepts (Hunt, 2001). Book publishers and even independent film makers have stepped up and provided access to "movies" of a variety of common work situations (Bodemer, Ploetzner, Feuerlein, & Spada, 2004). Faculty members have since the 1990s been actively using relatively short "clips" in their classrooms which has evolved into a formulaic "theory introduction, video clip, discussion" (Sprinkle & Urick, 2016; Tolich, 1992). The use of actual movies certainly made courses more popular with students however, some faculty became concerned that students may be too passive and not thinking deeply about why the movie is being viewed as well as ho it illustrates the academic concepts (Sprinkle & Urick, 2016).

To help students retain the concept worksheets have often been developed to help students link specific concepts to specific scenes (Champoux, 1999). Using discussion questions and worksheets, thus helped students be engaged with the video keeping the conscious effort at linking concept and visual at hand. This has worked in business courses for topics ranging from organizational behavior (Champoux, 1999), leadership and power relationships (Sprinkle & Urick, 2016), and even very abstract concepts such as ethics (Champoux J. E., 2006). Often, several scenes can be used that help a student track from a more simple use to more complex uses (Champoux J. E., 2006).

Others have tried for a more immersive experience for the students. Sprinkle and Urick (2016) suggest two modes of using movies: a game-like experience and a panel discussion using experts, books and related movie clips called a "Movie Club". In the first instance, the faculty member provides a challenge and awards points in a competitive mode for students to find the illustrations and interconnection between concepts displayed in a movie. Thus, the students earn points for identifying the various layers of complexity about a topic and compete openly with others to score the most points and acquiring extra rewards along the way (snacks, extra credit points, small game tokens, and so forth). In the Movie Club, the students still received an introduction to the concepts but rather than just viewing a short clip, they then participated in a scavenger hunt looking for concepts in action during the watching of the movie in its full length.

The students had a paper guide to help the students know when to focus more closely on the film. The debriefing included a panel of experts both on the business topics but also on the author of the related book. The example provided by Sprinkle and Urick (2016) took about 8 hours and was an extra-curricular event.

We see that the use of video in the classroom has changed over time moving from relying on the novelty of its use to engage students to changing how students watch the video once that novelty did not prove to be of sufficient motivation to spark student engagement. We know look more closely at recent student attitudes towards media and its impact on how we use movies in the classroom.

CURRENT COLLEGE STUDENTS IN COLLEGES OF BUSINESS

For a number of years now, scholars have noted significant differences in today's college students who are entering college directly from their K-12 experiences (Nonis, Hudson, Philhours, & Teng, 2005; Twenge, 2010). Some have reached the conclusion that they simply learn differently than older generations learn (Johnson & Romanello, 2005). Pure lectures simply won't engage these students where interactive learning experiences (i.e. technology enabled and mediated) will (Sprinkle & Urick, 2016). However, they also come to the higher education classroom with weak preparation and knowledge bases in reading skills, writing skills, and analytical thinking skills (Nonis, Hudson, Philhours, & Teng, 2005). Furthermore, while they do not engage well in a lecture format, they have been trained over the years to be very passive in the classroom and to do only what the instructor clearly communicates is needed (Litzenberg, 2010). This often results in their continuing asking of clarifying questions that instructors refer to as needing to be "spoon fed" or "hand held" in accomplishing larger projects. Whenever possible, students prefer to use technology as they learn (O'Connor, Kieser, & Olivo, 2011) in a less formal instructional way (Price, 2011) and which has either an immediate application or deliverable (Price, 2011). Less formal does not mean a more general descriptions of the assignment.

Students when moved to the greater freedoms allowed in higher education find that they prefer to choose when and where to do the work (Hershatter & Epstein, 2010) even as they find it difficult to transfer skills learned in one class or life in general to a different classroom or context (Charsky, et al., 2009). They still prefer precise and extensive directions on what to do (Hershatter & Epstein, 2010). Even when put in charge of their interaction with media (video in particular) students still do better with extensive aids guiding their experiences (Sprinkle & Urick, 2016).

SKILLS NEEDED BY BUSINESS STUDENTS

Many of the employers of graduates of colleges of business expect students to move into white collar work or management. Such work requires be capable of managing themselves in staying on task and completing work; that they be able to communicate across a range of mediums; that they be problem solvers who actively use critical thinking; that they can lead others in accomplishing tasks as well as knowing when they can accomplish tasks on their own; and to be able to interact well with others (Black, Keels, & Rhew, 2014). The soft skills of professionalism, communications and proactive contextualized behavior is also very critical (Black, Keels, & Rhew, 2014).

It is evident from the above stated needs of current employers and from the preferences and learning styles of the traditional-aged college student that we need to make further changes in our a teaching approaches. This includes how we use videos whether short or long in our classrooms.

THE PROACTIVE LESS STRUCTURED USE OF VIDEO IN THE CLASSROOM

If we agree that we need to change the way that we teach to help students learn some of the soft skills needed by business employers, then some of the areas that need to be changed include helping students to learn to be proactive in solving problems; to learn to transfer skills more readily to new contexts, to be more confident in the gathering of information, in its interpretation and use

and to be able to communicate well both orally and in written forms and in more formal business technology-mediated forms. We present three possible ways of using videos to help reach these goals: Generating Video Cases and Presenting Them, Rapid Online Video Case Expansions, and Live Case Video Documentaries Productions. These progress in complexity and in the competent use of self-directed learning and handling of uncertainty.

GENERATING VIDEO CASES AND PRESENTING THEM

The first example is designed to be used in a first-semester Junior-level face-to-face corebusiness course. It is developed on the assumption that students have successfully handled their first two years at college and have passed freshman English. It is anticipated that they will not be confident in acting on their own with a wide open assignment such as "Present a video case on Chapter 11 next week"; but, that they will need instruction on what a video case looks like, and some initial help in what to include. For this assignment the traditional video case use of "theory, video, discussion" will be utilized.

Student Learning Objectives

The following are assignment student learning objectives:

1. Students will display the ability to correctly identify course concepts in contexts other than the classroom setting.
2. Students will correctly identify key terms related to course main concepts and their definitions.
3. Students will correctly spell and present professionally on a page key terms related to course main concepts.
4. Students will present a professional set of instructions and guides to enable others to identify concepts, problems and issues related to course topics.

5. Students will professionally present a video example of key concepts in action..
6. Students will professionally guide a small group discussion of topics or concepts from video case.
7. Students will confidently provide oral answers to discussion questions.

These student learning objectives support program learning objectives such as:

1. Students will know basic business concepts.
2. Students will demonstrate understanding of concepts in business or real world contexts.
3. Students successfully communicate in written means.
4. Students engage in professional oral communication practices.

Faculty Set Up

The faculty member will first use this emerged traditional form of using videos and will include a vocabulary page from a textbook's chapter upon which the theory or lecture portion of the class is based and a discussion guide to direct the student's attention while watching a video clip of about 5 minutes long. After demonstrating this process a few times, the instructor will then assign student groups to create a similar video case for an anticipated chapter. All students groups will have a different chapter for which to prepare. The instructor can restrict students to movies or allow students to find any video clip of about 5 minutes (plus or minus 1 minute) to use.

Student Responsibilities

The students will develop the vocabulary list for the chapter, identify the video clip portion to be used and acquire it to display to the class, and prepare a discussion guide for the rest of the class to use. The students will also prepare a series of slides in a presentation software to use to guide

their presentation of the video case and its subsequent discussion. The student then have 20 minutes in which to present their video case exercise to the class.

RAPID ONLINE VIDEO CASE EXPANSIONS

The second example is designed to be used in a Senior-level management or entrepreneurship elective course. It is developed on the assumption that students have successfully handled their first three years at college, are familiar with their libraries online databases and know the course management system used to deliver the course in an online fashion. It is anticipated that they have already been exposed to skills such as obtaining articles from the library's database and in doing online searches. For this assignment the traditional video case use of "theory, video, discussion" will be utilized and expanded upon. The time frame for this exercise is one week.

Student Learning Objectives

The students learning objectives for this assignment are:

1. The student will demonstrate competency in finding specific articles in the library databases.
2. The student will be able to successfully identify concepts from scholarly articles in noneducational environments as demonstrated by the video case.
3. Students will be able to find out about the background of someone who provides material online.
4. Students will be able to link other peoples' perspectives to the concepts from scholarly articles.
5. Students will be able to demonstrate the work of others through proper use of citations.

Faculty Set Up

The faculty member needs to identify an extension scholarly article on a concept of interest within the boundaries of the course topics. Along with the article, the faculty member will identify a popular movie that illustrates one or more points from that article; a quote from an expert practitioner in that area; and a relevant Ted talk. For example, Table #1 shows this range of preparation in an extension area related to the dilemmas faced by entrepreneurs on whether to gain experience or to engage in more education.

Insert Table 1 about here.

The faculty member can also identify a documentary for an Honors student to do in addition to the work done by the regular students. The faculty member should also create a short quiz based on the key concepts from the scholarly article that they want the student to extract. This quiz would happen on the first day of the week. Ideally, the rest of the material will not be made available until the students successfully pass the quiz. The quiz can be very short but should have a set of questions to draw upon so that students may receive different questions randomly provided by the computer through the class management system in use. The students should receive the names of the articles and the names of the movies in their syllabus so that they can access these materials rapidly at the start of the week or at the end of the week before.

It is recommended that the movies be available through an online streaming service such as Netflix or Amazon prime. Then, provide the student with guiding discussion questions for answering when or after watching the movie. For example, the following was provided for article and movie in Table 1.

As you watch this movie, look for classic parts of the entrepreneurial process and the answers to these questions...

1. Do they have a compelling product/service? Are they passionate about it?
2. Do they seek outside funding or fund themselves? Do they spend appropriately given your business school education?
3. Do they find a location? What is right about it? What is wrong about it?
4. Do they have any problems? How well do they make their decisions?

After students post their responses, they are asked to respond to each other's postings with thoughtful comments and additional linkages if any. On the next day, debrief by providing the extension concepts and present the name of the expert practitioner and their related quote along with the name of the Ted talk that you wish the students to view. The students are instructed to find out who the practitioner is and to determine how it is linked to the extension concepts as well as looking up and viewing the Ted talk, finding out about that presenter and again determining how it is linked to the concepts. Students again post their links between these additional sources of information and their original reading and the movie. After they post, they respond to other students' postings. They finish the week with a reflection journal where they comment on what they learned that week and describe an article about a current company or entrepreneur who has also demonstrated the concepts.

Student Responsibilities

Students are responsible for searching the library databases for the scholarly article, reading it, and taking the short quiz. Students are responsible for obtaining and watching the movie and answering the related questions and linking it to one or more concept from the article. Students read each other's observations and comment on them. They next look up the author of the quote and post what they found out about the author and why they should or should not believe the quote and how it links to the concepts under discussion. They find and watch the Ted

talk, look up the person there and determine if they should believe what is said and again link it to the topics of interest. Notice that the student is being drawn into engagement with the items by the gathering of information and then its use within the class management system.

LIVE CASE VIDEO DOCUMENTARIES PRODUCTIONS

The last example is designed to be used in a Junior-level face-to-face first course in major. It is developed on the assumption that students have successfully handled their first two years at college and have passed freshman English and have some basic back ground in management terms and in business terms. It is anticipated that they will not be confident in acting on their own with a large term project assignment that will require them to work in teams across time to accomplish. For this assignment the traditional video case use of "theory, video, discussion" will NOT be utilized. This use of a video requires that the students actually create a documentary on a live business and its owner (or possibly its manager). The video is more of an example of the student putting into practice skills that they learn in class and seek confirming information for a whole series of lectures. Because of the interaction with the real world, there is an inherent amount of uncertainty and dependencies on outsiders who have different goals in life that requires students have plans and back up plans. There are also expectations that students will be able to figure out common computer applications and learn to use them moderately effectively which are anticipated to take students outside of their comfort zones.

Student Learning Objectives

This assignment has the following student learning objectives:

1. Students will demonstrate the ability to contact people off campus to participate in a project with the student.

2. Students can effectively video an interview so that the people involved can be both seen and heard.
3. Students demonstrate an understanding of developing a story or narrative about an entrepreneur by creating a coherent documentary.
4. Students explore the real world instances of entrepreneurial practices discussed in class and confirm or disaffirm their existence in the world outside of academia.
5. Students identify and add to their entrepreneurial social network.
6. Students can link their work to class concepts and present those linkages clearly to others.

Faculty Set Up

This particular exercise requires the most set up. Faculty will need to create a manual explaining to students the processes of doing qualitative research and how to do cold calling to contact potential interviewees. Faculty will also need to include some interviewing skill days where they cover in addition to the concepts required by the course, the interviewing, videoing, storytelling and editing skills that may be needed. For example, many students do not know professional phone etiquette and so how to present yourself professionally on the phone to businesses may need to be discussed and practiced. Because the interviews are a form of research on human beings, we require that students take the online training in human subject research requirements that are required by all researchers on campus. This provides students with an understanding of ethical practice in doing research and an opportunity to bring ethics from conceptual discussions to action. Practice in interviewing and in following a qualitative interview guide (where students have the questions that all will ask written down) is recommended due to students' lack of working without such specific guidance and it follows general practices in qualitative research processes. Finally, it is a good idea to show students examples of a final

"documentary". The faculty member can find some short videos about entrepreneurs on YouTube (if nothing else, you can find copies of ones our students have put up). The documentary is limited in length to between 3 and 5 minutes per subject. Each student is expected to find a subject, interview them, and create a documentary. Then, groups of 3 to 5 students then gather their documentaries together, identify common themes across their entrepreneurs and stories that are related to class concepts. Finally, the group presents their themes and documentaries in a public forum where students beyond just their classmates are invited to attend. Often, these documentaries are first uploaded to YouTube and then shown as a YouTube video due to their size and the variations of being able to view the movies on different videos.

Student Responsibilities

Students are expected to read and follow their research manuals. They are expected to use their own personal social networks or to cold call until they find at least two people who would be willing to be a part of their research project and video documentary. The students practice their contact and interview efforts during class sessions and then go out and do the actual interviewing with video capture. They next edit down the larger video session into a shorter version that follows a storyboard that they have developed to tell the story of the entrepreneur's start up efforts. They use main titles, subtitles identifying their entrepreneur, maps showing where the entrepreneur's business is located, and visuals of the entrepreneurs' locations and products or services in addition to the interview footage in the development of their documentaries. They bring all of their documentaries into one larger themed documentary (it is between 10 and 20 minutes long). Finally the students present their documentaries to their audiences. These presentation sessions are usually either a part of a university-wide celebration of faculty and student research or is a special session

introducing entrepreneurship and entrepreneurs to freshmen students as part of the freshmen students' orientation to the college of business.

CONCLUSION

Students entering higher education today directly from high school benefit from learning in ways that engage them. Video use by professions has changed over the years to meet the needs of both faculty and students. Some ways that we can change how we currently use videos in class can range from small changes from just presenting videos to students as examples and cases to requiring students to find and present such video examples. Another extension would be to have students link the video cases directly to scholarly articles and practitioner statements and presentations thus translating the scholarly concept into practical applications. Finally, students can actually use the generation of amateur documentaries as a way to demonstrate the concepts in action. All of these ways require that students learn, practice, and persist in efforts and thus help them to also learn the soft skills desired by today's employers of our graduates.

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Table 1:

Required Content Material for Entrepreneurial Elective Course				
Article	Movie	Documentary (Honor Students)	Quote	Ted Talk

Cooper, A. & Mehta, S. (2006) Preparation for entrepreneurship: Does it matter?, *The Journal of*	Ghostbusters, 1984	Beer Wars, 2009	*"The critical ingredient is getting off your butt and doing something. It's as simple as that. A lot of people have ideas, but there are few who decide to do something about them*	Richard St. John: *8 Secrets of Success*
Private Equity, Fall 2006: 6-15			*now. Not tomorrow. Not next week. But today. The true entrepreneur is a doer, not a dreamer."* -Nolan Bushnell, entrepreneur	

ADVANCING THE ETHICAL TAX PROFESSION

Joseph Krupka, Lander University

ABSTRACT

The ethical environment in which tax professionals operate is multifaceted. In the recent past there has been an ethical crisis within the tax profession, as excessive cases of ethical failures have weakened the tax profession in the eyes of the public. These ethical dilemmas arise from the stress inherent between assisting the client and upholding the public interest.

Tax professionals should accept the obligation to act in a way that will serve the public interest and exhibit a responsibility to the profession. Our voluntary compliance-based system functions on the public's perception that all tax professionals have their ethical obligations at the forefront of their professional attention. Compliance to essential ethical principles may potentially be affected by self-interest, self-review, advocacy, familiarity and intimidation threats. In resolving those conflicts, a tax professional should comply with five ethical principles: Integrity, Objectivity, Competence, Confidentiality, and Professional Behavior.

Collaboration between academia and the tax profession has been slowly advancing over the past several years. The Association to Advance Collegiate Schools of Business (AACSB) has encouraged that accounting education embrace ethics in its curricula. Tax ethics research remains a challenging arena to produce practice driven benefits to the tax profession.
This paper will present assertions to enhance ethical initiatives for the tax profession to assist in restoring public confidence and the advancement of ethical tax professionals.

INTRODUCTION

The ethical environment in which tax professionals (TPs) operate is multifaceted. In the recent past there has been an ethical crisis within the tax profession, as excessive cases of ethical failures have weakened the tax profession in the eyes of the public. The accounting profession in general has undergone severe criticism in the aftermath of numerous accounting scandals as we have witnessed the catastrophic fall of Arthur Andersen as a result of the Enron nightmare. In recent years there has been ample evidence of an ethical crisis within the tax profession. As Sikka and Hampton (2005) note, the aggressive tax avoidance behavior of the major public accounting firms "raises major questions about the assumed social responsibility and ethics of accountancy firms. Understanding the unique issues facing the tax profession is therefore a high priority."

The American Institute of Certified Public Accountants (AICPA) has identified ethical dilemmas involving tax issues as posing the most challenging ethical problems for their members. Ethical failures over the past decades have weakened the tax profession and called into question the extent to which practitioners in fact operate in a manner consistent with the public interest. Prior literature supports the contention that TPs operate in an environment characterized by factors that give rise to numerous ethical pressures.

In the context of taxation, "ethics" is a term most commonly used to mean a set of values or principles which should be of universal application – in other words "normative ethics', which define what we ought to do. Thus, what is normative can be subject to development and change, and it depends on the extent to which changes have been successfully implements as to whether values and principles may also change. The ethics environment in which TPs operate is complex. At the core of the ethical debate is the question of how much a taxpayer is "obligated" to pay and what exactly the tax professional (TP) should be prepared to do or advise to reduce the tax bill. The debate is not over "to pay or not to pay", but rather

about the ethical standard to be applied to determine what should be paid. Taxpayers have the right to pay only the amount of tax legally due.

TPs have always been concerned with ethical issues in conducting their practice. Three significant directives that impact the TP are (1) the AICPA's Statement of Standards for Tax Services, (2) the IRS's Circular 230, and (3) relevant penalty provisions in the Internal Revenue Code affecting both TP and their clients. These three directives suggest ways for the TP to strengthen his or her ethical awareness. Through analyzing the tax profession within the framework of the fraud triangle (Cressey 1953), we can explore the ethical problems observed in the tax profession and consider changes to safeguard the future of the profession.

THE FRAUD TRIANGLE FRAMEWORK

The fraud triangle (Cressey 1953) provides a helpful and well-established framework for analyzing the tax profession. A fraud, or "trust violation" in Cressey's (1953) terminology, generally involves three elements: opportunity, incentives, and rationalization.

Opportunity

In the tax reporting environment lax enforcement mechanisms can create opportunities for tax reporting fraud. The tax law is brimming with "gray" areas, thus creating opportunities to exploit tax loopholes to resolve taxes, but which simultaneously undermine the integrity of the tax system. Opportunities for trust violations also exist where detection risk is low. The IRS is not sufficiently resourced to comprehensively monitor tax reporting (Smith 2004).

Incentives

Incentives serve to influence judgment (Watts and Zimmerman 1986); three primary forms incentives take are economic, social, and moral. Economic incentives involve individuals behaving in ways that maximize their own self-interest. Economic incentives generally involve the prospect of financial gain. For example, increasing client fees provide a strong economic incentive for the TP. Avoidance of legal penalties serves not only as an economic incentive, but also carries with it a social incentive element. This is because the desire to avoid adverse publicity might limit persons from engaging in fraudulent behavior. Congress has reduced the IRS's budget leading to less effective enforcement. These changes placed increased pressure on individual TP's moral incentives to maintain professional trust by meeting responsibilities to both clients and the public.

Rationalization

The rationalization is reconciling an individual's internal moral incentives with economic and social incentives present in the environment and created by the situation. In effect, these rationalization approaches involve the TP mentally eliminating the difference between what should be done and what is done. The TP can then rationalize the action because it is technically in compliance with the law; that is, the public interest condition has been satisfied.

When they coincide, opportunity, incentives, and rationalization can cause the TP to deviate from its intended ideal. Conversely, if each of the elements is not present, according to Cressey (1953) fraud will not occur. The challenge is then to find ways to control the impact of each of the three elements, thus limiting the occurrence of tax fraud. This framework suggests that violations of the public trust occur when three elements are present: the opportunity to engage in unethical behavior, incentives to engage in such behavior, and rationalization of the behavior. These ethical dilemmas arise from the stress inherent between assisting the client and upholding the public interest.

THE PUBLIC INTEREST

The public interest is defined as the collective well-being of all stakeholders that the TP serves. The TP should accept the obligation to act in a way that will serve the public interest, honor the public trust, and demonstrate a commitment to professionalism; acceptance of its responsibility to the public continually demonstrating their dedication to professional excellence.

The TP operates with a public interest focus and is motivated by something beyond commercial gain. Thus a requirement of the TP is to balance the needs of the client with the duty to uphold the integrity of the tax system within which the TP operates. There is an inevitable tension between serving the client and maintaining the integrity of the tax system. Resolving this tension necessitates an ethics-infused judgment process. In terms of TPs and their decision-making processes, in an ideal world, TPs acting ethically should follow not only the letter of the law, but also the spirit of the law. In an ideal world the letter of the law and its underlying spirit would be aligned with one another, but, in reality this is not always the case. Compliance efforts may be seriously compromised when the TP fails to "walk the talk," thereby giving the taxpayer license to disregard tax laws.

To Avoid or Evade

TPs are the gatekeepers who are the leaders of tax law compliance for their stakeholders. Measuring tax evasion is notoriously difficult, there is widespread evidence that tax evasion is extensive and commonplace. Tax evasion consists of illegal and intentional actions taken by individuals and firms to reduce their legally due tax obligations, by underreporting incomes, sales, or wealth, by overstating deductions, exemptions, or credits, or by failing to file appropriate tax returns. Prior studies regarding tax evasion do not focus specifically on the cash business sector. Some of the studies suggest that the TP and taxpayers often have an unspoken understanding that they will not discuss cash income; allowing the TP to avoid the uncomfortable question of whether to contribute in what is clearly an evasion scheme.

Tax avoidance constitutes tax payers efforts to reduce their tax payments to taxing jurisdictions through perfectly legal tax planning. The connection between Corporate Social Responsibility (CSR) and tax avoidance has drawn considerable interest recently as research has shown mixed results. Hoi, Wu, and Zhang, (2013) present findings are consistent with a negative relation between CSR and tax avoidance. They interpret their results as evidence that tax avoidance is an indicator of corporate culture that is associated with a lack of CSR. In contrast, Davis, Guenther, Krull and Williams, (2015) present findings consistent with a positive relation between CSR and tax avoidance and conclude that firms findings consistent with a positive relation between CSR and tax avoidance. In addition, it was discerned that firms do not view tax avoidance as part of CSR.

Most Certified Public Accountant (CPA) firms are very aware of the importance of managing the risks of financial statement audits in an environment characterized by heightened litigation, but they are now becoming increasingly cognizant of tax engagement risks (Beasley et al., 2006). Yancey (1996), observes that while audit failures have been well publicized in the media and are very costly to settle, tax claims occur more frequently and tax engagements give rise to approximately half of all malpractice claims against CPA firms. As we have seen, the literature supports the contention that TPs operate in an environment characterized by factors that give rise to numerous ethical pressures and risk. A TP rendering tax services is entitled to put forward the best position in favor of their client providing the service is performed with professional competence, and does not in any way impair their integrity, objectivity or confidentiality and is consistent with the law.

A recommitment to professionalism is a needed change the profession must make to enhance its future. This recommitment can manifest itself in leadership's actions and initiatives using stringent ethical criteria. For real character development to be effective a renewed commitment to, communication of, and training in professionalism. Sikka and Hampton (2005) describe public accounting firms as being a "part of the contemporary 'enterprise culture' that persuades many to believe that 'bending the rules' for personal gain is a sign of business acumen." This is inconsistent with the public interest perspective; these need changes in our recommitment, communication, and training.

THE FIVE ETHICAL PRINCIPLES

TPs should accept the obligation to act in a way that will serve the public interest and exhibit a responsibility to the profession. Compliance to essential ethical principles may potentially be affected by self-interest, self-review, advocacy, familiarity and intimidation threats. In resolving those conflicts, a TP should comply with five ethical principles: Integrity, Objectivity, Competence, Confidentiality, and Professional Behavior.

Integrity
TPs should be straightforward and honest in all professional and business relationships. The AICPA Code Rule 102, Integrity and Objectivity, states, "In the performance of any professional service, a member shall maintain objectivity and integrity, shall be free of conflicts of interest, and shall not knowingly misrepresent facts or subordinate his or her judgment to others."

Integrity refers to honesty, fair dealing, and trustworthiness along with free from conflict of interest. Integrity refers to personal qualities and attributes that are considered essential for the TP which include transparency, correct interpretation of facts, ability to make fair decisions, and the ability to exercise reasonable skill. The principles of integrity include:

- Integrity is an element of character fundamental to professional recognition. It is the quality from which the public trust derives.
- Integrity requires a TP to be honest and candid within the constraints of client confidentiality. Service and the public trust should not be subordinated to personal gain.
- Integrity is measured in terms of what is right and just.
- Integrity is doing the right thing when nobody is watching.
- It is a character trait than enables a TP to withstand client pressures even if it means loss of a client

Objectivity
Objectivity refers to another independent TP arriving at the same conclusion using similar processes. The principle of objectivity addresses a responsibility for all TP to:

- Not to compromise their judgment due to bias or conflict of interest.
- Rely on verifiable data;
- Display impartiality
- Colleagues looking at the evidence will
- Derive at the same solutions for the transaction that their colleagues would when inspecting the same documentation

Competence
TPs should provide services that they have competent professional skills to perform and not portray themselves as having expertise or experience they don't possess. The principle of competence expects the following commitments to be adhered by TP:

- To maintain professional knowledge and skill at the level required to ensure that clients receive competent professional services ; and
- To perform conscientiously with applicable tax laws.

Professional competence may be divided into 2 phases:
(1)Achieving professional competence:

- Completing professional education requirements.
- Suitable working experience.

(2) Maintenance of professional competence:

- Continuing Professional Education programs (CPE).
- Proper training and supervision.

Confidentiality
TP should respect confidentiality of information acquired during the course of performing professional services and should not disclose without proper authority. The principles of confidentiality require the TP not to:

- Reveal confidential information acquired as a result of a professional relationship without proper authority.
- Exploitation of confidential information acquired for personal benefits.

The obligation of confidentiality continues even after the end of the relationship between the TP professional and the client. Even after the end of the tax engagement with the client, confidential information can be disclosed:

- When the disclosure is authorized by the client.
- When disclosure is required by law.
- In the course of legal proceedings.

Professional Behavior
The principle of professional behavior imposes an obligation on TP to comply with the tax laws and avoid any action that discredits the profession. TP should not bring the profession into disgrace as they ought to be honest and truthful and should not:

a. Make exaggerated claims for their services, qualifications, or experiences.
b. Make disparaging references or unsubstantiated comparisons to the work of competitors.

Tax practitioners operate within a highly complex regulatory environment in which knowledge of the tax law is critical. One of the primary services provided by the TP is competently negotiating the myriad of tax laws. The concept of "profession" has been widely debated in literature as Toren (1975) identifies two key characteristics of professions that appear to be accepted within the literature: "a body of theoretical and technical knowledge and a service orientation." These foundational professional responsibilities of technical competence and service-oriented character build trust (Covey1989; Covey et al. 1994). The second of Toren's (1975) characteristics is service-oriented character. In effect, this service orientation amounts to the members of a profession adopting a public interest, rather than merely a personal business

perspective. Accountability should communicate the professional understanding that each TP has authority and responsibility for his or her decisions.

DUE DILIGENCE

Most people understand "due diligence" to mean the research and analysis of a company that is performed in preparation for a business transaction. In a legal context, it also means the care that a reasonable person exercises to avoid harm to other persons or their property. The due diligence standards applicable to tax services stem from the standard-of-care definition of due diligence. While there is no universal requirement as to the steps a TP must take when preparing a tax return or giving tax advice, the due diligence standard is an objective standard that asks what a reasonable TP would do under the same circumstances.

Practice Tips
The following are some best practice due diligence tips regarding tax services as encouraged by IRS Circular 230 for TPs:

- The expectation that TPs should communicate clearly with clients about the terms of the engagement.
- TPs must determine the client's expected purpose for and use of the tax advice they are receiving, and they should have a clear understanding with the client about the form and scope of the advice and assistance they are rendering.
- To determine the facts in the case and determine which facts are relevant.
- TPs should also evaluate the reasonableness of any assumptions or representations and relate the applicable law to the relevant facts.
- TPs must also evaluate potentially applicable legal cases and support their conclusions with an analysis of the law and how the law applies to the facts in the case.
- TPs must also advise clients about the importance of the conclusions they have reached.
- TPs are expected to act fairly and with integrity when practicing before the IRS.
- Those TPs with managerial authority should take reasonable steps to ensure that their firm is in compliance with Circular 230's best practices.

Reasonable Inquiry
At the heart of due diligence is the necessity to make reasonable inquiries of the taxpayer as circumstances warrant. A TP may not ignore the implications of any information provided to or actually known by the TP. This means that The TP must be able to spot the potential issues implicated by the facts presented, and must then follow up with the client to obtain additional facts necessary to make an accurate determination of tax liability.

For example, OPR v. Kaskey, a CPA was barred from practice before the IRS for, in part, failure to exercise due diligence under section 10.22. The due diligence claim against Kaskey stemmed from an examination of the CPA's clients that showed that the officer compensation reported on the corporate return did not match the wages reported on the individual returns. Kaskey claimed that his clients had misrepresented their income to him, however the appellate court found there were clear indications that the client's representation was incorrect and that Kaskey had failed to make adequate inquiry of his clients. The Kaskey case is the first published opinion under Circular 230 to examine the due diligence requirement of section 10.22.

In Brockhouse v. US, the court upheld the imposition of a preparer penalty under IRC section 6694(a) against a CPA for the CPA's failure to pursue further factual inquiry when the facts as presented by the taxpayer suggested additional information was necessary to adequately determine the tax liability. The

regulation under section 6694(a) at that time provided that a preparer is not negligent if he exercises due diligence. In interpreting that regulation, the court stated that "this due diligence requirement means that a preparer must act as a reasonable, prudent person with respect to the information supplied to the preparer," and if the information supplied would lead a reasonable, prudent preparer to seek additional information, it is negligent not to do so. Both Kaskey and Brockhouse serve as examples where a preparer is found to have not fully investigated the factual circumstances supporting a tax return positon.

Resolving ethical conflicts
TPs encounter situations that give rise to conflicts of interests. TPs may conflict with internal or external demands of one type or another:

- There may be a danger of pressure from a supervisor or partner.
- The TP may be asked to act contrary to the technical/professional standards.
- A question of divided loyalty between the TP's superior and the required professional standards.

When resolving ethical conflicts, the following should be considered:

- Review the conflict problem with the immediate supervisor.
- Seek counseling and advice confidentially from an independent TP to obtain a possible course of action.
- If the conflict still exists after fully exhausting all levels of review, the TP should resign the tax engagement.

THREATS TO FUNDAMENTAL PRINCIPLES OF ETHICS

Anyone practicing tax law cannot risk not knowing the fundamental ethical rules that govern tax practice before the IRS. Failure not to know and observe these rules can expose both the TP and their clients to great harm. The client is potentially subject to increased income tax and tax penalties, and the TP may be subject to tax penalties and the risk of losing the right to practice tax law before the IRS. TPs must be prepared for increased IRS scrutiny. The days of a "kinder and gentler" IRS are long over. The federal government is faced with an enormous need for additional revenues, and there are two ways of generating that revenue – increase taxes or increase tax compliance.

Compliance to the fundamental principles may potentially be affected by self-interest, self-review, advocacy, familiarity and intimidation threats.

- **Self Interest Threat** Self Interest threat occurs when a TP could benefit from a financial interest in, or other self-interest conflict with an assurance client.
- **Self-Review Threat** Self-Review Threat occurs when (1) any product or judgment of a previous engagement needs to be reevaluated in reaching conclusions on the engagement or (2) when a TP was previously a director or officer of the client or was an employee in a position to exert direct and significant influence over the subject matter of the engagement.
- **Advocacy Threat** Advocacy threat occurs when TP promotes or may be perceived to promote, a client's position or opinion to the point that objectivity may, or may be perceived to be, compromised.
- **Familiarity Threat** Familiarity threat occurs when, by virtue of a close relationship with an client a TP becomes too sympathetic to the client's interests.
- **Intimidation Threat** Intimidation threat occurs when TP may be deterred from acting objectively and exercising professional skepticism by threats, actual or perceived, from the client.

Safeguards
The TPs has a responsibility to remain ethical by reducing the threats and developing safeguards available to reduce or eliminate the threats to an acceptable level. Safeguards fall into two categories:

(1) Safeguards created by the profession, legislation or regulation:

- Educational, training and experience requirements for entry into the profession.
- Continuing education requirements.
- Professional standards and monitoring and disciplinary processes.
- External review of a firm's quality control system.

(2) Safeguards within the firm's own systems and procedures:

- Firm leadership that stresses the importance and the expectation that members will act in the public interest.
- Policies and procedures to implement and monitor quality control of tax engagements.
- Timely communication of the firm's policies and procedures and any changes thereto, to all partners and professional staff, including appropriate training and education thereon.
- A disciplinary mechanism to promote compliance with policies and procedures.

Our voluntary compliance-based system functions on the public's perception that all TPS have their ethical obligations at the forefront of their professional attention. This works in part due to the public's perception that all TPs are honest, reasonable, and efficient. If we do not report ethical violations by the unethical TPs the taxpaying public will not trust the system.

ACCOUNTING ETHICS EDUCATION

Can Accounting Ethics Be Taught
One of the greatest challenges facing the accounting profession today is to maintain exemplary ethical behavior. It follows therefore that one of the greatest challenges for accounting academics is how to get the ethical message across to accounting students, the practitioners of tomorrow. The accounting scandals in the early 2000's had a devastating effect on the reputation of the accounting profession. The public perceives the scandals as a lack of ethics in the profession. The business world has changed; the role of the TP has changed; and accounting curricula must also change in order to prepare students for ethical dilemmas they may encounter in their future careers. An educational reform is needed in the accounting curriculum whereby several questions arise regarding teaching ethics in business schools:

- How does accounting and ethics mix?
- Is teaching ethics in accounting relevant?
- Does good business means good ethics?
- Is ethics a personal or public matter?

So what can be done to address accounting ethics education? The concern about the level of unethical behavior in the accounting profession reflects the need for accounting programs to effectively prepare accounting students to handle ethical dilemmas in their accounting careers.

Challenges of Teaching Ethics in Accounting
Who Should Teach Ethics? Questions have been raised by the academic community regarding who should teach ethics to accounting students. One school of thought suggests that accounting ethics should be taught by accounting faculty; another view is that should be taught by Ethics Philosophy Professors; a third view is a combination.

There are two opposing viewpoints to consider effectively teaching accounting ethics: accounting ethics should be taught as a stand-alone course; or integration throughout all accounting and business school courses. Should Ethics be taught as a Single Course? Should Ethics be embedded within all accounting courses in the curriculum? Most researchers favor integration as the superior mode of introducing students to ethical training, on the basis that it provides for a wider variety of ethical situations which an accountant might meet in practice (Bampton and Cowton, 2002). In addition, Alam (1999) found that the majority of accounting teachers surveyed favored the integration approach, or the combined approach of an ethics subject and integration through the rest of the course. Could Ethics as a team teaching concept be effective? Encourage training of the accounting faculty members to teach the accounting ethics course. Textbooks and other educational materials should address current events, costs of unethical behavior, and the prominence of ethical dilemmas.

Evidence suggests that academics teaching or wishing to teach ethics in accounting courses may well face skepticism or even outright opposition. At one extreme ethics is seen as simply not relevant. The objection that ethics is not even relevant in the accounting curriculum reflects a naïve view of accounting. Short of that, teaching ethics to accounting students is questioned in terms of its necessity, effectiveness or appropriateness; at times. There is some evidence that this is more characteristic of academics that lack real world experience never having to face actual ethical dilemmas in the business realm, would be inadequately qualified to effectively teach accounting ethics. The increasingly narrow emphasis of accounting PhD programs (Lee 1995; Schwartz et al.2005; Cohen and Holder-Webb 2006; Williams et al. 2006; Shaub and Fisher 2008) leaves the greater majority of accounting professors without the tools with which to explore the ethical dimensions of our discipline. Academics object claiming willingness if only resources to teach ethics were available. Albrecht & Sack (2000) report a survey that found ethics was ranked as being more important by practitioners than by academics, these viewpoints continue today.

Dillard (2008) notes, “the public expects universities to transcend the production of accounting technicians by exploring the societal role of accounting, integrating and enhancing technical competence with an understanding of the complex responsibilities of accounting to organizations, society, and the environment.” To this extent, if students are not exposed to this kind of thinking by professors; therefore, it would not be surprising that they fail to see their ethical responsibilities.

Academic Responsibility

The question of academic responsibility to teach accounting ethics is an important component in future accounting curriculums. However, it seems clear that there is much misunderstanding. Scandals having involved egregious ethical failures such as Enron have brought to the forefront the need for ethics education. In academic literature there has been inconsistency regarding the need and nature of accounting ethics education at the collegiate level for accounting students. The issue of nature of ethics instruction revolves around whether ethics should be taught as a stand-alone topic (Hanson, 1987; Loeb, 1998) or whether the issue should be integrated throughout the entire accounting course (Thomas, 2004; Swanson, 2005; Bodkin and Stevenson, 2007) or implementing a team teaching concept could be effective.

Bampton & Maclagan (2005) suggest that the various objections put forward by the sceptics can be summarized as follows:

- That teaching ethics to accounting students is not relevant**.**
  This objection typically reflects a belief that accounting is concerned with objective criteria, for example, with profit and the bottom line as incontestable measures, and that therefore accountants do not face ethical issues.
- That even if teaching ethics is relevant to accounting, it is not necessary, because the existence of legal frameworks for business and professional practice, the presence of codes of ethics, and the

prior influence of family, church and other institutions in society, are sufficient to provide guidance.
- That in any case teaching ethics has no effect**,** as it will not change people's fixed views or disreputable behavior.
- That teaching ethics to accounting or business students is not a responsibility of universities or their staff anyway.
- Feasibility because of staffing, timetabling and other constraints. It taken at face value, this is not an objection to the inclusion of ethics as much as a practical consideration concerning the availability of resources for such teaching.

Feasibility

Feasibility is one of the most common explanations offered for the absence of ethics in the accounting curriculum. The struggle with how to effectively include ethics into their curriculum continues to plague many accountancy programs. Accreditation demands have exacerbated the issue creating an outcry that there are not enough teaching hours to include ethics. Clearly, any decision on teaching accounting ethics and its placement in the accounting curriculum must be made by business school deans and/or accounting department heads along with guidance from the AACSB. Since the Bedford Committee report was issued in 1986, the American Institute of Certified Public Accountants (AICPA), the American Accounting Association (AAA), the Accounting Education Change Commission (AECC), and the National Commission on Fraudulent Financial Reporting (NCFFR) have all called for increased ethics coverage in the classroom.

Ethical education does not cease the day a student graduates walks across the stage with their degree. Forty-four state boards of accountancy have responded to the need for ethical training with various continuing education requirements for Certified Public Accountant licensure; the six states currently not requiring any ethical training are Alabama, Georgia, Louisiana, Georgia, North Dakota, South Dakota and Wisconsin.

Business schools play a crucial role in developing professionals who exhibit both competence and character. Collectively, we need to accept and meet this responsibility. Ghoshal (2005) suggests that "we-as business school faculty – need to own up to our own role" in the ethical failures that have plagued the business world in recent years. Ghoshal (2005) attributes part of the problem due to the exclusion of ethics and morality within the components of teaching and research. Similarly, Cohen and Holder-Webb (2006) suggest that "we as accounting educators must ask ourselves how much responsibility we collectively bear for this apparent decay." The interrelated context of research and teaching are interchangeably the problem and the solution.

Accounting Ethics Courses

Tax students should be exposed to ethical problems during their education, so that when they get out into practice they have some foundation for evaluating alternative actions in an ethical framework. Teaching accounting ethics course does not promise to provide answers to complex moral dilemmas; however, thoughtful and resourceful business ethics educators can facilitate the development of awareness of what is and is not ethical, help individuals and groups realize that their ethical tolerance and decision-making styles decrease unethical blind spots, and enhance curiosity and concern about discussing moral problems openly in the workplace.

Ethics courses and training can afford the following:

- Provide students with rationales, ideas, and vocabulary to help them participate effectively in ethical decision-making processes
- Help students "make sense" of ethical dilemmas by establishing ethical priorities

- Provided intellectual weapons strengthen their ethical knowledge.
- Develop conscientiousness to moral issues and an assurance to finding moral solutions
- Strengthen moral courage

Accounting ethics courses cannot or should not advocate a set of rules from a single perspective nor offer only one best solution to specific ethical problems. Given the facts and circumstances of situations, more-desirable and less-desirable courses of action may exist. Decisions depend on facts, inferences, and rigorous, logical, ethical reasoning. Neither should ethics courses or training sessions promise superior or absolute ways of thinking and behaving in situations. Rigorous, informed, and conscientious ethical analysis is not the only way to reason through ethical dilemmas.

To be effective in accounting ethics teaching, it must be identified what are the learning objectives. Loeb (1988) suggested several possible goals that include:

- Relate accounting education to moral issues.
- Develop students' ability to recognize and deal with ethical issues and conflicts in accounting
- Develop in students a sense of moral obligation or responsibility
- Help students deal with the uncertainties of the accounting profession
- "Set the stage" for a change in ethical behavior.

Faculty

Faculty need to commit to, communicate, and teach ethics in the classroom. Professional character and competence development problems arise when agency theory assumptions of aggressive self-interested behaviors become self-fulfilling prophesies and business topics are taught in an ethical vacuum (Ghoshal 2005; Ferraro et al. 2005; Cohen and Holder-Webb 2006). Professional behavior is guided less by self-interested incentives and more by service-oriented motives. Faculty should commit to being role models for students to emulate their ethical actions and interactions.

To some extent, the problem may lie in the training of faculty since some may lack the tools with which to teach accounting ethics. I suggest that a lack of training and inability to teach ethics are essentially excuses; deflecting attention away from the more significant problem of not educating future TPs in accounting ethics. Equipping faculty with such tools is necessary as academic administration should encourage professors to attend professional and academic accounting training seminars and conferences. Faculty should model high ethical ideals for students to serve as an example and mentor.

The ultimate purpose of accounting research should be to improve accounting practice, rather than simply describe, understand or critique. An inconsistency appears to have emerged between the concerns of practitioners and academics as to the need to identify the impact of accounting ethics research. Early research in ethics business education was a limited interest as noted by Loeb and Bedingfield (1972).

The AACSB (2008) task force on research stated that scholarly inquiry is an essential process that places business schools in a unique and important position at the intersection of theory, education and practice. Any discussion about the impact of research on practice must include education in the equation as there is a triangular connection between research, practice and teaching.

Mitroff (2004) argues that business school faculty has promoted a distorted view of human nature, outdated notions of ethics, and a narrow definition of the role of management, among other things; he suggests "that what is being promoted in the classroom is a world of self-gain, competitiveness, and market morality; that is, an essentially amoral and some might say immoral world." As a result, he says, business school faculties have essentially created an educational environment that fosters corporate collapses, making them accomplices in these collapses.

Everett (2007) in response to these critiques provides a discussion of business faculty ethics. This disconnect focuses on the perceptions of academics working in the field of accounting, as it is in this field that Mitroff and others (Etzioni, 1991;Ghoshal, 2005) single out in the "appalling and sorry state of business schools" (Mitroff, 2004). Everett (2007) focused on accounting academics that completed their Ph.D. programs at top tier universities. This disengagement could be a function of these individuals' anticipation of the demands of this field's symbolic market, and the prices that this market places on certain symbolic goods (Bourdieu, 1989), primarily, high level academic publishing.

In the field of accounting academe, Everett (2007) noted that ethics is seen as a relatively important issue, more important than these critiques imply. That said, however, ethics is no by no means seen as a key educational priority. On the surface the disconnect between values and action could be attributed to a number of factors, including a lack of time, materials, encouragement, training, or reward (Loeb and Rockness, 1992; McNair and Milam, 1993). Everett (2007) concluded that the majority of the accounting faculty he interviewed had seemingly genuine interest in improving business practices and in producing graduates that practice with honesty and integrity.

In the business school curriculum, coursework in accounting ethics should have a rather prominence in the preparation of the next generation of TPS. There has been a growing concern regarding the ethical behavior of TPs. It remains generally unexplored in academic literature the TPs approach to ethical dilemmas. Not all research supports the notion of ethical and moral growth over time through education. Some researchers have found that students with high positive scores on ethical tests could also behave unethically, even though they had been exposed to ethics education and have attained higher-stage development in ethical assessment models (Ponemon, 1993; Thomas, 2004).

CONCLUDING REMARKS

This paper has presented assertions to enhance ethical initiatives for the tax profession to assist in restoring public confidence and the advancement of ethical tax professionals. Times are changing. There are signs of improving interactions between the accounting profession, professional and scholarly publishing, and academics. This is observed by the inclusion of academic work in professional publications; research funding supported by the accounting profession; and the publishing of research on current issues facing accounting academics by the accounting profession. Tax ethics research remains a challenging arena to produce practice driven benefits to the tax profession.

The Association to Advance Collegiate Schools of Business (AACSB) has encouraged that accounting education embrace ethics in its curricula. A lack of competence in professors, limited administrative support, and weak accreditation, support are current reasons for the deficient within accounting curriculums. "Support for faculty**"** is the idea to provide accounting ethics education of the highest quality including the faculty need for resources in the areas of training, increasing time in the curriculum, furthering encouragement and budget. Unfortunately, interest in accounting ethics has not been widespread and the issue has re-emerged only sporadically. Academic accounting research remains a challenging and engaging area. Collaboration between academia and the tax profession has been slowly advancing over the past several years.

Price is only ever an issue in the absence of value. So is your accounting ethics curriculum an issue or of value? Resolving these issues is necessary for the academics to fully implement effective accounting ethics into the discipline. Character development and trustworthiness are critical components of the development of future TPs. This should be an integral part of our restorative process to gain the trust of the public once again after the scandals of the past two decades. Academia can no longer ignore its responsibility to deliver the content necessary to help future TPs learn the difference between ethical and unethical behavior. We cannot guarantee success, but we have a responsibility to try.

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AGE-BASED SOLUTIONS FOR CLASSIFICATION AND SELECTION OF MUTUAL FUNDS

Ali A. Nazemi, Ph.D., Roanoke College, Salem, VA
Nazemi@Roanoke.edu

C. Michael Smith, CFP®, Ph.D., Roanoke College, Salem, VA
Cmsmith@Roanoke.edu

ABSTRACT

This study analyzes the population of available mutual funds to determine the best funds available for investors. In determining ideal fund choices, asset allocation categories are utilized to identify the mutual funds that best meet an investor's risk capacity, as determined by the investor's age.

INTRODUCTION

In 2008, more than 92 million individuals in the U.S. (about 45% of U.S. households) owned mutual funds but many do not know what they own, why they owned them, and what makes a mutual fund more desirable than the rest. In 2001, the mutual fund industry held over $11.7 trillion worth of assets and funds are available in practically any investment category and size. The mutual fund constituted about 17% of the estimated total of financial securities. There are a number of variables that contribute to the rate of return of a mutual fund and its overall rating and within category ratings. For that reason, many funds use a variety of diversification strategies to achieve favorable returns.

Although, mutual funds were designed to be simple and straightforward, recent developments in the market and increasing popularity of these funds have prompted the introduction of more complex and diversified issues. This in turn, has made the individual, managerial and institutional decisions regarding the purchase of such issues much more difficult, requiring a great deal of analysis both quantitatively and qualitatively.

One of the difficulties encountered by many investors in decisions regarding such financial securities is the large number of decision variables that must be analyzed and taken into account before considering such securities for a portfolio. This becomes particularly important in situations where investors need to achieve certain financial goals at various stages of life and have different risk propensities. In such cases, a robust and easy-to-use decision model is needed to guide the investor in the classification and selection of such financial securities.

Financial advisors earn a living by providing financial advice and investment guidance to individuals and families. Financial advisors serve an important role in a consumer-driven society, where many individuals may not know the best tools and methods to pursue their financial goals. Due to the complex nature of each client's financial needs, it is important for advisors to perform a significant amount of due diligence to be sure that they "know the client". Advisors frequently meet for hours with new clients in an effort to better understand not only their financial goals, but the methods of pursuing those goals that might best meet the client's risk tolerance. Unfortunately, there is no reliable and accepted method for truly understanding another individual's tolerance. While there are numerous models and methods, all are significantly flawed, and frequently provide results that do not match a client's true motivations in practice.

For instance, a client is likely to complete a generally accepted risk-tolerance assessment with results that suggest that the client has an "aggressive" risk tolerance. With no reason to question the client's results, the advisor is practically obligated (given the "know your client" rule by the Financial Industry Regulatory Authority) to suggest "aggressive" investments for the client's portfolio. While the client may be pleased with this strategy for as long as returns are positive, many times a downturn in the economy reveals the client's "true" risk tolerance. Oftentimes, frantic calls are made to the advisor and demands are made to pull their money out of the aggressive investment and reallocated to much more conservative investments – to stop the pain of the investment's short-term losses. In this case (which is not atypical), the client's true risk tolerance and their stated risk tolerance did not match. Oftentimes, suffering an actual downturn in the market is the only method of revealing a client's true risk tolerance.

Because of the difficulty in assessing risk tolerance, many advisors secretly admit that they provide the risk assessment tools to clients for the simple fact that they are required to do so. The "know your client" rule requires that an adequate attempt is made to assess risk tolerance, but unfortunately, advisors have no way to successfully perform this assessment despite numerous attempts [6]. Therefore, advisors may be tempted to simply "check off the box" that they provided the tool in case they are ever sued by the client, or in case regulators ask for it in compliance checks.

While these circumstances are unfortunate, assessing a client's true risk tolerance is terribly difficult, if not impossible due to the biological complexity of human-beings [8]. Although ample efforts have been made to create reliable tools for measuring risk tolerance, persistent flaws exist because of the complexity involved in human decision-making [4] [6] [9] [12].

Given the lack of practicality in adequately assessing risk tolerance, this study suggests that regulators and advisors refocus their efforts from risk tolerance to risk capacity. While risk tolerance is a vague human concept, risk capacity is easily determined. Simply, younger clients have a higher risk capacity and are capable of handling more risk than older clients.

Risk capacity is not a new concept. In fact, there is an old rule of thumb in the financial planning community when it comes to asset allocation. The rule is - subtract your age from 100 – and that is the percentage of your investment assets that you should invest in stocks (with the remainder invested in bonds). This rule of thumb is based solely on a client's risk capacity and does not consider individual risk tolerance. But which stocks and which bonds?

While research has been conducted to address asset allocation choices using age [3], no research has been conducted to aid advisors in the specific selection of investments that best match a client's risk capacity. This study analyzes a collection of over 10,000 mutual funds and using factor analysis, determines the funds that prove to be the most beneficial to investors of a certain age group/risk capacity.

Data & Variables

Through collaboration with an investment company, we have acquired fund-specific information for over 10,500 mutual funds. For this investigation, we intend to narrow down this dataset to include only those funds that meet certain quantifiable characteristics. This is primarily because our model is built based on certain characteristics of diversified stock and/or bond funds.

For the models proposed in this study, several original variables were identified and analyzed to accommodate the complexity of decisions regarding the investment in mutual fund issues. These variables are associated with:

1. The characteristics of issues offered such as asset allocation, risk, return, fees (expenses), and past performance;
2. Requirements of the existing portfolio or investment objectives; and
3. Other elements such as management and external factors that can affect the mutual funds market.

Some of these variables are extremely heterogeneous in nature with complicated characteristics. Among those identified, some are directly associated with the issue itself while others are based on the risk propensity of the decision-maker. We have identified over 50 variables that might impact the decision regarding the selection of a particular mutual fund. Some of these variables were deemed to have only a minimal impact on the model design and were not considered for the model. During the course of study, we anticipate that some new variables may surface and/or some of the existing variables may be eliminated. The following table shows a list of potential variables that may be used in the model.

Potential Decision Variables
Asset Allocation (Fund Category)
Morningstar Overall Rating
YTD Return (November 2015)
1 Year Return (%)
5 Years Average Annual Return (%)
10 Years Average Annual Return (%)
Since Inception Average Annual Return (%)
Inception Date
Years in Existence (Years - calculated)
Risk Rating
Expense Rating
Management Fee (%)
Transaction Fee (Yes/No)
Administration Fee (%)
Load - Sales Charge (%)
Alpha
Beta
Standard Deviation
Sharpe Ratio
12b-1 (%)
Manager Tenure (calculated Years)
Net Assets Value (NAV)
Average Market Capitalization
Turnover Ratio
Credit Quality (if available)
Open to New Investors (Yes/No)
Duration (Years)

Model Design

For our model we had to identify several variables that are based on the investors' financial goals, their stage of the life-cycle and their capacity for risk. Age groups were classified much like popular risk tolerance classifications (conservative, moderately conservative, moderate, moderately aggressive, and aggressive) and based on a life expectancy of most life insurance contracts (100 years).

- Age group 5 – Ages 16-32 (Youngest – Highest risk capacity)
- Age group 4 – Ages 33-49
- Age group 3 – Ages 40-66
- Age group 2 – Ages 67-83
- Age group 1 – Ages 84-100 (Oldest – Lowest risk capacity)

Further, each age group has an assigned return goal. All investments have an inherent risk/return tradeoff. Therefore, investments with higher return potential will have inherently more risk (generally expressed by volatility) than investments with lower returns. Given that younger investors have a higher risk capacity, the return goals will be higher for younger age groups and become lower as the age group increases (thus lowering the risk).

- Age group 5 – Returns greater than 12%
- Age group 4 – Returns greater than 10% but less than 12%
- Age group 3 – Returns greater than 8% but less than 10%
- Age group 2 – Returns greater than 6% but less than 8%
- Age group 1 – Returns greater than 4% but less than 6%

Stock Funds

A popular variable used to determine the risk/return capacity of stock funds is the market capitalization of the firms in which the mutual fund invests. Small-capitalization (or small cap) funds have historically provided higher returns and higher standard deviations (a measure of an investment's risk). Large-cap funds tend to provide lower returns and standard deviations and mid-cap funds fall somewhere in between.

Market Capitalization (Size) Categories	
Large-cap	Market cap over (approx.) $30 billion
Mid-cap	Market cap between (approx.) $10 and $30 billion
Small-cap	Market cap under (approx.) $10 billion

Is this the most important variable in determining the risk/return tradeoff? This study will not only analyze market capitalization, but numerous other categorizations that include:

- Large Blend
- Large Growth
- Large Value
- Mid-cap Blend
- Mid-cap Growth
- Mid-cap Value

- Small Blend
- Small Growth
- Small Value
- World Stock (Global)

International Funds

- China Region
- Diversified Emerging Markets
- Diversified Pacific/Asia
- Europe Stock
- Foreign Large Blend
- Foreign Large Growth
- Foreign Large Value
- Foreign Small/Mid Blend
- Foreign Small/Mid Growth
- Foreign Small/Mid Value
- India Equity
- Japan Stock
- Latin America Stock
- Pacific/Asia ex-Japan Stock

Bond Funds

In the analysis of fixed income, the credit quality of the issuing firm is the most popular variable for determining the risk/return tradeoff of bond funds. For instance, high-yield (junk) bond funds tend to provide higher returns and standard deviations than U.S. Treasury funds. In addition, long-term bond funds have historically provided higher returns than short-term bond funds. Once again this study will analyze the credit quality and the maturity along with numerous other categories to determine the best funds for each age group.

- Short-term Bond
    - Short Government
    - Ultrashort Bond
- Corporate Bond
- Emerging Markets Bond
- High Yield Bond
- Inflation-Protected Bond
- Intermediate Government
- Intermediate-Term Bond
- Long Government
- Long-Term Bond
- Multisector Bond
- World Bond

Stock/Bond Funds

The return potential of asset allocation and balanced funds (combinations of stocks and bonds) is typically expected to be higher the more the fund invests in equities over fixed income.

- Aggressive Allocation
- Moderate Allocation
- Conservative Allocation
- Tactical Allocation
- World Allocation
- Target Date
    - 2000-2010
    - 2011-2015
    - 2016-2020
    - 2021-2025
    - 2026-2030
    - 2031-2035
    - 2036-2040
    - 2041-2045
    - 2046-2050
    - 2051+

Excluded Funds

For the purposes of this study, several classes of funds were excluded from the analysis.

- Undiversified stock funds (Financial, Utility, etc.)
- Municipal bond funds
- Real estate
- Derivatives
- Convertables
- Difficult-to-classify funds (Market Neutral, Nontraditional)

METHODOLOGY, ANALYSIS AND RESULTS

To compare fund performances, we selected the 5-Year return primarily because this data was available for most funds. Also, this selection does not include a significant downturn in the market or eliminate funds that are fairly new. For the first category of funds, clearly large cap and mid cap funds demonstrated stronger returns relative to the other fund classes analyzed.

Capitalization Category	5-Year Return (%)	StDev	Number of Funds
Large Growth	12.81	1.88	570
Large Blend	12.20	1.98	640
Small Growth	11.78	2.33	498
Mid-cap Value	11.49	2.13	160
Large Value	11.38	1.84	317
Mid-cap Growth	11.35	2.35	184
Mid-cap Blend	11.19	2.39	280

Small Blend	10.72	3.22	337
Small Value	10.30	2.52	180
World Stock	7.56	2.53	361

For International stocks, the 5-Year Returns are considerably lower than funds containing US stocks, however within the category, large and mid-cap international stock funds still enjoyed higher overall returns.

Capitalization Category	5-Year Return (%)	StDev	Number of Funds
Foreign Small/Mid Growth	7.48	2.61	62
Foreign Small/Mid Blend	6.29	2.63	26
Japan Stock	5.60	3.51	11
Foreign Small/Mid Value	4.82	2.99	21
Foreign Large Growth	4.67	1.91	141
Diversified Pacific/Asia	3.94	1.35	19
Foreign Large Blend	3.79	2.56	280
Foreign Large Value	3.42	2.12	118
Pacific/Asia ex-Japan Stk	1.43	2.13	23
India Equity	1.02	2.69	7
China Region	0.45	2.66	33
Diversified Emerging Mkts	-3.19	2.70	200
Latin America Stock	-13.16	1.22	15
Europe Stock			48

Returns for Bond funds were all considerably lower as expected**.** Long-term and Government bond funds demonstrated higher returns over the past 5 years.

Capitalization Category	5-Year Return (%)	StDev	Number of Funds
Long-Term Bond	7.64	1.44	2
Long Government	5.81	1.44	18
High Yield Bond	4.77	1.55	286
Corporate Bond	4.19	1.39	74
Multisector Bond	3.93	1.38	91
Intermediate-Term Bond	2.95	0.96	380
Intermediate Government	1.88	0.76	154
Short-term Bond	1.32	0.88	209
World Bond	1.24	2.15	128
Inflation-Protected Bond	0.94	0.73	81
Emerging Markets Bond	0.70	3.05	73
Ultrashort Bond	0.62	0.58	46
Short Government	0.61	0.58	58

For Balanced funds, 5-Year Returns were much higher with aggressively allocated funds as funds with a higher equity percentage enjoyed stronger overall performance.

Capitalization Category	5-Year Return (%)	StDev	Number of Funds
Target Date 2051+	9.39	1.06	12
Target Date 2041-2045	8.42	1.15	31
Target Date 2031-2035	8.15	1.33	33
Aggressive Allocation	7.98	1.72	148
Target Date 2046-2050	7.97	1.91	40
Target Date 2036-2040	7.78	1.87	43
Moderate Allocation	7.43	2.09	312
Target Date 2021-2025	7.11	1.34	31
Target Date 2026-2030	7.05	1.86	52
Target Date 2016-2020	5.75	1.65	51
Target Date 2011-2015	5.63	1.41	29
Target Date 2000-2010	5.02	1.41	31
World Allocation	4.64	2.45	169
Conservative Allocation	4.57	1.85	236
Tactical Allocation	3.43	2.84	75

Measure of Volatility

While knowing the "average" return on a mutual fund is helpful, consider that the average return provides no insight into the dispersion of returns that make up the average. The investment could have an average return with a narrow dispersion or a wide dispersion. The average, by itself, sheds no light on how tight (or wide) the dispersion of returns.

This dispersion of return is the basic measure for risk in an investment. Another term used to describe a single investment's risk is its "volatility". In finance, volatility is a measure of the variation of a security's price over time and it is measured by the dispersion of returns for a given security or index.

The larger a security's standard deviation, the more the security's returns are deviating from the expected (or mean) return. Thus, standard deviation provides a quantitative tool for comparing the volatility (risk) of different investments. The more deviation – the more risk.

Sharpe Ratio

The Sharpe ratio is one of the most popular measures of the risk/return used in mutual fund evaluation. The Sharpe ratio measures a portfolio's risk premium divided by the standard deviation of the portfolio. In other words, the Sharpe ratio provides the amount of excess return received, relative to the extra volatility endured while holding the fund.

$$\textbf{Sharpe ratio} = (R_p - R_f) / \sigma_p$$

Where:

- R_p = The return of the portfolio
- R_f = The risk-free rate

- σ_p = The standard deviation of the portfolio

The Sharpe ratio helps investors compare the risk-adjusted returns of one mutual fund to another. The higher the Sharpe ratio, the more the investor is being rewarded for the level of risk that has been assumed.

For our first asset allocation category, the Sharpe Ratio is higher for large and mid-cap funds. This indicates that investors are better compensated for the funds' inherent risks/volatility than investors of small cap funds and world stock. However, it is noted that the standard deviation of the Sharpe Ratio is higher for small-cap funds and world stock, suggesting that these asset classes may have a greater number of individual fund selections that provide excess returns given the level of volatility and a greater number of individual fund selections that fail in this same regard. This is important for those investors seeking higher returns since those returns will be associated with a higher level of fund-specific risk.

Capitalization Category	Sharpe Ratio	StDev
Large Blend	1.01	0.16
Large Growth	1.00	0.14
Large Value	0.96	0.17
Mid-cap Value	0.86	0.17
Mid-cap Growth	0.85	0.19
Mid-cap Blend	0.84	0.16
Small Growth	0.79	0.15
Small Blend	0.74	0.19
Small Value	0.73	0.15
World Stock	0.64	0.20

On average, international funds had lower Sharpe Ratios but a greater dispersion (as demonstrated by the Sharpe Ratio standard deviation) than did domestic funds. A greater dispersion of Sharpe Ratio standard deviations suggests that individual fund selection may be even more important for this category than in domestic securities. This information also needs to be considered along with lower returns for international funds over the past five years.

Capitalization Category	Sharpe Ratio	StDev
Foreign Small/Mid Growth	0.59	0.17
Foreign Small/Mid Blend	0.54	0.19
Japan Stock	0.51	0.22
Europe Stock	0.46	0.15
Foreign Large Growth	0.40	0.12
Foreign Small/Mid Value	0.37	0.19
Diversified Pacific/Asia	0.36	0.08
Foreign Large Blend	0.35	0.14
Foreign Large Value	0.32	0.18
Pacific/Asia ex-Japan Stk	0.19	0.13
India Equity	0.17	0.10
China Region	0.15	0.20

Diversified Emerging Mkts	-0.09	0.15
Latin America Stock	-0.52	0.08

Bond Funds should have the lowest level of overall volatility as demonstrated by the standard deviation. However, it is noted that these funds provided the highest Sharpe Ratios and (somewhat surprisingly) the highest standard deviations of Sharpe Ratios. This suggests that the individual fund selections within this asset class may be an important investing decision.

Capitalization Category	Sharpe Ratio	StDev
Intermediate-Term Bond	1.09	0.31
Short-term Bond	1.02	0.54
Corporate Bond	1.00	0.15
Multisector Bond	0.92	0.35
High Yield Bond	0.87	0.31
Intermediate Government	0.86	0.34
Long-Term Bond	0.75	
Ultrashort Bond	0.64	2.59
Short Government	0.63	0.49
Long Government	0.59	0.03
World Bond	0.38	0.53
Inflation-Protected Bond	0.26	0.14
Emerging Markets Bond	0.20	0.32

For Blended Funds, there does not appear to be a noticeable trend in excess return (as demonstrated by the Sharpe Ratio) given the allocation choice between equities and fixed income or the standard deviation of the Sharpe Ratio, suggesting that the flexibility of this category may make it too complex to analyze in this manner.

Capitalization Category	Sharpe Ratio	StDev
Moderate Allocation	0.94	0.23
Target Date 2000-2010	0.90	0.15
Conservative Allocation	0.89	0.31
Target Date 2011-2015	0.87	0.15
Target Date 2051+	0.86	0.11
Target Date 2021-2025	0.84	0.10
Target Date 2016-2020	0.82	0.14
Target Date 2031-2035	0.81	0.10
Target Date 2041-2045	0.80	0.09
Aggressive Allocation	0.78	0.19
Target Date 2026-2030	0.78	0.13
Target Date 2036-2040	0.78	0.12
Target Date 2046-2050	0.78	0.13
World Allocation	0.58	0.24

Tactical Allocation	0.47	0.35

Fees and Expenses

Mutual fund fees and expenses vary substantially from fund to fund. Mutual funds have three different types of fees that they can charge (sales charges, 12b-1 fees, and management fees). These three fees are all reported by the fund, and careful mutual fund investors will likely be able to save money by researching these fees before making a buying decision.

An additional "cost" worth noting is the fund's trading costs. While mutual fund managers may be able to trade more economically than the individual investor, they still incur trading and transaction costs. These costs are not reported directly, but funds with lower turnover not only increase the fund's tax efficiency, they also mean that the fund's trading costs are lower.

Sales Charges

Sales charges are oftentimes referred to as sales loads (or simply loads). These charges are generally associated with load funds that are sold by personal financial advisors and investment brokers. This load is how many brokers make their commission from selling the fund to the investor. In theory, the sales charge compensates the broker for assisting the investor in selecting the best mutual funds for the investor's return goals and risk tolerance.

The sales charge lowers the amount of money that is invested in the fund. For instance, if an investor saves $1,000 into a mutual fund that has a 5% sales charge, only $950 is actually invested in the fund. By law, a sales charge cannot be above 8%, but in practice, funds rarely have loads this high. Most loads fall within a range of 3% to 6%.

Typically, for funds that have sales loads, the loads may be reduced as the investor saves more and more money. Frequently, mutual funds have breakpoints, or dollar investment amounts that will lower the fund's sales charge.

While many funds carry sales loads, there are many more that do not. No-load funds do not carry a sales load as they are distributed directly by an investment company instead of going through an intermediary (like an investment broker). When investing $1,000 into a no-load fund, the entire $1,000 is invested in the fund.

12b-1 Fees

A 12b-1 fee is a mutual fund's annual marketing and distribution expense. The name "12b-1" comes from the section of the Investment Company Act of 1940 that describes the Act's allowance for the fee, and the Act currently limits the amount that investment companies can charge in 12b-1 fees to 1% or less per year. Like sales loads, these fees are designed to further incentivize brokers to sell the fund as generally two-thirds of the 12b-1 fee acts as a "quasi-commission" for the broker selling the fund.

12b-1 fees are always expressed as a percentage and along with management fees are included in the fund's expense ratio.

Management Fees

Unlike sales loads and 12b-1 fees, all mutual funds have management fees. These fees include the compensation that goes to the fund's managers for their time and expertise, as well as the paperwork, reporting, custodial, auditing, and any other expenses that the fund incurs in its daily operations. The structure of management fees can vary, but most are stated as an annual percentage of the assets under management. These percentages can vary widely from fund to fund, but most average between 0.5% and 1% per year.

Expense Ratio

Management fees and 12b-1 fees (if any) make up a mutual fund's expense ratio, which is a measure of what it costs the investment company to operate the mutual fund. Every investor in the fund carries a portion of the burden of paying the expenses associated with managing the fund. The expense ratio is the percentage of the total investment that goes toward managing the fund's operations. Generally, the lower the ratio, the more efficiently the fund is being run (and the better for the investor).

Comparing expense ratios for the domestic funds based on market capitalization show that mutual funds with large to mid-cap equities have consistently had lower expense ratios. This is important since many investors seek to minimize expenses associated with holding such securities. In addition, it appears that the standard deviation of the gross expense ratio is significantly higher for small cap growth funds, suggesting this category may have very expensive and very inexpensive fund choices for investors interested in saving fees.

Capitalization Category	Gross Expense Ratio (%)	StDev
Large Blend	1.21	0.59
Large Growth	1.35	0.61
Large Value	1.25	0.50
Mid-cap Blend	1.37	0.58
Mid-cap Growth	1.46	0.53
Mid-cap Value	1.37	0.57
Small Blend	1.46	0.58
Small Growth	1.61	0.92
Small Value	1.52	0.51
World Stock	1.55	0.56

Expense ratios for international funds were somewhat higher especially for funds that contain Asia and Asia/Pacific stocks and securities. However, with the exception of Japan Stock funds, the standard deviation of the expense ratios appears similar to that of domestic securities.

Capitalization Category	Gross Expense Ratio (%)	StDev
India Equity	2.13	0.59
Pacific/Asia ex-Japan Stk	2.10	1.04
China Region	1.96	0.57
Diversified Emerging Mkts	1.82	0.60
Japan Stock	1.76	1.12
Latin America Stock	1.72	0.50
Foreign Small/Mid Value	1.70	0.44

Europe Stock	1.68	0.74
Foreign Small/Mid Growth	1.67	0.47
Foreign Large Value	1.58	0.83
Foreign Small/Mid Blend	1.56	0.55
Foreign Large Growth	1.47	0.50
Foreign Large Blend	1.44	0.60
Diversified Pacific/Asia	1.43	0.63

For Bond funds, expense ratios are considerably lower as expected. This ratio is very small for Government bonds in particular. In addition, the standard deviation of the expense ratios is somewhat less than for equity funds.

Capitalization Category	Gross Expense Ratio (%)	StDev
Emerging Markets Bond	1.47	0.51
Multisector Bond	1.28	0.48
World Bond	1.26	0.49
High Yield Bond	1.20	0.46
Intermediate-Term Bond	1.08	0.95
Corporate Bond	1.05	0.48
Inflation-Protected Bond	1.04	0.50
Intermediate Government	1.04	0.47
Short-term Bond	0.94	0.42
Long-Term Bond	0.92	0.87
Short Government	0.89	0.42
Ultrashort Bond	0.79	0.33
Long Government	0.54	0.37

Expense ratio for balanced/blended funds are all in mid-range of all asset classifications. This is expected as these funds are a blend of bonds and sticks.

Capitalization Category	Gross Expense Ratio (%)	StDev
Tactical Allocation	1.90	0.62
World Allocation	1.57	0.58
Aggressive Allocation	1.52	0.58
Conservative Allocation	1.38	0.55
Target Date 2046-2050	1.38	0.66
Moderate Allocation	1.37	0.56
Target Date 2036-2040	1.31	0.54
Target Date 2026-2030	1.30	0.51
Target Date 2041-2045	1.29	0.59
Target Date 2016-2020	1.23	0.50
Target Date 2031-2035	1.22	0.51
Target Date 2021-2025	1.18	0.48

Target Date 2011-2015	1.11	0.51
Target Date 2051+	1.11	0.58
Target Date 2000-2010	0.95	0.41

Putting It All Together

Given the return goals and risk capacities of the five age groups, this study's findings suggest the following fund asset classes:

Ages 16-32 (Youngest – Highest risk capacity and Returns greater than 12%)

Classification	Capitalization Category	5-Yr Return	Excess Return Volatility	Expense Ratio
Stock Funds	Large Blend	Very High	Very High	Low
Stock Funds	Large Growth	Very High	High	Medium

Ages 33-49 (High risk capacity and Returns greater than 10% but less than 12%)

Classification	Capitalization Category	5-Yr Return	Excess Return Volatility	Expense Ratio
Stock Funds	Large Value	High	High	Low
Stock Funds	Mid-cap Blend	High	High	Medium
Stock Funds	Mid-cap Growth	High	High	Medium
Stock Funds	Mid-cap Value	High	High	Medium

Ages 40-66 (Medium risk capacity and Returns greater than 8% but less than 10%)

Classification	Capitalization Category	5-Yr Return	Excess Return Volatility	Expense Ratio
Stock Funds	Small Blend	High	Medium	Medium
Stock Funds	Small Growth	High	Medium	High
Stock Funds	Small Value	High	Medium	Medium
Blended Funds	Target Date 2051+	Medium	High	Low
Blended Funds	Target Date 2031-2035	Medium	High	Low
Blended Funds	Target Date 2041-2045	Medium	High	Low

Ages 67-83 (Low risk capacity and Returns greater than 6% but less than 8%)

Classification	Capitalization Category	5-Yr Return	Excess Return Volatility	Expense Ratio
Blended Funds	Target Date 2021-2025	Low	High	Low
Blended Funds	Moderate Allocation	Low	High	Medium
Bond Funds	Long-Term Bond	Low	Medium	Very Low
Stock Funds	World Stock	Low	Medium	Medium
Blended Funds	Aggressive Allocation	Low	Medium	Medium
Blended Funds	Target Date 2026-2030	Low	Medium	Medium
Blended Funds	Target Date 2036-2040	Low	Medium	Medium
Blended Funds	Target Date 2046-2050	Low	Medium	Medium
International Funds	Foreign Small/Mid Blend	Low	Low	Medium
International Funds	Foreign Small/Mid Growth	Low	Low	High

Ages 84-100 (Oldest – Lowest risk capacity and Returns greater than 4% but less than 6%)

Classification	Capitalization Category	5-Yr Return	Excess Return Volatility	Expense Ratio
Bond Funds	Corporate Bond	Very Low	High	Low
Bond Funds	High Yield Bond	Very Low	High	Low
Blended Funds	Target Date 2000-2010	Very Low	High	Very Low
Blended Funds	Target Date 2011-2015	Very Low	High	Low
Blended Funds	Conservative Allocation	Very Low	High	Medium
Blended Funds	Target Date 2016-2020	Very Low	High	Low
Bond Funds	Long Government	Very Low	Low	Very Low
International Funds	Foreign Large Growth	Very Low	Low	Medium
International Funds	Japan Stock	Very Low	Low	High
Blended Funds	World Allocation	Very Low	Low	Medium

CONCLUSION

Basing mutual fund selection decisions based solely on age is a concept that not many in the investment community would deem feasible. Risk tolerance is ingrained in the psyche of the investing public. Even with its significant (and known) flaws, few investors would consider taking an academic step backward – and dropping it from consideration. Unfortunately, the attempted assessment of risk tolerance has only added to the confusion and complexity of investing. Would more Americans make the concise choice to invest if the selection process were simplified?

This study demonstrates that there is ample evidence for continued research on age-based solutions for investment decision-making as the results demonstrate that there may be an opportunity for investors/advisors to make mutual fund selection decisions based solely on age/risk capacity and return history. The majority of the findings are consistent with the generally accepted asset allocation decision that investors should slowly re-allocate their assets into fixed-income as they age. For instance, this study suggests that twenty-something investors may benefit from over-weighting a diversified portfolio in

large-cap blend and growth stocks, whereas octogenarians may wish to heavily weight their portfolios with corporate and government bonds.

This study adds value in that it aids investors in making specific asset class choices based on age alone. Complicated investor and advisor decisions (based on risk-tolerance) are simplified dramatically by basing decisions on the investor's age/risk capacity.

It is terribly beneficial that complicated investing choices be simplified. As more and more evidence is compiled that risk capacity is an adequate measure of asset allocation, more and more investors may have confidence that they are capable of making wise investment choices for themselves. This expanded comfort zone may increase individuals' motivation to invest – which benefits not only the individual investor – but society as a whole, as it may reduce dependence on underfunded social programs like Social Security. Taking the complexity out of investing is very likely to give Americans the confidence to invest – and invest wisely for their own futures.

AREAS FOR FUTURE STUDY

There are several obvious outliers in the results of the study. For instance, not many advisors would suggest that their retired clients heavily weight their portfolios in "Japan Stock" or even "Foreign Large Growth". It is recommended that this data continue to be compiled and analyzed to identify longer-term trends in asset class returns.

In addition, while helpful, this research is far from complete. More analysis needs to be completed to aid investors in making specific mutual fund selections rather than generalized asset allocation choices. While the asset allocation is the first step, this knowledge in and of itself does not unburden investors from being faced with thousands of mutual fund choices. Faced with these numbers, many investors may still be overwhelmed by the investing decision. Future research is needed to select the best funds for each asset class. While this study began to analyze items (like the Sharpe Ratio and the Expense Ratio), many more items must be analyzed.

In fact, this study, in its analysis of the standard deviation of the Sharpe Ratio suggests that specific fund selection choices may be even more important for some asset classes than others – as several asset categories had a fairly wide dispersion of the Sharpe Ratio. This suggests that there may be a sizable difference between the "good" funds and the "poor" funds within those categories. While asset allocation is a necessary and first step, it is suggested that additional beneficial research could be conducted on fund/security selection.

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APPENDIX A

TERMINOLOGY

The following provides descriptions for variables in our study. There variables are organized by category. The source for these variables is Wells Fargo Advisors and several other websites.

Variable General Information

Symbol - The identifying symbol assigned to the security by its exchange.

Description - The name of the entity that issued the security.

Category - The Morningstar category based on the underlying securities in each portfolio.

Availability - The mutual fund is available for online purchase.

Inception Date - The date the mutual fund was formed and became available for sale to unit holders.

Years Since Inception – The calculated number of years since inception as of November 2015.

Manager - The individual or individuals who are directly responsible for managing the fund's portfolio.

Manager Tenure - The length of time that the current manager has been the portfolio manager of the fund.

Open to New Investors - The fund is eligible for purchase by all investors, even by those who are not already existing investors in the fund.

Total Net Assets - The fund's total asset base, net of fees and expenses, used to describe a fund's size.

Asset Classes - A group of securities that exhibit similar characteristics, behave similarly in the marketplace, and are subject to the same laws and regulations.

Fund Family - The parent company that offers mutual funds.

Average Market Cap - A measure of the size of the companies in which the fund invests, calculated by multiplying the number of a company's shares outstanding by its price per share.

Fees & Loads

12b-1 - A common expense charged by many fund companies to cover certain marketing and distribution costs.

Admin Fee - What a mutual fund charges investors, deducted from the fund's returns, to pay for its day-to-day operations, including renting office space, printing prospectuses, and keeping records.

Management Fee - The costs shareholders paid to the investment manager of a mutual fund, typically calculated as a percentage of the fund's total assets, for management and administrative services over the fund's prior fiscal year.

Maximum Redemption Fee - An amount charged when money is withdrawn from the fund within a certain timeframe of the investor's initial purchase. The fee is meant to discourage market timers, whose quick movements into and out of funds can be disruptive. The charge is normally imposed on the ending share value, appreciated or depreciated from the original value. Charges are not imposed after the stated time has passed.

Sales Charge (Load) - For initial sales charges, or front-end loads, this figure is expressed as a percentage of the initial investment and is incurred upon purchase of fund shares. For deferred sales charges, also known as back-end loads or contingent deferred sales charges, the amount charged is based on the lesser of the initial or final value of the shares sold.

Transaction Fee - A fee that a mutual fund company charges an investor to make a transaction.

Ratings & Quality

Morningstar Rating - A ranking of publicly traded mutual funds by the investment research firm, Morningstar, ranging from one (poorest rank) to five stars (best rank) based on how well they've performed (after adjusting for risk and accounting for sales charges) in comparison to similar funds.

Morningstar Risk Rating: Morningstar Risk evaluates a mutual fund's downside volatility relative to that of other funds in its Morningstar Category. It is an assessment of the variations in a fund's monthly returns, with an emphasis on downside variations, in comparison with the mutual funds in its Morningstar Category. In each Morningstar Category, the 10% of funds with the lowest measured risk are described as Low Risk (LOW), the next 22.5% Below Average (-AVG), the middle 35% Average (AVG), the next 22.5% Above Average (+AVG), and the top 10% High (HIGH). Morningstar Risk is measured for up to three time periods (three-, five-, and 10 years). These separate measures are then weighted and averaged to produce an overall measure for the mutual fund. Funds with less than three years of performance history are not rated.

Morningstar Expense Rating: Morningstar evaluates a mutual fund share class's expense ratio relative to other funds that invest in a similar asset class and have similar distribution characteristics. Within each Comparison Group, a fund share class' expense ratio is ranked against peers using five quintiles (Front Load, Deferred Load, Level Load, No Load, and Institutional.) The Fee Level rating is objective, based entirely on a mathematical evaluation of a share class's expense ratio relative to similar funds. It is a useful tool for putting a fund's fees into context, but alone is not a sufficient basis for investment decisions.

Credit Quality - An average of each bond's credit rating, adjusted for its relative weighting in the portfolio, to inform investors of a bond portfolio's credit worthiness or risk of default.

Returns

Average Annual Total Return - The amount of money your mutual fund investment earns or loses, given as a percentage of the amount you invested, over a given period of time:

- YTD (%) - From the beginning of the calendar year to the "Data as of" date

- 1Y (%) - Over the past 365 days to the "Data as of" date
- 5Y (%) - Annualized over the past 5 years to the "Data as of" date
- 10Y (%) - Annualized over the past 10 years to the "Data as of" date
- Since Inception (%) - Since the creation of the fund to the "Data as of" date
- Alpha - A measure of the difference between a fund's actual returns and its expected performance, given its level of risk as measured by beta.
-

Ratios

Gross Expense Ratio - The fund's gross expense ratio is its annual operating expenses expressed as a percentage of average net assets and does not include any fee waivers or expense reimbursements the fund may have in place. A fund's current expense ratio may be lower or higher than the figure reported in the prospectus.

Sharpe Ratio - A risk-adjusted measure that uses the standard deviation and excess return to determine reward per unit of risk. The higher the Sharpe ratio, the better the fund's historical risk-adjusted performance.

Turnover Ratio - A measure of the fund's trading activity, computed by taking the lesser of purchases or sales (excluding all securities with maturities of less than one year) and dividing by average monthly net assets.

Expense Ratio - The fund's total operating, management, and administrative expenses as a percentage of the fund's net assets.

Volatility

Alpha - A measure of the difference between a fund's actual returns and its expected performance, given its level of risk as measured by beta

Beta - A measure of a fund's sensitivity to market movements. A portfolio with a Beta greater than 1.00 is more volatile than the market, and a portfolio with a Beta less than 1.00 is less volatile than the market.

Volatility - The change in price of an investment over a period of time.

Risk - The amount of price volatility in an investment, including the possibility of losing some or all of the original investment.

Standard Deviation - A statistical measurement, which depicts how widely a mutual fund's returns varied over a certain period of time. The higher the standard deviation, the wider the predicted range of performance, which implies greater volatility in the fund’s performance.

Duration - A measure of the sensitivity of the price (the value of principal) of a fixed-income investment to a change in interest rates, expressed as a number of years.

AN APPLICATION OF SOCIAL NETWORK ANALYSIS TO HEART FAILURE RECORDS AND COMORBIDITIES IN THE NATIONWIDE INPATIENT SAMPLE: COMORBIDITY NETWORKS

Caleb Bradberry, Radford University,

cbradberry@radford.edu

Abstract

Heart failure is the costliest condition to treat in the United States. With the Centers for Medicare and Medicaid Services imposing a 3% penalty of reimbursement on any hospital that does not meet certain quality of care measures for patients with heart failure, it is of interest for hospitals better understand the profile of a patient with heart failure, including the comorbidies that present with the condition. While medical literature examines the presentation of heart failure and its related comorbidities, this study adopts an abductive approach to the heart failure domain. We present social network analysis as a tool to understanding the connections of a heart failure diagnosis with comorbidies as a solution domain. Specifically, this study examines diagnoses of patients age 65 or older and presents the connections of diagnoses codes using social network analysis.

Introduction

Heart failure encounters are the most costly type of encounter to a hospital in the United States, with a

projected cost of $32 billion each year [1]. Being readmitted to a hospital for any cause within 30 days of a heart failure encounter is considered to be a measure of poor quality of care being delivered [2], [3]. The Medicare Payment Advisory Commission (MedPAC) assessed the efforts being made by hospitals and has found that 68% of heart failure readmissions could be avoided [4].These findings account for such avoidable readmissions as a patient being discharged from the facility and coming back due to complications from preventable conditions (such a hospital acquired infections, being discharged to the wrong clinic, etc). Over one fifth of Medicare beneficiaries have been readmitted within the 30 day window, and over 34% have been readmitted within the 90 day window [5].

Additionally, beginning as of October 2013, hospitals that fall below the acceptable readmission rate were penalized by 1% of their total Medicare reimbursement [6]. As of 2015, this number is now capped at 3%. Starting in 2017, hospitals will have to shift their readmission focus from 30 day all-cause readmissions to 90 day all cause readmissions[6]. These quality penalties are enforced through the United States federal government based on quality indicators adopted by The Agency for Healthcare Research and Quality (AHRQ) [6]. While the benchmarks vary based on the hospitals themselves, the underlying goal of the penalties is to deliver better quality to the patient. To this end, the Patient Protection and Affordable Care Act has made it easier for researchers and clinicians to access hospital administrative data to understand the effects of quality on patients as well as hospitals.

Directed by AHRQ, the Healthcare Cost and Utilization Project (HCUP) provides a data sample of national inpatient records for nationwide claims for each year. The records include a 20% claim sample of all CMS claims, including heart failure records and the associated conditions of the heart failure inpatient events. The fields in the HCUP data include 25 diagnosis columns for primary diagnoses as well as comorbidities, cost metrics, and anonymized socioeconomic demographics information (HCUP, 2016).

This research examines the 2013 HCUP National Inpatient Sample (NIS) subset to heart failure records and comorbidities. Because heart failure events are the costliest and result in long length of stays

varying based on comorbidities, it becomes interesting to understanding the most prevalent comorbidities for a heart failure inpatient event. Specifically, this research applies network analysis to these data in order to understand the diagnosis codes most central to a heart failure inpatient event. Utilizing HCUP NIS records with a heart failure primary diagnosis, the secondary and tertiary diagnoses are mapped using social network analysis in order to understand directionality and influence of the varying conditions on the heart failure events.

The results of this research will put forward a study in what can be referred to as comorbidity networks. A comorbidity network is the application of social network analysis to the influence that comorbidities have on primary diagnoses. This approach can be applied beyond heart failure diagnoses to other chronic conditions as well.

2 Materials and Methods

To understand healthcare cost and quality, this research uses metrics put forward by AHRQ that establish prevention as a quality indicator. Specifically, prevention quality indicator #08 discusses at length what constitutes an inclusion criterion for a heart failure event.

Preventative Quality Indicators

The data has been subset to include only claims of patients that contain a heart failure diagnosis, classified by the international classification of diseases, 9th revision, ICD-9. The ICD-9 codes that correspond with a heart failure event can be found in table 1.; these diagnoses are based on the AHRQ preventative quality indicator #08 for heart failure readmissions [7].

ICD-9 Code	Diagnosis
398.91	Rheumatic heart failure
402.01	Malignant hypertensive heart disease with congestive heart failure (CHF)
402.11	Benign hypertensive heart disease with CHF
402.91	Hypertensive heart disease with CHF
404.01	Malignant hypertensive heart and renal disease with CHF
404.03	Malignant hypertensive heart and renal disease with CHF and renal failure (RF)
404.11	Benign hypertensive heart and renal disease with CHF
404.13	Benign hypertensive heart and renal disease with CHF and RF
404.91	Unspecified hypertensive heart and renal disease with CHF
404.93	Hypertension and non-specified heart and renal disease with CHF and RF
428.x	All ICD-9 Heart Failure codes

Table 1. ICD-9 Codes used to subset data for heart failure records.

3 Example Results

The following figure social network analysis applied to 1000 heart failure records. What we find from these results is that the heart failure diagnoses are intuitively most central to the network. But it also demonstrates the influence that other conditions and comorbidities have on a heart failure diagnoses.

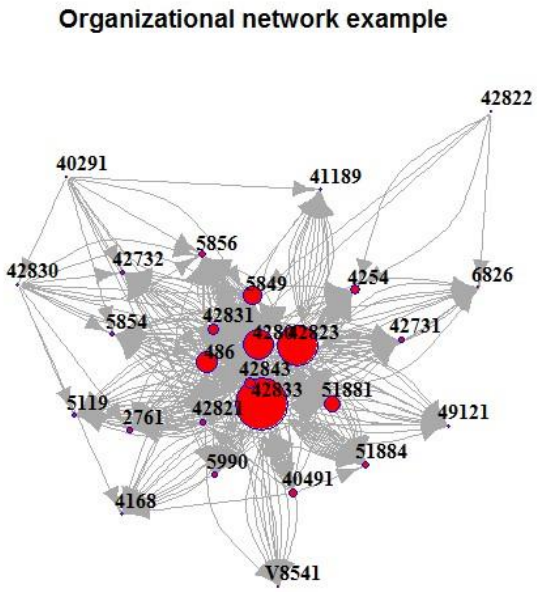

Figure 1. Example Comorbidity Network Result.

ICD-9 Code	Diagnosis
486	PNEUMONIA UNSPECIFIED
2761	HYPOSMOLALITY AND/OR HYPONATREMIA
4168	OTHER CHRONIC PULMONARY HEART DISEASES
4254	OTHER PRIMARY CARDIOMYOPATHIES
5849	ACUTE KIDNEY FAILURE, UNSPECIFIED
5856	END STAGE RENAL DISEASE
5854	"CHRONIC KIDNEY DISEASE, STAGE IV (SEVERE)"
5119	UNSPECIFIED PLEURAL EFFUSION
6826	CELLULITIS AND ABSCESS OF LEG EXCEPT FOOT
4118	ACUTE CORONARY OCCLUSION WITHOUT MYOCARDIAL INFARCTION
51881	ACUTE RESPIRATORY FAILURE
51884	ACUTE AND CHRONIC RESPIRATORY FAILURE
49121	OBSTRUCTIVE CHRONIC BRONCHITIS WITH (ACUTE) EXACERBATION
V8541	BODY MASS INDEX 40.0-44.9, ADULT

Table 2. Sample Network Result ICD9 codes.

While this paper is still a work in progress, this demonstrates the abductive approach to applying social network analysis to heart failure. By applying network analysis, we can learn more about the influence specific conditions have. From this example, we see that common conditions, such as end stage renal

failure and kidney failure are associated with heart failure. We also gain a new view of the condition, by seeing pleural effusion and V-code influence on the various kinds of heart failure.

This paper will continue by expanding the dataset beyond 1000 records to the full 2013 NIS dataset. Additionally, the weights of each arc on the network will be assessed, and contributes will inform several disciplines. Healthcare will be informed by gaining a new perspective on present comorbidities of patients that suffer from heart failure; health care management and operations gain new insight as to an approach to understand patients; information systems applies a design approach to healthcare data.

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No One Is as Smart as Everyone – A Japanese Proverb
The Story of a High-Performing Work Team
A Case Study

Dr. Stan Vinson
Lander University

Abstract

In 1998 a rapidly growing manufacturing company hired a new Vice President of Operations. While his responsibilities were very traditional, as one of his "duties as assigned" he was privileged to lead a work team that promoted and installed what was to be called the "Employee Ownership Program". This case study is written from the perspective of the team leader and done after interviewing all the team members and reviewing the documentation supporting the team's activities.

A CASE STUDY OF A HIGH-PERFORMING WORK TEAM

Teams are the leaders of the 21st century. Almost nothing grows in the direction of simplicity; chaos is necessary to new creative ordering (Wheatley, 2000, p. 13). In short, the world is too complex to think that one person can make sense of the chaos that Margaret Wheatley refers to in her book – "*Leadership and the new science: Discovering order in a chaotic world"*. The need for collaboration, teamwork, and an understanding of the unique perspectives of our progressively more diverse society is increasingly critical to success. Leadership is not a solo act; it is a team effort.

This case study looks at the critical events and the team structure that created a high-performing work team. It is of interest because of the team's success, the unique events involved, the creative people who were on the team, and the characteristics that defined the team and generated its powerful work environment. This case study is meant to help answer how and why this team was a success (Feagin, Orum, & Sjoberg, 1991, p. 121).

Methods

The story is auto-ethnographic, an autobiographical genre of writing and research that displays multiple layers of consciousness, connecting the personal to the cultural (Humphreys, 2005, p. 840). Because the story is auto-ethnographic, it is constructed from interpretations of the personal observations of the team leader, information gathered from interviews with the team members as well as the executive sponsor and study of substantial documentation supporting the project.

Clarity of Purpose

Larson and LaFasto (1989) emphasize the crucial need for clarity concerning goals and principles surrounding the establishment of successful teams. They write:

> *Our sample was relatively small (31 interviews covering more than 75 teams), but very diverse. Therefore, it was surprising to find that in every case, without exception, when an effectively functioning team was identified, it was described by the respondent as having a clear understanding of its objective. (p. 27)*

The seminal and defining meeting for this project occurred shortly after the team members were identified. This session, the first of many organizational meetings, was attended by the chief financial officer (CFO) and the chief legal counsel as well as three members of the team. They discussed the challenges ahead of them and the resources needed to complete the project. Although the team members had outlined the goals and objectives several times in our casual conversations, and generally agreed on some of the details, during this meeting the CFO made sure we understood his instructions. We had one year to publicly register the company and two years to create, develop and sell the program to the 6,000 employees of the Company. In true Nature Manufacturing fashion, he left it up to us to organize ourselves and bring in additional team members that might be needed, with one caveat: Any team we built would be a "virtual team." By "virtual team," he meant that everyone on the team would report to the team leader via a dotted line and would be drawn from other parts of the company. This requirement really meant that the team members would retain their primary duties and would effectively be part-time members of the team working on this project.

After delivering these instructions, he left the room for another meeting, leaving the three-team members with the chief legal counsel to contemplate how we could

successfully complete such a daunting project with part-time employees. While everyone wanted to make a good impression on their new employer, they were all experienced enough to know what SEC registration really meant and the challenges they had in front of them. Although they had the support of our organization, the ability to pull in the right people to make the team a success, seemingly a clear understanding of the goals and objectives – they were still concerned.

Context

> *Broadly, organization environment is the psychological atmosphere that emerges from the way an organization conducts itself. The environment is never neutral. It has compelling content. It shapes our ideas and perspectives. It can promote openness or silence. It can encourage risk taking or risk aversion. It can allow for differences or require sameness.– Frank LaFasto and Carl Larson, When Teams Work Best, 2001, p. 158*

Supportive Organizational Environment

Often companies have organizational structures that overwhelm the best of intentions (LaFasto & Larson, 2001, p. 157) and management cultures that do not support teams – but "group effectiveness" (Katzenbach & Smith, 2003, p. xiv). In the United States, this is especially true, given the emphasis on strong personal and political freedoms which are counter to building a team culture (Manz & Sims, 1993, p. 17). While some refer to it as the "fuzzy factor" (Larson & LaFasto, 1989; p. 109), the supportive atmosphere of the organization was critical to the success of the employee-ownership team.

Nature manufacturing is a 50-year-old company that makes plumbing products and tools. The original founders, rich in technical knowledge, dialogued about their plans to build the company while severing as privates in the various theaters of WWII. Through

a series of letters and discussions the three partners created a plan to develop a business with creative, innovative people that had a strong sense of values.

Believing that culture was critical to the development and success of the company the original owners focused on it, constantly referring to culture in speeches and internal communications. In addition they insisted that it be discussed as part of any training programs the employees were sent to. The drive to develop a strong culture eventually led to the company motto: "Do good work, have fun, and make money."

As part of the celebrated culture the company always believed that sharing the wealth was critical to the success of the firm. The philosophy was simple; given that the employees create the profits, a large part of that wealth needs to be returned to the them – in this case via increase in the value of the stock. Another way of understanding this concept is that they are building a company where what is good for the shareholders, is good for the company and good for the employees – everyone wins.

In support of employee ownership there is a growing and substantial body of research that builds on this idea. In the book *In the Company of Owners* (Blasi, Kruse, & Bernstein, 2003) the authors report that "there is compelling evidence that broad-based employee ownership does in fact produce more value for shareholders" (p. xi). Blasi goes on to examine many facets of broad-based employee ownership, arguing that it creates a focus on long-term corporate stability and a less autocratic corporation that is far less likely to breed executive malfeasance (p. xv). To quote Henry Ford, "No one is apathetic, except those in pursuit of someone else's goals." At Nature Manufacturing having employees own a large part of the company was critical to their innovative and creative success and a way to maintain the collaborative culture.

With the Company growing rapidly and on sound financial footing, several senior officers were hired to bring broader experiences to the business and to help explore ways to expand and develop the culture of employee ownership. Several of these new hires became members of this high performing team and committed to the concept of employee ownership.

The Team

> *A team is a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable. — Jon Katzenback and Douglas K. Smith, The Wisdom of Teams, 2003, p. 158*

A successful team begins with the right people (LaFasto & Larson, 2001, p. 1). In the survey Larson and LaFasto (1989) present in *Teamwork: What Must Go Right, What Can Go Wrong*, the factor designated as the most critical determinate of success was choosing the right team members (p. 59). In the end, a team's performance is defined by both individual efforts and collective work-products, and the first step in that process is choosing technically competent people.

There were six members of the original team that designed and installed the program. Each came to the team with unique technical expertise and insights into the organization. Four members of the team were hired just prior to beginning the project and two had been with the company for a number of years, one for 12 years, and the other for more than 25 years. They also represented different departments of the organization, including Treasury, Accounting, Legal, Human Resources, and Information Technology.

Another member of our team rarely attended our meetings but was critical to success: an executive vice-president of the company. He reports directly to the chairman

and was a member of the Executive Leadership Team, which consists of the chairman and presidents of the three major operating groups.

The executive sponsor selected the team members entirely for technical reasons; we needed an SEC-qualified accountant, an attorney, and a finance person to lead the project. His multiple years of experience with publicly traded companies and work with Wall Street played a crucial role in his selection of team members. He knew what critical skills were needed to complete the project (Larson & LaFasto, 1989, p. 62). Without this technical expertise, it would have difficult to bring this project to a successful conclusion.

Team Leader

The role of the leader in the small group tends to be exaggerated (Burns, 1979, p. 290). There is a traditional leadership theory that says the appointed leader is a legitimate authority figure and acts like the boss, but it does not apply to the unique situation of a self-managed team (Manz & Sims, 1993, p. 55). Team leaders genuinely believe they do not have all the answers (Katzenbach & Smith, 2003, p. 131).

Sometime during this first meeting, the Operations Manager volunteered to be the team leader. Although no one remembers how or why this happened, it turned out to be a unique choice. Since, according to LaFasto and Larson (2001) in their book *When Teams Work Best*, "team problem solving is not harmony, but constructive integration of diverse perspectives" (p. 66), the VP Operations generalist background played an important role in resolving disputes and negotiating between team members.

The selection as leader also turned out to be a good choice because of his passion for the project. While he had no previous experience with employee ownership, over time he began to understand what a powerful tool this structure could be in developing and

growing a company. The concept that those who created the value (the employees) would receive the value created (increase in share price) simply began to make sense to him. While everyone eventually felt that a spike in profits could be attributed to the Employee Ownership Program, the immediate success showed up in an annual employee survey which reported that employees felt good about the products delivered and enjoyed working at Nature. They also reported that they were very optimistic about the company's future.

The VP Operations leadership position was also unusual in other ways. While he set the agenda, managed the budget, and took primary responsibility for keeping our executive sponsor up to date, it often seemed in the meetings that the leadership position was transferred from one member to another. If we faced a significant accounting issue, the accountant would take the lead; if we had a significant legal issue, the lawyer would take over, and, for a period of several weeks when we were building the technology that supported our effort, the IT expert was the leader.

While all considered him the formal leader and allowed him latitude to see the project through to completion**,** he was not a conventional leader, but rather what Manz and Sims (1993) describe as a *coordinator* (p.55), a person who creates an environment of trust and confidence so that the team members can collectively move the project forward. I was not the boss in any traditional sense.

Organizing the Team

At the broadest level, processes are the nervous system of an organization, the location where the talent, tasks, and information are used to produce an outcome (LaFasto & Larson, 2001, p. 175). When teams first come together, ground rules,

policies, and norms are created to govern the working environment (Hoy, Van Eynde, & Van Eynde, 1997, p. 103). High-performing teams develop a commitment to working relationships in which they agree on who will do particular jobs, set schedules, and determine how team membership is earned (Bolman & Deal, 2003, p. 105).

While our executive sponsor had chosen the team for their technical expertise, he had no idea how they would "jell" as a team. How would they plan and organize themselves; how would they deal with the organizational stress created by this proposed change; how would they deal with the competing loyalties – they each worked for a particular group but were assigned to this "virtual team". And most important, how would they deal with the inevitable conflict that was going to occur? The first "team meeting" answered several of these questions.

Each person accept the responsibility for ordering lunch at our meetings; everyone would have their turn. While this was a seemingly small, unimportant task, passing around the responsibility for ordering lunch established a social contract between us that made each person a full member of the team. It would have been easy for the people with professional designations, more important titles, or outspoken personalities to place themselves above other participants, creating a more controlling environment, but no one did. The assignment also put a bit of "fun" in what was to be at times a very stress-filled environment. It created what LaFastow refers to as "a commitment of self to the project" (Larson & LaFasto, 1989, p. 76).

In a strange way, it also fostered a more creative environment. Everyone took the task to heart, ordering unusual food that demonstrated their unique heritage, exceptional understanding of caloric intake, or interest in food that was just fun. The team members

began to think outside of the box, demonstrating the diversity of their backgrounds, personalities, and thinking patterns which was to be a highlight of this team's success. In the morning before a meeting, they all spent time trying to guess what was going to be served and making fun of the person who had the responsibility for selecting it. It turned out to be a hazing process that created a relaxed, comfortable, informal, and fun environment – a fertile climate for the team's success (LaFasto & Larson, 2001, p. 68).

The second decision arrived at was just as critical. They would have meetings twice a week, assign responsibilities, and expect everyone to deliver. When the team leader raised the topic of the need to be results-driven, the mood became very serious, and he found himself listening more than driving the conversation. The team made the interesting and critical decision to engage in considerable face-to-face interaction. It was an unusual commitment of time and personal resources to the project. Everyone had other jobs, and the team members reported to other bosses, but everyone would commit themselves to delivering on responsibilities to this team.

During this conversation, every team member made a comment on responsibility and making commitments. While they used different words, they each recited the obvious challenges we faced almost as if they were chanting a mantra. But then, they reached a higher level of understanding as each member went into the benefits of the change they were working toward and its emphasis on sharing the wealth. The whole team decided when, where, and how to meet; it turned out to be one of the few times that a meeting ended on a very serious note. The team was deeply committed to its purpose, goal, and approach, and the members began the process of being very committed to each another.

The personal dedication of the team members was demonstrated in many ways, but most obviously reflected in the time invested. On most days, several of them would work well into the evening, and often the only cars in the lot would belong to team members. At first, as a good deed, but later as a running joke, the team leader would often stop by members' cars and knock the snow off the windows.

Although the entire team was making the project successful, everyone pointed to the team leader as the reason for success. As Katzenback and Smith (2003) suggest, most people overestimate the leader's role and responsibilities (p. 133). While he went out of my way to make sure the benefits and contributions of each team member were known – putting their names on the opening slide at board presentations, making sure everyone's name was on memos updating executive management, and making sure that their participation was highlighted in their annual reviews – it never felt to him he could do enough. So at every opportunity, he would do what he could, including knocking the snow off their windows. The interesting part was that for a while no one could figure out who was doing it. At one point, it was the opening topic of a team meeting, and the leader volunteered to be the first lookout.

The team was dedicated to constant and continual communications. The team made it a priority to communicate not just among ourselves but with the broader constituency. Not only did he have two official meetings a week, but they also had several informal meetings on specific subjects that were critical to moving the project forward. In addition, at 7:00 every morning, the leader briefed our executive sponsor in a meeting often attended by other team members, and every quarter, supported by a report

that the entire team would review and help prepare, the leader briefed the board of directors.

The most important thing the team did was to make sure that everyone on the team was heard (Larson & LaFasto, 1989, p. 47). The leader monitored this carefully, mediating minor disputes, making sure the quieter group members had a space to talk, and at times visiting separately with team members to counsel them on presenting issues they were passionate about.

At one of our meetings, the controller and the SEC lawyer got into a particularly difficult argument, a routine which was becoming standard operating procedure, given the tension between legal and accounting rules. The problem was that the conflict, which everyone originally felt was a healthy and important part of moving forward, was quickly developing into a dispute with very entrenched positions. The team seemed to stall for several meetings as the discussion went on but nothing was getting accomplished. The team leader met with the controller and the lawyer individually, had open discussions about the issue, and the executive sponsor did the same, but, as the weeks went by it was becoming increasingly obvious that their positions were getting farther apart and that they were both taking the dispute very personally.

No one can remember who brought it, but it is dated November 12, 1999, and it turned out to be an amazing icebreaker. It was the "Asshole Certificate." The original, which is framed on the wall in one team member's office, is a certificate suggesting that the person who receives it is being a jerk, and the team is asking them to stop playing a disagreeable role and just be themselves. At one of our meetings, the traditional argument broke out about the accounting rules and the law, and, as was becoming standard

operating procedure, things quickly got personal. Out came the certificate, which was presented to each of the disputants, and the other team members asked them to sign. There was a predictably awkward moment as they both read the document, and then a burst of laughter quickly filled the air; they signed, and we were off. It turned out to be a friendly reminder that ours was a "collective effort," and, while we all had our positions to represent, in the end, if we did not learn as a team, we would not be successful.

Over time, this certificate would be signed by everyone in the group – multiple times – and on occasion, we would sign it in abstentia for outside advisors and others whose behavior proved challenging. When each person was presented with the document, there was always that moment when you could challenge the demand to sign, grouse about how unfair it was, or declare that no one understood you, but in the end, it would provide relief. The certificate let you know that, for some reason, you were not being heard, and the frustration that you were feeling was making it more difficult to hear you. The team used this certificate to recognize the challenging situation and say they wanted to learn from you and with you – but we needed to stop conversation and start it again.

While the introduction of this certificate did not occur until several months after the meetings had started in earnest, it was the point at which we began evolving from a working group, defined as a place for sharing information and making decisions to enhance individual performance, to a high-performance team that supported learning and success for the whole (Katzenbach & Smith, 1994, p. 92). This transition occurred as we learned how to learn as a team and broke down the psychological barriers to open-mindedness, a step that meant we could now continually learn (Vaill, 1996, p. 80). This certificate, as silly as it seems, created a safe place in which to be told that you were

wrong, or were letting your emotions get the better of you, or were just not being understood - most important, it allowed us to go to the next level of performance

The First Crisis

While there would be a few crises in the project, none tested the team like the first one. The nature of this project required a very deep understanding of accounting and SEC law. Because the Company had chosen a leading-edge structure, the legal and accounting work needed to be tested and retested by multiple experts. This meant they needed a strong, intensive legal and accounting partnership to advise and direct us in activities. While on the accounting side they felt very confident in their long-standing relationship with a major firm, the legal side was much more challenging.

Prior to building the team our sponsor and the person primarily responsible for doing the initial research on the project, had hired a well known (translate that as *expensive*) law firm from Washington, DC. They were chosen on the recommendation of the only other company in the country to have implemented this type of ownership structure, and only after several other firms were interviewed and it became obvious that the new structure was foreign to most legal consultants. In other words, it appeared that this was law firm could give us a real jumpstart on the project.

While the firm's work prior to the formation of the team was minimal, they did recognize they would receive a substantial fee (approximately $1 million). With this in mind, and understanding the business opportunity, they developed a working relationship with our company's executive management and began to help define the project - a process which set expectations and focused everyone's efforts.

As the team initially came together, they recognized the firm's experience and worked hard to integrate them into our sessions. The team's shortcomings were obvious – they had no direct experience in setting up a program like this one – and wanted an experienced firm to help us understand the basics, help us build a written plan, and introduce us to the other company that had made the same transition. They were all desperate to gain knowledge and to find out what specific roles each person would be playing in this project, and using this firm's experience seemed the most productive way to achieve those aims.

The firm and the team decided the best way to proceed was by holding a kick-off meeting. The accountants, the law firm, and the team would get together to introduce themselves and to review responsibilities. The meeting started with an air of excitement, as most projects do, and opened with a brief presentation by the team, focusing on what we knew so far; then the accountants went next. The law firm was scheduled to present last, thinking that they would give an overview of their experience with internal market structures and act as the "teacher" for most of the meetings.

While their presentation was helpful, it displayed a bit of arrogance. Everyone seemed to notice this attitude, and, while not overtly offensive, the presentation appeared to minimize the technical expertise and experiences others brought to the table. It also appeared that the partner did not have the depth of understanding that everyone thought he had. The partner referred to another partner, who was available for consultation but too busy for our project, as the one that had done the legal work at the other company. Furthermore, the presenter gave only superficial responses to several of our questions.

These shortcomings raised a red flag, and although our team did not overreact, we did talk about our concerns at our next weekly meeting. The team all decided to have the lawyer who was on the team talk with the assigned partner, giving them some feedback on their presentation and asking more about their experience and exactly what the rules were for working with the more experienced partner.

As the weeks went by and our interface with the firm continued, it became obvious to everyone that the relationship was not working. The responsible partner was hard to contact; he constantly postponed answering our questions, and in the end the team talked more with the experienced partner than with the representative one. Aside from the obvious disappointment, the bills were outrageous. Both partners were billing at an astronomical rate, and the Company was not going to come anywhere near its legal budget if this continued.

The next few meetings focused on this challenge. The team wanted to fire the only people who had real experience on a project of this type – the firm hired by the Executive sponsor. The group debated and discussed the risk of taking this step, with the lawyer on the team leading the conversation. The leader's job was to make sure everyone was heard. The debate focused on the many risks of making this dramatic move and the unusual challenges we would face in accomplishing the goals. While it would have been easy to force the decision back on to the lawyer – but no one did. Everyone was going to make the decision on the outside legal team.

With the decision in place to hire another firm, the team made an appointment with the executive sponsor and everyone helped build a presentation. While the leader flipped through the PowerPoint slides at the meeting, outlining the reason for the change

and the plan for moving forward, each team member added important points and helped define the leader's words. As the presentation ended, the sponsor asked each member if this was what they wanted to do. Each replied "yes" in a firm voice.

Analysis and Conclusions

An analysis of this case study and the literature on teams leads to some interesting conclusions.

1) Organizational environment matters; it is never neutral. Opinion surveys conducted on teams suggest that the principal reasons for team failures are organizational factors, primarily non-supportive attitudes of senior management (LaFasto & Larson, 2001, p. 157). The executive management and board of directors of Nature never failed to support this team. They did this by making sure the team had adequate financial resources, by making available the very best people for the project, and most important, by giving them immediate access and feedback on the project's progress. This support assured the team they were wrapping the program around the Company's long-term strategic plan.
2) People matter: Nobody is as smart as everybody. This project crossed organizational lines, integrating accounting, the legal department, treasury, operations, marketing and communications, and the technology area. Each team member represented the unique perspective of one of these departments; each member used that expertise and insight to play a unique role in helping to weave the multiple objectives of these departments into the single project goal. Had any one of the team members been left out, the project's success would have been in question.

3) Communicate, communicate, and communicate. The team members all agree that the most critical and important decision made was to meet twice a week. As a result of this team-member commitment, they never had time to let the inevitable disagreements and conflicts simmer or get out of control, no project deliverable could get seriously behind, and most important, they had a chance in a comfortable, safe environment to challenge underlying project assumptions. The team learned and advanced thinking in every meeting.

In its own unusual and quirky way, this high performing team learned how to reach beyond self and build meaning out of a collective purpose. In the interviews, team members expressed this concept when they talked about "doing more," "creating lasting value," "rising above it all"; it is what Peter Drucker says reaffirms that we are not just biological, or psychological, but also spiritual beings (Beatty, 1998, p. 98). This evolved sense of purpose is what took us to the next level of performance – from simply being a "team" to being a "high-performing team" that exceeded everyone's expectations.

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AN EXPLORATION OF USING TWITTER DATA TO PREDICT THE RESULTS OF THE U.S. PRIMARY ELECTIONS

Jeffrey P. Kaleta, Georgia Southern University, jkaleta@georgiasouthern.edu
Hayden Wimmer, Georgia Southern University, hwimmer@georgiasouthern.edu

ABSTRACT

The use of social media user feeds is a common interest of researchers exploring public views and opinions. In this exploratory study, we look to investigate how Twitter feeds during a presidential primary election can be evaluated to determine the relationships between contesting candidates and garner any predictive insight into election contest outcomes. In this study we collect data from both the REST API and STREAMING API from Twitter, each having their own data collection merits, and perform an association analysis, sentiment analysis, and linear regression to determine what insights can be captured from the data. In this work we find revealing relationships between candidate users accounts on how they interact with each other. We also show how sentiment from verified user accounts on Twitter show significance in election contest outcomes.

INTRODUCTION

The role of Twitter in researching the population's perceptions regarding common pop culture topics, what they do in their everyday life, and, as the focus of this study, how the public political perceptions serve as predictions toward election results, is a growing interest to data researchers. To investigate what can be done using data from Twitter, this study is an exploratory research project to investigate how can be used Twitter use for prediction of election results and how we can use that knowledge to move forward in the analysis of data through Tweets. More specifically, we look to answer the following questions:

1. Is social media a reliable predictor of public preferences in primary election outcomes? Furthermore, are there any significant indicators in tweet data that are more reliable in the prediction of U.S. voter based contests?
2. Do users of Twitter, as a social media platform, reflect the political landscape and public perceptions that affect political contest results? And can the political landscape be identified through users' posts?

To present our approach to these questions, this paper is organized as follows: First we introduce some background literature on how Twitter data has been used in event analysis, measuring sentiment of tweets, and a brief review of other work using social media in evaluating election outcomes. We then present our key approach to collecting data followed by the analysis. Lastly, we follow the results with discussion and next steps for projects stemming from this effort.

RELATED WORKS

Twitter Election Prediction

Political campaigns using social media has become common practice. Predicting US congressional elections based on tweets proved less efficient than predicting them using poll analyzing techniques, because knowledge of people discussing elections in Twitter are scant [1]. Although electoral prediction using tweets seems simple and straight forward issues remain. Following are additional examples of studies that have attempted to find variables that can serve as reliable predictors of election outcomes.

To investigate, authors of [2] used the Twitter API to collect data and applied many different methods for filtering and predicting. Results show that predicting elections based on tweets is too dependent on the period of data collection and too unstable because of parameterizations. Their assessment was that using tweet counting alone was not a reliable indicator for predicting elections.

Using Twitter instead of googling, before and after US presidential election 2008, authors of [3] collected the tweets in accordance with the size of each state that played a major role. Samples correctly predicted Obama would be the winner; however, the results showed a landslide victory for Obama in every state showing cases of unreliability with the model. In [4], the researchers revealed that data from social media did only slightly better than chance in predicting election results in the last US Congressional elections via reviewing the findings of other researchers and then try to duplicate their findings both in terms of data volume and sentiment analysis.

Using supervised learning and volume-based measures for sentiment analysis, authors of [5] showed that analyzing tweets can be an effective way to predict voters' intentions. On predicting, volume of the data is biggest predictive variable followed by inter-party sentiment. Authors of [6] examined the characteristics of the three main parties in the U.K. 2010 general election, classified terms related to each, and counted the number of hashtags and URLs for each party. Experimental results showed that the proposed classification method, based on Bayesian frameworks, is capable of achieving an accuracy of 86% without any training. Collecting data through Twapperkeeper and processing with the command-line tool Gawk, [7] shows that collecting data for specific hashtags can help us track collective and individual interest and connection with certain events.

Social media takes an important role in a regulated society, but can also have unintended drawbacks depending on the government characteristics. In [8], authors examine Twitter's role during Iran's 2009 election crisis to understand how ordinary people use social media to gain power against the regime. They found that Iranian Twitter users did not know that the security agency can use Twitter to identify, locate and kill them. Social media like Twitter can provide information sources for protestors but not the physical power to go against the regime. With exponentially increased number of users, social media became a great tool to track people's political preferences in Italian and French elections. Authors of [9] employed a statistically improved sentimental analysis method and demonstrates consistent correlation between tweets prediction and traditional poll survey. Accuracy improves when focusing more popular leaders or parties. Microblogs have made the online campaign possible. Authors of [10] archive tweets and SPSS to perform statistical analysis. This research suggests structural aspects of Twitter do not use the qualitative data; therefore, research needs to go beyond structural aspects to better understand Twitter use for election prediction.

Other tools geared toward language semantics have been applied to aid in the validity of user tweets. Authors of [11] collect Dutch Twitter messages for the Dutch Senate elections of 2011 with the filter stream provided by Twitter, and apply a language guesser developed to filter out irrelevant Tweets. Additionally, since there is no sentiment analysis software for the Dutch language. They constructed a corpus of political tweets with manual sentiment annotation for sentiment analysis. Despite having no gold standard training data, the total error of the final system was only 29% higher than that of two experienced private polling companies.

A Study of the 2011 Singapore General Election by [12] seeks to test validity of Twitter message on political public opinion during the 2011 Singapore General Election. Authors developed their own Twitter crawler using the Perl programming language, a MySQL database, and the application programming interface (API) provided by Twitter. They found the strong correlation between the share of Twitter messages and actual result of election. Interestingly, the ruling party received a far smaller percentage of tweets than its percentage of votes, while its opposition parties received a significantly larger percentage of tweets than the percentage of their vote.

In [13], authors used the Twitter API to collect data and identify supporters for each party by sentiment analysis, machine learning, and t-test analysis. They found that the network agendas of candidate supporters were positively correlated with the network agendas of various media types during most of the 2012 U.S. election period. In [14] authors find the difference in usage of social media during the midterm elections in the US using text mining and graph structure and find significant relationships between content, graph structure and election results by building a model that predicts whether a candidate will win or lose with accuracy of 88.0%.

In [15], authors use Twitter data on consumer confidence and presidential job approval polls over 2008-2009. Methods used include text analysis, opinion estimation, moving average aggregate sentiment, correlation analysis, and forecasting analysis. Many techniques from traditional survey methodology can be used for automatic opinion measurement, but more advanced NLP techniques can improve opinion estimation. Authors of [16] describe a system for real-time analysis of public sentiment toward presidential candidates in the 2012 U.S. election as expressed on Twitter. The real-time data processing infrastructure, based on IBM's InfoSphere Streams platform, enables analysis and visualization modules and assembles them into a real-time processing pipeline. Their method and statistical sentiment model can evaluate public sentiment effectively.

Considering that the landscape for analyzing Twitter micro blog data is of interest by many researchers considering the cited studies above, this study is the initiation of further studies to add to the current knowledge of analyzing Twitter data in the context of political outcomes. Given the exploratory spirit of this study, we maintained a simple focus based on the U.S. Presidential Primary race of 2016 to collect data to see what can be learned by analyzing those outcomes. To guide the data collection and analysis, we emphasized our efforts to answer the following questions:

- Can election outcomes be predicted using data from Twitter account feeds?
- What are the factors that have the greatest significance toward contest outcomes?
- Does public sentiment matter?

METHODOLOGY

Data Collection

Twitter data was collected from two sources using the Twitter REST API and the Twitter STREAMING API. Collecting tweets using the Twitter REST API has limitations depending on which calling method is used. For this study, we used the GET_status method to request tweets directly from a user's timeline. With this method, each request can only retrieve up to 200 distinct tweets, regardless if they were original from the user or if they were posted as retweets. The Twitter REST API also limits the amount of requests using the GET_ statuses method to 180 requests per 15-minute window (user authorization) [17, 18]. With these limitations in mind, a scheduled call was made every 15 minutes for each of the primary candidates' main Twitter accounts collecting their most recent tweets (Table 1).

A second source to collect Twitter feeds was established using Twitter's STREAMING API. The STREAMING API allows requests to retrieve live tweets directly from the Twitter stream given a set of search parameters for an established amount of time. When using the STREAMING API, all live tweets are fed to a collection location over a set duration of time specified by the calling application. Due to the limitations in processing large files directly, the final strategy employed was to open the stream more frequently for short durations (e.g. every 5 minutes for 3 minute lengths). The calls to the STREAMING API was derived of search terms comprised of candidate names, candidate nicknames, and candidate handles (Table 2).

TABLE 1
ASSOCIATE TWITTER HANDLES FOR REST API GET_STATUSES

Political Figure	Twitter Handle	Party Affiliation
Donald Trump	@realDonaldTrump	Republican
Ted Cruz	@tedcruz	Republican
Marco Rubio	@marcorubio	Republican
Ben Carson	@RealBenCarson	Republican
John Kasich	@JohnKasich	Republican
Jeb Bush	@JebBush	Republican
Hillary Clinton	@HillaryClinton	Democrat
Bernie Sanders	@BernieSanders	Democrat

TABLE 2
'Q' SEARCH KEYWORDS FOR STREAMING API (OPEN SEARCH)

Full name	Single word search	@mentions
donald trump	trump	@realdonaldtrump
ted cruz	tcruz	@tedcruz
marco rubio	mrubio	@marcorubio
ben carson	carson	@realbencarson
john kasich	kasich	@johnkasich
jeb bush	jbush	@jebbush
hillary clinton	clinton	@hillaryclinton
bernie sanders	sanders	@berniesanders

*single word keywords were established based on frequent references to candidates in preliminary tweet review

The overall data collection using both the REST API[1] and the STREAMING API[2] were set-up to operate automatically through the end of February 2016 and through the month of March 2016 to capture social media responses of major contests (e.g. Super Tuesday).

Data Analysis

The data collected from the REST API was used to determine how often candidates mention other candidates in their candidacy Twitter accounts and if the relationships provide any evidence regarding winners of election contests. All tweets from candidate user accounts were compiled into a single table in an Excel Spreadsheet. The text of all tweets were assessed to determine if the user's discussion was directed toward themselves, another candidate in the election, or a simple non-directed rallying tweet. The resulting data was then analyzed using a market basket analysis using Excel's Data Mining plug-in linked to Microsoft's data mining tools.

[1] Tweepy, a Python based package, was used for establishing a connection to the REST API (see http://www.tweepy.org/)

[2] An R based packaged was set up for accessing the STREAMING API. For an example of the process of pulling tweets and conducting sentiment analysis, see: http://datascienceplus.com/sentiment-analysis-on-donald-trump-using-r-and-tableau/

The output of the market basket analysis resulted in illustrating that the candidates of the two major parties typically mentioned candidates that were in direct competition within their associated political party (Figure 1). Interestingly, the analysis suggested that the majority of candidates in the Republican Party pointed the majority of their comments toward the leading front runner, Donald Trump. Interestingly, Hillary Clinton, a leading candidate of the opposing Democratic Party, also had a strong association with tweeting about the opposing party's front runner. This suggests there was some identification to respond to the opposing party candidates through the primary election process. Furthermore, it is noted that Ben Carson never had an opposing comment toward Donald Trump and subsequently over course of the data collection had dropped out of the race.

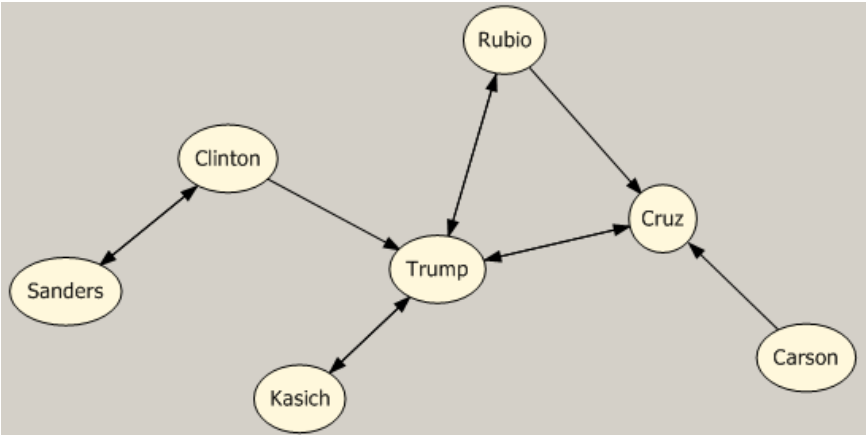

FIGURE 1. ASSOCIATION ANALYSIS OF CANDIDATE MENTIONS

Further analysis showed the stronger relationship to be associations between Donald Trump and Ted Cruz (Figure 2), and a relatively equally distributed discussion directed Toward Ted Cruz from opposing candidates, Donald Trump (26%), Marco Rubio (23%), and Ben Carson (22%) (Figure 3).

Support	Size	Itemset
165	2	Trump = Existing, Cruz = Existing
88	2	Trump = Existing, Kasich = Existing
77	2	Rubio = Existing, Cruz = Existing
69	2	Kasich = Existing, Cruz = Existing
51	2	Clinton = Existing, Cruz = Existing
49	2	Clinton = Existing, Trump = Existing
46	2	Clinton = Existing, Kasich = Existing
44	2	Sanders = Existing, Clinton = Existing
41	2	Rubio = Existing, Trump = Existing
39	2	Carson = Existing, Cruz = Existing
37	2	Sanders = Existing, Cruz = Existing

FIGURE 2. ASSOCIATION ANALYSIS ITEM SET SUPPORT

Probability	Importance	Rule
26 %	-0.16	Trump = Existing -> Cruz = Existing
23 %	-0.20	Rubio = Existing -> Cruz = Existing
22 %	-0.21	Carson = Existing -> Cruz = Existing
15 %	-0.19	Cruz = Existing -> Trump = Existing
14 %	-0.23	Trump = Existing -> Kasich = Existing
13 %	-0.23	Kasich = Existing -> Trump = Existing
12 %	-0.22	Rubio = Existing -> Trump = Existing
12 %	-0.50	Clinton = Existing -> Cruz = Existing
12 %	-0.25	Clinton = Existing -> Trump = Existing
11 %	-0.08	Sanders = Existing -> Clinton = Existing
11 %	-0.32	Clinton = Existing -> Kasich = Existing
11 %	-0.08	Clinton = Existing -> Sanders = Existing
10 %	-0.62	Kasich = Existing -> Cruz = Existing

FIGURE 3. ASSOCIATION ANALYSIS RULE PROBABILITY

The data collected from the STREAMING API, representing a sample of the population of tweets from the public, was used to evaluate both the user sentiment and preform a regression analysis on the factors that were significant in predicting the winners of contests over the month of March 2016. First a simple lexicon

based sentiment analysis was performed using an R script to evaluate the text [19] (for a complete example see http://analyzecore.com/2014/04/28/twitter-sentiment-analysis/) [20]. Although minimal in nature, the script evaluated each word in each tweet against a dictionary of words that were semantically either negative or positive. A composite score summing the total positive and negative words was created representing the sentiment of the tweet[3] [21].

The data was assembled to perform an analysis surrounding each primary contest comprising of the data for each candidate associated with each event. To establish an observation for a single event as cross-sectional data, we assembled the data from the day before a contest, the day of the contest, and the day after the contest. This included the dependent variable as the number of delegates won per contest and the following independent variables:

Number of tweets: The total number of tweets directed toward a candidate (e.g Donald Trump) from the entire population of collected tweets.

Number of retweets: The total number of tweets that were 'retweeted' directed toward a candidate from the entire population of collected tweets.

Sentiment (Sum): The accumulated sum of all the sentiment values directed toward a candidate

Average sentiment: The accumulated sum of the sentiment over the number of tweets directed toward a candidate

Number of tweets by verified user account: The total number of tweets directed toward a candidate derived only from verified users.

Number of retweets by verified user account: The total number of tweets that were 'retweeted' directed toward a candidate derived only from verified users.

Sentiment from verified users (Sum): The accumulated sum of all the sentiment values directed toward a candidate derived only from verified users.

Average sentiment from verified user accounts: The accumulated sum of the sentiment over the number of tweets directed toward a candidate derived only from verified users.

Using SPSS, a linear regression was performed on all the data to determine which factors, if any, were significant in predicting the winning count of delegates of each contest. The overall descriptive statistics are summarized in Table 3 and the results of the regression analysis are portrayed in Table 4.

[3] This method is a simple semantic analysis comparing each word in the tweet against a lexicon library of words that have been tested to be perceived as either positive or negative in valance. A complete example of R based code can be found on this website: http://analyzecore.com/2014/04/28/twitter-sentiment-analysis/ . The key components are comprised of the lexicon library for comparison. For this study, a lexicon of approximately 6800 words were used available at this site: https://www.cs.uic.edu/~liub/FBS/sentiment-analysis.html#lexicon. The process entails each word in each tweet to be compared to the corpus of words in the lexicon to determine if it is positive or negative. A sum value of positive and negative words is calculated for each tweet, then the semantic score of the tweet is calculated by summing the count of positive words less the count of negative words. This method has received some criticism due to the potential for double negative in phrases, however given nature of tweets, it is felt that this method can provide an indicator toward the exploratory investigation of sentiments in user tweets.

TABLE 3
DESCRIPTIVE STATISTICS

Variable	Min	Max	Mean	SE	Std. Dev
Delegates	0	522	76.4	22.2	122.
No of Tweets	1,259	2,885,578	404,135	117,885	645,685
No of Retweets	54,926	4,517,777,559	405,340,208	175,109,249	959,112,860
Sentiment	-35,970	227,480	19,702	8,374	45,868
Avg Sentiment	-0.0242	0.167	0.047	0.0086	0.045
Ver No of Tweets	27	23,908	3,777	991	5,428
Ver No of Retweets	42	1,866,478	262,267	87,821	481,016
Ver Sentiment	-64	3,390	805	213	1,170
Ver Avg Sentiment	-0.1429	0.566	0.221	0.036	0.195

Note: N = 30

Given the data set was derived from a panel of time related data, one potential threat to the validity of the data is the issue of autocorrelation and the effects that previous events had on following event outcomes. Autocorrelation is common threat to statistical validity when data is analyzed as cross-sectional, yet derived from serial or time based information and having the potential to carry effects from one measurement onto another. To alleviate this threat is to test for autocorrelation by calculating a Durbin-Watson statistic. In general, a Durbin-Watson statistic is a test statistic used to determine if the threat of autocorrelation exists within data when conducting a regression analysis. For this analysis, the Durbin-Watson statistic was calculated with SPSS resulting in a value of 2.79, which is above the preferred limit of 2[22, 23]. With this outcome, there were no concerns to perform additional transformations to the data for analysis.

The regression analysis showed that the factor that was significantly supported in predicting the number of won delegates is the sentiment from verified users (ρ = 0.003, SE = 0.040; R^2 = 0.88). As an effort to prevent false brands and identities representing key individuals, Twitter has a process that verifies user accounts to ensure those posting tweets are who they say they are. The verification process is rigorous and Twitter does not allow verified user accounts from general public, distinguishing authentic accounts from fan-based or non-associated users of popular trademarks. The findings from the regression analysis suggest that the sentiment generated from verified user accounts are significant predictors in the outcomes of a primary contest. This may be because verified users are sound boards, echoing the feelings and sentiment of public preferences, or they could also be a voice that influencing public preference. However, with this study, the directionality of influence is unable to be determined without further investigation. Other factors within the regression model failed to provide support for contest outcomes.

TABLE 4
REGRESSION OUTPUT – DEPENDENT VARIABLE
NUMBER OF DELEGATES WON

Variable	B Coeff	SE	Sig
No of Tweets	0.000	0.000	0.476
No of Retweets	0.000	0.000	0.116
Sentiment	-0.001	0.001	0.194
Avg Sentiment	555.9	336.2	0.144
Ver No of Tweets	-0.009	0.019	0.635
Ver No of Retweets	0.000	0.000	0.537
Ver Sentiment	0.138	0.040	0.003**
Ver Avg Sentiment	3.931	95.975	0.968

Note: ** $p < .05$ level, * $p < .10$ level, N = 30, $R^2 = 0.882$

CONCULSIONS AND LIMITATIONS

As the nature of this study being exploratory to investigate the options that can be garnered from Twitter data during an election, our goal was to initiate an effort into the use of social media outlets in collecting predict public views and how they related to political contests. Within this context, our intention is to explore how candidate participation within elections correspond to the public views and the political landscape of the election. Conducting association analysis using Twitter accounts associated with competing candidates, we observed how relationships were perceived with respect to be the leading candidate (Donald Trump) and how that influenced the frequency of mentions in Twitter account feeds. Furthermore, we witnessed how the conversation created between Donald Trump and Ted Cruz exemplified a prospective rivalry demonstrating a struggle between first and second position in the race. Further findings show that there were targeted mentions between Clinton and Trump regardless of the fact they were competing in different political races. A last interesting note were the lack of mentions of the early Republican front runner Ben Carson, who later dropped out the race.

By nature of this study, it is limited in these association observations by not statistically exploring how these relationships are directed in valance (e.g. sentiment) and in time variance. Also, it is unclear if the extended mentions of the Republican front runner from other candidates also contributed to his growth in popularity in the race. This would be a good opportune area for future research to understand the nature of the conversations and their effect on candidate popularity and election outcomes. This can be expanded to include the discussions through news outlets and other media.

Another goal of this exploration was to evaluate if social media can be a predictor of contest winners. Based on the linear regression event analysis, we can see there is some validity toward verified user sentiment as a predictor toward election contests. This finding suggests there is some relationship with verified Twitter users and public political views. Verified users are deemed by Twitter as being popular figures in society which can explain their potential to have influence on public views. However, it is not feasible to assess the direction of causality of this relationship if public opinion also influence the views of the verified users.

One limitation in evaluating the predictors of election outcomes for this study is the relatively small sample size generated from the events of a single month of the presidential primary contests. With extended data

collection, it possible to confirm not only if verified user sentiment is robust predictor of voter results, but expanding the data collection may provide the variation required for variables smaller in effect size to be recognized as significant. The findings of this study does provide a direction for future research toward the influence of verified user accounts in social media to determine if they are a reflection of voter preferences, or if they establish them.

One question we were not able to address is if the general public sentiment, either positive or negative, really had an impact on election results. With the general user sentiment not being significant in the regression model, it is difficult to show support in how the public sentiment influences voter responses. One way to potentially address this question would be to evaluate public sentiment over multiple social media platforms and explore if the combined tone of user opinions have an impact.

In summary, the exploratory study provided some insight into the U.S. Presidential primary elections over the spring of 2016. With that, we were able to show some research that can be conducted investigating political contests using social media user feeds. With the study, future ideas can be explored, such as how verified user sentiment has an impact on general user perceptions related to public social issues involving businesses, public health, or government activities.

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AN OBSERVATION OF WARRANT BUFFETT'S INVESTMENT

Aimao Zhang, Georgia Southern University, Statesboro, GA 30458, USA
aimao@georgiasouthern.edu

ABSTRACT

Warren Buffett is one of the most successful investors in the world (Farrington 2015). His investment portfolio or Berkshire's portfolio is closed observed and followed by investors (Stockpickr, 2016). This paper is an attempt to examine Berkshire's investment portfolio. First, Berkshire's stock holdings are evaluated using Alman's Z-score (Altman, 1968) and a Welch's T test which examines the means of Z-score between 2 groups: Berkshire's holdings and non-Berkshire's holdings. Secondly, top-3 performers in 29 sectors are selected using Zhang's method (Zhang & Kersey, 2015). Then we observe if any of Berkshire's holdings are in top-3 category. The result indicated that (1) the Z-score mean of Berkshire group is higher than that of non-Berkshire group, and (2) 83% Berkshire's holdings are in top-3 category.

INTRODUCTION

Warren Buffett is one of the most successful investors in history (Loth, n.d.). Buffett has been called "The Oracle of Omaha" for his impressive investing prowess. Berkshire's buying and selling has effect on stock price. When Berkshire disclosed a stake in Kinder Morgan, Kinder Morgan's shares went up 11% (Shen, 2016). Shares of Apple soared 9% after Warren Buffett revealed his stake. Every move that Buffett makes and every stock that he picks are closely observed (Warren Buffett, 2016, February 17). There are times when Berkshire asks for, and receives, the SEC's permission to temporarily withhold information on some stock holdings to muffle the shock to the stock market (http://www.cnbc.com/berkshire-hathaway-portfolio/).

In this paper we want to test how good the investment strategy of Warren Buffett is. In the following sections, we review previous studies and perform 2 analyses using data from Compustat. First, we evaluation Berkshire's stock holdings using Alman's Z-score (Altman, 1968), and run a Welch's T test on Z-score means between 2 groups: Berkshire's holdings and non-Berkshire's holdings. Second, we select top-3 performers from 29 sectors using Zhang's method (Zhang & Kersey, 2015). Then we observe if any of Berkshire's holdings are top-3 performers.

LITERATURE REVIEW

Many models use financial ratios to predict stock performance. A few prominent models are Altman's Z-score (Altman, 1968), the Piotroski score (Piotroski 2000), Fama-MacBeth regression (Fama & MacBeth, 1973), and the F-R model (Francis & Rowell, 1978). Financial ratios used in these models vary from macroeconomic factors (for example, consumer inflation or the unemployment rate) to firm level financial data, such as quick ratio. In this paper, we use Altman's Z-score and Zhang's model of 2015. These two methods are simple to use, and data are readily available to feed into these models.

Altman Z-Score

Altman constructed Z-score using data from balance sheet and income statement (Altman, 1968). The Z-score is a sum of several weighted ratios. Common interpretation of Z-score is that the higher the Z-score, the better performance of the firm. The formula is:
Z-score = A x 3.3 + B x 0.99 + C x 0.6 + D x 1.2 + E x 1.4
Where,

A=EBIT/Total Assets;
B=Net Sales /Total Assets;
C=Market Value of Equity / Total Liabilities
D=Working Capital/Total Assets
E=Retained Earnings /Total Assets

Zhang's Logistic Regression Model

Zhang performed logistic regression on 32 financial ratios (See Appendix) from 2086 firms (Zhang & Kersey, 2015). A logistic regression model gives the probability of success (p ≈1) or failure (p ≈0), based on a set of explanatory variables X (financial ratios), with

$$p = \frac{1}{1 + e^{-(\alpha+\beta X)}}$$

where α is -0.7351, β is (0.0498,-0.3356,0.000850,0.5792,-0.0962), and X is (Quick Ratio, Total Market Value, Cash Ratio, Earnings Per Share, Total Asset Turnover).

DATA

The Securities and Exchange Commission (SEC) requires publicly traded companies to file quarterly and annual reports, and makes these financial reports publicly accessible. Among the required filling documents, income statements, balance sheets, and cash flow statements are the most common reports used by investors to evaluate companies' performance. For this study, the financial data are extracted from Compustat which provides financial data of all publicly traded companies. The information of Berkshire's holdings is compiled from several websites (http://www.cnbc.com, http://www.stockpickr.com, http://warrenbuffettstockportfolio.com). These websites give quarterly updates on Berkshire's holding base on Berkshire's filing data from SEC.

ALTMAN'S Z-SCORE ANALYSIS

Financial data of 847 firms are extracted from Compustat and separated into 2 groups. Group 1 consists of 33 firms in Berkshire's holdings. Group 2 consists of 814 firms that are not in Berkshire's holdings, but are operating in the same sectors. There are total 29 sectors defined by SIC (Standard Industrial Classification) code. Since two groups having different sample sizes and standard deviations, Welch's t-test is conducted. Table 1 and 2 show the result of the T test with T value of -1.90 and p-value of 5.76 %. In social science, 5.76 % probability is acceptable. The conclusion is that Z-score means are significantly different between Berkshire group and non-Berkshire group.

Table 1: T Test Result

Group	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Non-Buffet		-18.4039	-40.4219	3.6141	320.0	305.2	336.4
Buffet		2.9513	1.8448	4.0579	3.1207	2.5096	4.1277
Diff (1-2)	Pooled	-21.3553	-130.8	88.0545	313.9	299.6	329.6
Diff (1-2)	Satterthwaite	-21.3553	-43.3989	0.6884			

Table 2: Welch's T Test

Method	Variances	DF	t Value	Pr > |t|
Pooled/Overall Standard Deviation	Equal	845	-0.38	0.7017
Satterthwaite/Welch's T-test	Unequal	816.7	-1.90	0.0576

TOP-3 ANALYSIS

Financial data of 990 firms are extracted from Compustat. 30 firms out of 990 firms are in Berkshire's holdings. The other 960 firms are not in Berkshire's holdings, but are operating in the same sectors. There are total 29 sectors defined by SIC code. According to Zhang's Logistic Regression Model: $p = \frac{1}{1+e^{-(\alpha+\beta X)}}$, p values of 990 firms are calculated and sorted. The top-3 firms with highest p value for each sector are listed in Table 3. Berkshire's holdings appear as top-3 in 24 sectors out of 29 sectors, which is 83% of the times.

Table 3: Top-3 Firms in 29 Sectors

Top 3	SIC	Company Name	In Buffet Holding	$p(X)$
1	2000	Mondelez International Inc	Yes	1.0000000000
2	2000	Nestle Sa/Ag	No	1.0000000000
3	2000	Danone	No	1.0000000000
1	2030	Campbell Soup Co	No	0.9999961546
2	2030	Kraft Heinz Co	Yes	0.9999957583
3	2030	Pinnacle Foods Inc	No	0.9651899990
1	2086	Coca-Cola Co	Yes	1.0000000000
2	2086	Monster Beverage Corp	No	0.9999999002
3	2086	Coca-Cola Femsa Sab De Cv	No	0.9999997134
1	2711	News Corp	No	0.9991654229
2	2711	New York Times Co -Cl A	No	0.8262034144
3	2711	New Media Investment Group	No	0.7118973838
	2711	Lee Enterprises Inc	Yes	0.4346965654
1	2834	Sanofi	Yes	1.0000000000
2	2834	Johnson & Johnson	Yes	1.0000000000
3	2834	Abbott Laboratories	No	1.0000000000

1	2840	Procter & Gamble Co	Yes	1.0000000000
2	2840	Church & Dwight Inc	No	0.9998203610
3	2840	Ikonics Corp	No	0.9134870445
1	2851	PPG Industries Inc	No	1.0000000000
2	2851	Sherwin-Williams Co	No	0.9999999993
3	2851	Akzo Nobel NV	No	0.9999993441
	2851	Axalta Coating Systems Ltd	Yes	0.9930717887
1	2911	Suncor Energy Inc	Yes	1.0000000000
2	2911	Statoil ASA	No	1.0000000000
3	2911	Petroleo Brasileiro Sa- Petr	No	1.0000000000
1	3270	James Hardie Industries Plc	No	0.9839771709
2	3270	Eagle Materials Inc	No	0.9665864437
3	3270	USG Corp	Yes	0.9639401260
1	3663	Apple Inc	Yes	1.0000000000
2	3663	Ericsson	No	1.0000000000
3	3663	Nokia Corp	No	1.0000000000
1	3711	General Motors Co	Yes	1.0000000000
2	3711	Volkswagen Ag	No	1.0000000000
3	3711	Toyota Motor Corp	No	1.0000000000
1	3714	Continental AG	No	1.0000000000
2	3714	Magna International Inc	No	0.9999999942
3	3714	Delphi Automotive Plc	No	0.9999999831
	3714	Wabco Holdings Inc	Yes	0.9964748328
1	4210	United Parcel Service Inc	Yes	1.0000000000
2	4210	Swift Transportation Co	No	0.9726552945
3	4210	Con-Way Inc	No	0.9163545580
1	4812	Verizon Communications Inc	Yes	1.0000000000
2	4812	NTT Docomo Inc	No	1.0000000000
3	4812	America Movil Sa De Cv	No	1.0000000000
1	4832	Sirius XM Holdings Inc	No	0.9999999231
2	4832	Liberty Media Corp	Yes	0.9999530203
3	4832	Cumulus Media Inc	No	0.8046421574
1	4833	Scripps Networks Interactive	No	0.9998282526
2	4833	Tegna Inc	No	0.9981774743
3	4833	Tribune Media Co	No	0.9960204153
	4833	Media General Inc	Yes	0.9205551946
1	4841	Comcast Corp	No	1.0000000000
2	4841	Time Warner Cable Inc	No	1.0000000000
3	4841	Liberty Global Plc	Yes	1.0000000000
1	4888	Twenty-First Century Fox Inc	Yes	1.0000000000
2	4888	Naspers Ltd	No	1.0000000000
3	4888	Time Warner Inc	No	1.0000000000
1	4923	Kinder Morgan Inc	Yes	1.0000000000
2	4923	Spectra Energy Corp	No	0.9999999985
3	4923	EQT Corp	No	0.9999551789

1	5084	Airgas Inc	No	0.9987578450
2	5084	Now Inc	Yes	0.9189649867
3	5084	Transcat Inc	No	0.5368302339
1	5331	Wal-Mart Stores Inc	Yes	1.0000000000
2	5331	Target Corp	No	1.0000000000
3	5331	Wal Mart De Mexico Sa	No	1.0000000000
1	5812	McDonald's Corp	No	1.0000000000
2	5812	Yum Brands Inc	No	1.0000000000
3	5812	Chipotle Mexican Grill Inc	No	0.9999999937
	5812	Restaurant Brands Intl Inc	Yes	0.9982520063
1	6099	Mastercard Inc	Yes	1.0000000000
2	6099	Euronet Worldwide Inc	No	0.8981146259
3	6099	Xoom Corp	No	0.8295275930
1	6411	Marsh & Mclennan Cos	No	1.0000000000
2	6411	Aon Plc	No	0.9999999999
3	6411	Verisk Analytics Inc	Yes	0.9997176099
1	7323	McGraw Hill Financial	No	0.9999999981
2	7323	Moody's Corp	Yes	0.9999999543
3	7323	Equifax Inc	No	0.9996462735
1	7370	Intl Business Machines Corp	Yes	1.0000000000
2	7370	Facebook Inc	No	1.0000000000
3	7370	Baidu Inc	No	1.0000000000
1	8090	Fresenius Medical Care Ag&Co	No	0.9999999959
2	8090	Davita Healthcare Partners	Yes	0.9999992300
3	8090	Envision Healthcare Hldgs	No	0.9968741587
1	8200	Graham Holdings Co	Yes	0.9999833946
2	8200	Success Holding Group Intl	No	0.9878632454
3	8200	New Oriental Ed & Tech	No	0.9496287175
1	5399	Costco Wholesale Corp	Yes	1.0000000000

5 Berkshire's holdings are not in top-3. Table 4 lists p values of these 5 firms. Among the five firms which did not make to the top-3, Lee Enterprises Inc has a low p value of 0.4346965654, and Media General Inc has a relative low p value of 0.9205551946. Both of these companies are media companies.

Table 4: Five None Top-3 Firms

SIC	Company Name	$p(X)$
2711	Lee Enterprises Inc	0.4346965654
4833	Media General Inc	0.9205551946
2851	Axalta Coating Systems Ltd	0.9930717887
3714	Wabco Holdings Inc	0.9964748328
5812	Restaurant Brands Intl Inc	0.9982520063

Further investigation of Lee Enterprises Inc shows that Lee is a provider of local news, information and advertising in 50 markets in 22 states. Lee's stock price peaked at $49/share in

2005 and dropped to $0.28/share in 2009 (See Figure 1). As of March 31, 2016, the holding of Lee is accounted for 0.16% of total Berkshire's holding, and Media General Inc is accounted for 2.68%.

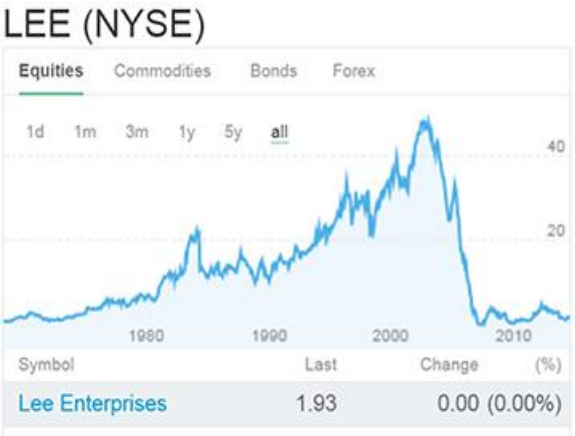

Figure 1: LEE stock price chart.
Source: http://lee.net/financial/

DISCUSSION

Beside the two media companies, Buffet has selected the firms with excellent records. The strategy of following Buffet's investment choice is supported by the numbers shown in this paper. If you don't have the resources to conduct in-depth investigations on firms, following in Buffet's footsteps may not be a bad idea.

APPENDIX

32 FINANCIAL RATIONS STUDIED IN ZHANG'S 2015 STUDY

1. Total Asset Turnover= Sale / Total Assets
2. Book to Market Ratio= Book Value / Market Value
3. Cash Turnover = Sale / Cash and Short Term Investments
4. Cash Ratio= Cash and Short Term Investments / Total Current Liabilities
5. Cash Flow Margin=(Income Before Extraordinary Items + Depreciation and Amortization) / Sale
6. Current Ratio= Total Current Assets / Total Current Liabilities
7. Long-Term Debt/Equity Ratio = Total Long-Term Debt /Market Value of Equity
8. Financial Debt/Equity Ratio = (Total Long Term Debt +Total Debt in Current Liabilities) / Market Value of Equity
9. Long Term Debt/Equity Ratio = Total Long-Term Debt /(Book Value of Equity)
10. Debt/Net Working Capital Ratio= Total Long Term Debt/(Total Current Assets - Total Current Liabilities)
11. Dividend Payout Ratio= Dividends Common Ordinary / Income Before Extraordinary Items Adjusted for Common Stock Equivalents
12. Dividend Yield=Dividends Per Share / Price Per Share
13. Earnings Yield= EPS Excluding Extraordinary Items / Price Per Share

14. Earnings Per Share Including Extraordinary Items
15. Earnings Per Share Excluding Extraordinary Items
16. Profit Margin=(Sale - Cost of Goods Sold) / Sale
17. Inventory turnover= Sale /Total Inventories
18. Inventory to Net Working Capital = Total Inventories/ (Total Current Assets - Total Current Liabilities)
19. Total Market Value = Common Shares * Price Per Share;
20. Net (After-Tax) Profit Margin= Income Before Extraordinary Items/ Sale
21. Net Working Capital Turnover= Sale / Net Working Capital
22. Working Capital =Total Current Assets - Total Current Liabilities
23. Operating Profit Margin After Depreciation= Operating Income After Depreciation / Sale
24. Payables Turnover= Sale /Accounts Payable
25. P/E Ratio= Price Per Share/ EPS Excluding Extraordinary Items
26. Price/Sales Ratio
27. Pre-Tax Profit Margin= Pretax Income / Sale
28. Quick Ratio (Acid Test)=(Total Current Assets - Total Inventories) / Total Current Liabilities
29. Receivables Turnover= Sale / Total Receivables
30. Return on Assets= (Net Income + Total Interest and Related Expense) /Total Assets
31. Return on Equity= Net Income / Book Value
32. Return on Sales= Net Income / Average Sale

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Analyzing Service Levels in Location Problems with Disproportionate Assignment Costs

DR. JEREMY NORTH
Murray State University
DR. ROBERT NAUSS
University of Missouri-St. Louis

ABSTRACT

A common assumption in facility location modeling is that customer assignment cost is proportional to distance. In this work, we drop this assumption and analyze the subsequent effect on service level when weighted average distance is minimized. Computational experiments contrast the p-median with an augmented version enforcing higher overall service levels. We show that our modeling approach is more economical than implementing a closest assignment restriction. Additionally, a Greedy Random Adaptive Search Procedures (GRASP) algorithm is applied to solve larger problem instances.

Facility location has been an active research area for several decades. In this time, many innovations have been achieved in the form of algorithmic contributions or various modeling extensions addressing new or undiscovered problems. In these problems, it is commonly assumed that the cost to service a customer from a given facility is proportional to the distance between them. Historically, this seems to have been a reasonable simplification. In light of the widespread acceptance of this property, very little work has been done analyzing the effects of dropping this assumption. However, service cost may not be justifiably simplified to a linear function of distance in all cases. Some examples include the consideration of border crossing fees or tax implications in international freight distribution. Also, varying terrain throughout a

region can result in changing rates of consumption of fuel. A more abstract example would be the differing rates of change of utility experienced by different sub-regions in a public sector location problem.

In this paper, we drop the assumption of proportionality and examine the subsequent affect this has on customer service levels and the network of selected locations. When the assumption of proportionality is dropped, some customers may not be assigned to their closest respective open facility. Our modeling approach in this work is to augment the classic medianbased model with new constraint sets and parameters enforcing a property we refer to as "mandatory service." This constraint set enforces the highest service level available to any customer when a selected facility is within a specified distance, a restriction that could be desired in some cases.

In the scenario of warehouse replenishment at retailers, customers could insist on higher service levels then they are receiving, especially if they are aware of their logistics provider's distribution network. For example, perhaps a customer receives service from a warehouse over three day's drive away instead of their provider's facility that is one hundred miles away. Or, consider the problems that may arise when a populous residing in a sub-region must travel to distant service facilities when a closer one would suffice.

This problem may be formulated as an Integer Linear Program with binary variables on an undirected network. In the mathematical model presented here, candidate facility locations are indexed by $j \in J$ and customers by $i \in I$.

Let:

$a_{ij} = \begin{cases} 1 \; if \; d_{ij} \leq d_c \\ 0, \text{otherwise} \end{cases}$, where d_c is a coverage distance

$w_{ij} = f(h_i, d_{ij}')$, where h_i is the demand at customer i and d_{ij}' is a random permutation of d_{ij} at a set correlation coefficient (ρ).

p = the number of candidate facilities to select

The decision variables are:

X_{ij} = proportion of demand at customer i serviced by facility j

$$Y_j = \begin{cases} 1 \text{ if facility } j \text{ is selected} \\ 0, \text{ otherwise} \end{cases}$$

With this notation, the p-median with mandatory service restrictions can be formulated as follows:

$$Minimize \quad \sum_{i\in I}\sum_{j\in J} w_{ij}X_{ij} \qquad \text{(1) s.t}$$

$$a_{ij}Y_j \leq \sum_{k\in J} a_{ik}X_{ik} \qquad \forall i \in I, j \in J \qquad (2)$$

$$\sum_{j\in J} X_{ij} = 1 \qquad \forall i \in I \qquad (3)$$

$$X_{ij} \leq Y_j \qquad \forall i \in I, j \in J \qquad (4)$$

$$Y_j = p \qquad (5)$$

$$X_{ij} \geq 0 \qquad \forall i \in I, j \in J \qquad (6)$$

$$Y_j \in \{0,1\} \qquad \forall j \in J \qquad (7)$$

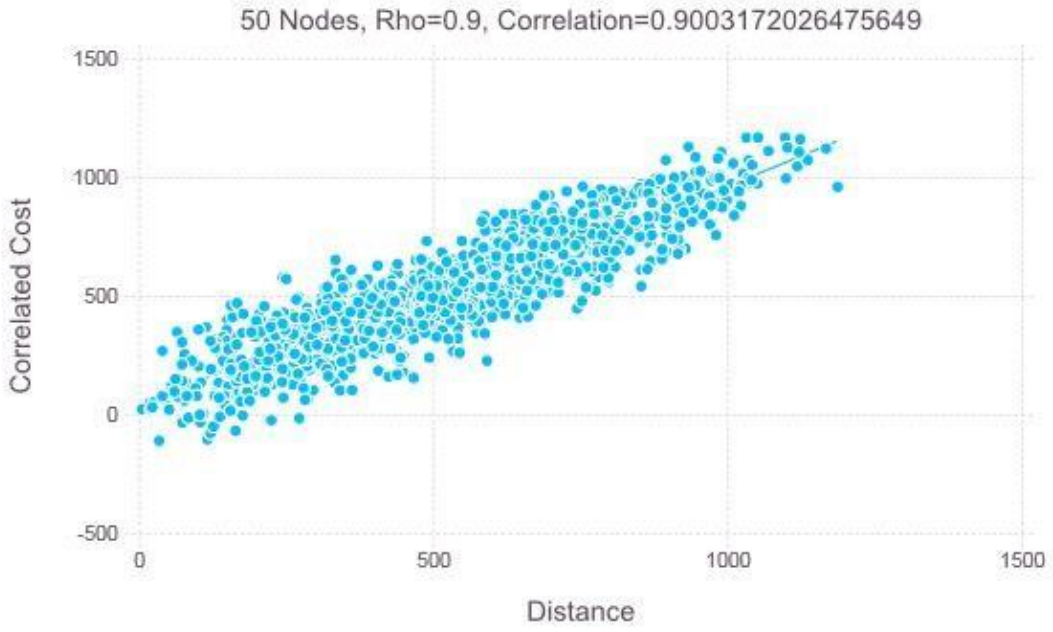
In this model, the objective (1) minimizes demand weighted total distance. (2) enforces the property of "mandatory service", where all customers must have the entirety of their demand satisfied by a facility within the coverage distance where possible. Constraints (3) ensure that all

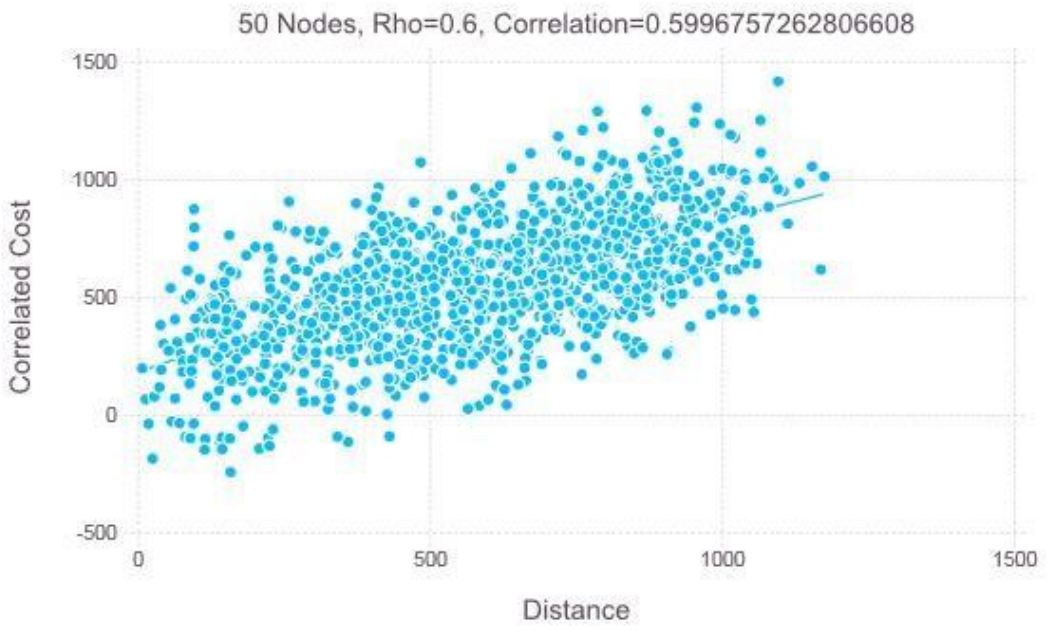
demands are assigned. (4) prevents customer assignment to an unselected facility, and p facilities are to be located (5). (6) and (7) are non-negativity and binary restrictions respectively.

In order to create the correlated cost per unit of demand for each i,j pairing (d_{ij}'), the following procedure is taken for all $(i,j) = (j,i)$:

$d'_{ij} = \left\{\alpha_{ij} d_{ij} \middle| \alpha_{ij} = \rho + \sqrt{(1-\rho^2)} \times \varepsilon\right\}$, where $\varepsilon = \sim N(0,1)$, a standard normal random variate.

What follows are diagrams depicting distance versus cost for a 50 node network at differing values of Rho (ρ).





As seen above, the correlation between distance and cost isn't exact because ε is a random variable, but the difference between Correlation and Rho (ρ) is negligible.

Extensive computational testing is given, analyzing the impact that varying the size of the network, the number of facilities to locate, and the correlation coefficient (ρ) may have on this problem. We show that our modeling approach is superior to enforcing a closest assignment restriction, and that a significant improvement in service level is almost always attainable at an insignificant increase in cost. Lastly, the difficulty of solving this problem to optimality is significantly higher than the classic median model. We therefore develop and present a GRASP algorithm to solve larger instances.

Business Intelligence, Analytics and ERP training

Belinda Shipps (North Carolina A&T State University)

Abstract

Business Intelligence (BI) and analytics continues to be one of the fastest growing areas for businesses (DeAngelis, 2015). One of the top ten skills that employers want their new college graduates to have is the ability to analyze quantitative data (Adams, 2014). BI and analytics were predicted to be the number one investment for CIOs in 2015 (Richardson, 2015). Organizations are actively recruiting students with analytical and business intelligence skills but having difficulty finding candidates with Enterprise Resource Planning (ERP)/analytical and BI skills... For these reasons, many Universities are adopting ERP systems that have BI and analytic components into their curriculums. However, ERP systems can be challenging to set up, operate and teach. This in-progress research investigates methods of teaching ERP systems using hands-on and collaborative approaches. Qualitative and quantitative methods will be used to evaluate the methods discussed in this paper. The results will be used to propose possible best practices.

ERP/Business Intelligence (BI) and analytics skills are widely sought after skills by a vast number of employers in the current job market. BI continues to be one of the fastest growing areas for businesses (DeAngelis, 2015). One of the top ten skills that employers want their new college graduates to have is the ability to analyze quantitative data (Adams, 2014). BI and analytics were predicted to be the number one investment for CIOs in 2015 (Richardson, 2015).

Enterprise Resource planning systems (ERP) s which also include business intelligence tools, integrate various business functional areas using a shared database across the entire organization. Some of the functional areas involve: accounting, finance, customer relationship management, human resources, sales and manufacturing. It allows for reporting and analysis of business data.

ERP systems can be valuable to organizations in many ways. For example, they can provide increased efficiency and productivity (Hitt et al., 2002). However, the implementation, training and use of ERP/business intelligence systems can be complex and challenging. The challenges address the need to use and understand the technology and the theories as well as organizational and socio-technical issues and concerns.

Academic institutions are increasingly recognizing the need to adapt their curriculums to include ERP/BI courses. This training will enable students to be prepared to compete in job markets that are increasingly seeking students with ERP/BI skills. ERP training can be challenging due to the different types of skills and knowledge that are required. After a review of literature, there is limited knowledge on setup considerations and effective methods for training students in the various areas of ERP/BI. This in- progress research investigates ERP setup considerations and methods of teaching ERP systems in order to develop best practices for teaching ERP systems. In the following sections, an overview of ERP setup and teaching considerations and methods are presented.

Considerations in Setting up ERP systems:

In considering an ERP system, one of the first considerations is the development of an ERP plan with goals/objectives for the ERP system for the academic institution. It is important to identify answers to questions such as: what you want to achieve; who will use the system; what courses will be taught; what are the costs that are involved; what are the expected student outcomes; how will ERP enrich the curriculum (Watson & Schneider, 1999).

Some possible objectives for an ERP program may include: Increased competitive advantage for students and university; hands on, real world training opportunities; ERP research

opportunities and development of a cross-functional, multi-disciplinary curriculum throughout the University.

ERP systems can be expensive and there may be academic-based cost saving opportunities. . For example, academic institutions may be able to join academic-based ERP programs such as the SAP University Alliance which can help to minimize academic expenses (Watson & Schneider, 1999). Another consideration for the ERP program is whether it will be offered in one particular academic curriculum such as Management information systems or will there be a cross-functional curriculum that services several departments.

Watson & Schneider (1999) indicate that an ERP system for an academic environment can be challenging and suggest considering the following critical success factors:

CRITICAL SUCCESS FACTORS

- Early planning is important and should take into account critical success factors. ERP will require a significant amount of time and resources to install and implement
- Executive commitment from top ranking administrators is important with executive sponsorship.
- ERP Faculty team with faculty dedicated to learning and using the system. This is important for curriculum development.
- An ERP Industry Advisory Group with industry ERP experience in their company will be helpful.
- A faculty training program where faculty get all of the necessary ERP training, knowledge and information. An in-house study group should collaborate and communicate by sharing information and ideas.
- A physical facilities plan helps by making sure all the necessary computer-based resources are provided such as :(computer hardware, networks, communications, etc.).
- A pilot implementation would help work out initial problems before students use the system.

Examples of hands on methods (early programs) from Watson & Schneider (1999) included:

1. Use of Internet Surfing through the development of a relationship with an ERP vendor so that the academy had access to online business information.
2. Intranet Surfing using ERP systems where students study how processes work such as transaction processing.
3. Role playing -students learn about business concepts through experiential learning using a business script to simulate business processes and activities.
4. Goal Seeking provides the students with a goal or objective such as creating a report or identifying a problem and the student must find a solution using exploratory, investigative and analytic skills and pattern identification to come up with a solution. . Business scripts are not required to conduct business activity.
5. Other activities might involve simulations and role playing as system administrators or consultants where students use the ERP system to help monitor the business processes and models and produce reports. The students might also look at the business ERP system for best practice analysis.
6. Students might also use ERP tools to create an ERP system from beginning to end from requirements analysis to full implementation.

Some of the ERP systems relate to activities in the following areas:

1. Data Warehouse: Activities relate to database design and operation and solutions to database problems.
2. Supply Chain Management and Optimization: Students study supply chain problems relating to optimization and efficiency and examination of how the supply chain works
3. Electronic Commerce and Internet-based Application Development:
4. Simulations of ERP systems – looking at business processes and efficiencies
5. Business analytics --- analyzing what has happened and making predictions

Training method using triangle model of teaching:

The triangle training method takes into account the complexity and challenges associated with ERP/BI training. This framework was developed over time and involved an iterative process which resulted in a teaching model. The framework takes into account many pedagogical principles. There are three learning contexts: classroom, lab and organizations. The students were assigned to teams where the majority of the learning would take place. The hands-on assignments were used to work on organizational configuration issues. The students were also required to prepare papers and summaries of case studies and present their work. This was used

to help with reflection and learning through reflection on topics discussed in class (theory and organizational learning) as well as hands on lab assignments.

Methodology:

The previous methods and techniques will be used to develop an ERP curriculum and training methods. Qualitative and quantitative methods will be used to evaluate the effectiveness of different activities in a cross-functional ERP system. The results will be used to propose best practices.

Conclusion:

As the need for ERP/Business Intelligence (BI) and analytics skills continues to expand, it becomes important to for academic institutions to address this need by incorporating ERP course into the curriculums. This will ensure that students are prepared for the competitive job markets as they prepare for their careers. Training in ERP courses can be very complex and challenging. Students must be able to understand organizational, technical and sociotechnical aspects of learning. This in-progress paper has provided a first look at methods and practices to consider when setting up ERP and teaching ERP courses. Continued research will use this information to setup ERP courses and conduct qualitative and quantitative research to evaluate the methods and propose best practices. Future studies could evaluate practices in different countries using different modules and different BI and ERP processes.

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Challenges to J. M. Keynes Assumed Stability of Marginal Propensity to Consume (MPC)

by

Nozar Hashemzadeh and Dan Farhat
nhashemz@radford.edu and dfarhat@radford.edu
Professor of Economics and Assistant Professor of Economics,
Department of Economics
Radford University, Radford, VA 24142

Abstract

John M. Keynes' hypothesis "that the marginal propensity to consume (MPC) is a fairly stable function" (Keynes, 1936, P. 96) is one of the most enduring foundations for exploring and analyzing economic performance. The proposition, that a predictable causal relationship exists between income and consumption, allows researchers to create and test parsimonious models (both theoretical and empirical), making it an attractive and robust assumption to rely upon. Furthermore, a fixed MPC allows for the identification of a constant "multiplier effect" for the application of fiscal policy. Since the idea is both simple and intuitive, it has become a component of introductory economic analysis taught in most undergraduate macroeconomics courses. In this article, we review the robustness of this proposition. Notwithstanding, his exceptional insight that adding stimulus to aggregate demand will help to shorten the duration of a recession, Keyes generalizations that all consumers react similarly to a change in income is refuted by the weight of historical evidence.

Introduction:

Although it is a prevalent conception, Keynes understanding of the consumption psychology of the community has not gone unchallenged or been accepted as a "scientific fact". Since its introduction, moral philosophers and social scientists who rely on the scientific method and objectivity have questioned the Keynesian macroeconomic paradigm and its suitability to economic decision making. Among others, Agnus Deaton who merited the Nobel Prize in 2015, has been raising serious questions about the relationship between income and consumption in many of his presentations and published works (Deaton 2010, 2011). Deaton's pioneering empirical work has shifted the emphasis away from the behavior of macro aggregates to the decision-making process at the individual and household levels. We can now agree that a fixed

aggregate MPC tells us nothing about economic behavior since the impulsive and perhaps random actions of millions of individual agents may "add up" in such a way that the aggregate MPC appears constant.

Empirically, if the Keynesian paradigm was subjected to the more exacting versions of the scientific methodology as articulated by some classical philosophers (Hume, et al, 1888), his hypothesis would have been rejected at the outset. Soon after the publication of the *General Theory*, Machlup (1939, 1943) attempted to qualify Keynes *multiplier theory* as a gradual process rather than being as an instantaneous episode as conjectured by Keynes. He attempted to lend some credibility to Keynes consumption theory and make it more convincing by suggesting that other variables such as time lags, unpredictable propensities to consume and random events should be taken into consideration.

In contemporary times, Keynes hypothesis would fail the scientific rubrics as vigorously defined by such eminent philosophers as Karl Popper, Dennis Phillips and other epistemologists. For instance, in Popper's view, empirical theories such as conjectures about the trajectory of MPC can only be tested and falsified, but never logically verified. Thus, from a pragmatic perspective, we submit that unless Keynes' proposition has been *falsified* through extensive and verifiable tests and corroboration. Therefore, Keynes consumption theory cannot be accepted as a scientific theory. The falsity of Keynes speculation that "if the consumption psychology of the community is such that they will choose to consume, e.g. nine-tenths of an increment of income, then the multiplier k is 10; and the total employment caused by (e.g.) increased public works will be ten times the primary employment provided by the public works themselves" (Hazlitt, 1992, pp. 116-117) is manifestly obvious. Mathematically speaking, if one assumes that MPC is zero or near zero, then the size of the multiplier approaches infinity—which is an incongruous corollary. Herbener (1992) pointed out there is no "accounting principle" to justify that MPC is bounded between zero and one. He used US income and consumption data from 1939 through 1960 to show that MPC ranged from -1. 38 in 1945 to 45.33 in 1949.

Casually, the scientific validity of a stable MPC which is based on Keynes inductive methodology is a dubious proposition. Nearly two hundred years before the publication of Keynes' influential work, David Hume (1888) had cautioned that the problem of inductive logic is that "instances, of which we have had no experience, must resemble those of which we have had experience, and that the course of nature continues always uniformly the same." (Selby-Bigge, p. 104). Therefore, limited evidence of a stable MPC in short instances at one level (aggregate) cannot logically be worked into a universal theory. In an evolving economy, we should hesitate to presume anything is "fixed"; a constant MPC evident in today's data does not necessarily imply it will remain so indefinitely.

Recently, the irregular behavior of the MPC by income class, regional and country differences and the phase of economic development are being robustly and progressively questioned in the more insightful scientific approaches that have used more consistent and dependable microeconomic data in testing the theory and its implications. This research also has had important implications for the shape and behavior of the utility function, since the value of the MPC emerging from the utility-maximization exercise depends in part on the exact formulation

of the utility function. This outcome has contributed to academic debates in the context of the Permanent Income Hypothesis. Nevertheless, the simplicity and established popularity of the theory has served to divert objective and impartial analysis of typical consumption behavior by households. Sadly, the intransigent fascination with Keynes simplistic model by many wellknown contemporary authors of introductory Principles of Economics text-books continue to severely obstruct academic literacy, modelling innovations and policy design. In an intensive reappraisal of the Keynesian multiplier theory and the related literature, Ahiakpor (2001, p.768) categorically rejects Keynes Multiplier Theory (Based on MPC). He correctly argues that Keynesian theory seems "plausible only because both its proponents and previous critics have failed to ask the pertinent questions to help unmask its fundamental misconception of the economic process, especially the concurrent nature of production and subsequent exchange rather than a unidirectional one."

In this reevaluation article, we review the robustness of the "constant MPC" hypothesis. We began by reviewing select insights from recent research findings. In the following segments, we extend the discussion by exploring current data on consumption and disposable income for the US. We provide a simple empirical framework which demonstrably falsifies Keynes assessment of MPC. We end the article with implications and recommendations for future research.

The Empirical Causality Between Consumption and Income

While a significant causal relationship between income and consumption is theoretically and empirically sound, there is no scientific foundation to support that changes in the level of income changes consumption spending by a predictable amount at every stage. The failure of Keynes hypothesis in explaining the post-war consumption and saving behavior in the United States and elsewhere in Europe prompted much debate soon after the publication of the "General Theory". In a treatise published in 1947, A.C. Pigou criticized Keynes General Theory for ignoring the "wealth effect" in the consumption function. Pigou submitted that in due time, as a result of a falling price level, the wealth effect would stimulate consumption as well the MPC. Nobel Prize laureate, Paul Samuelsson (1943) questioned the stability of the Keynesian consumption function and proposed a "ratchet model" with the implication that during an economic recession household are reluctant to abandon their consumption habits in response to declining levels of spendable income.

Soon after, other economists including Brady and Friedman (1947), Duesenberry (1948) Modigliani (1949) and Katona and Mueller (1953, 1956), offered competing hypotheses about consumers' consumption behavior during the post-war era. Friedman's theory of *Permanent Income Hypothesis* which initially gained considerable support in the macroeconomic literature, conjectures that it is the *permanent income* that drives consumption behavior rather than current income. All the same, consumption theories that use "*Permanent Income*" or life cycle income as a determinant of consumption have proved inadequate in explaining the behavior of the MPC over the short horizon. These theories often subsume a world of certainty in which individuals have perfect information about their future income, the direction of interest rates, and availability of credits, life expectancy and so on. Tobin (1958), a celebrated Keynesian and a Nobel

Laureate, questioned aspects of Keynes consumption theory as it related to large expenditures on consumer durables such as cars, boats, etc. and developed a sophisticated model famously known as the "Tobit Regression" to better explain the relation between income and consumption. Empirical estimates of the MPC by Watts (1958) and Bodkin (1959) did not support a predictable and stable MPC. In fact, Watts's statistical study (1958) indicated that the behavior of the MPC was asymmetrical depending on whether changes in income were perceived to be positive or negative. Watts's research is consistent with further evidence reported by Jonathan Parker (1999) and Nicholas S. Souleles (1999). These authors demonstrated that consumers' spending behavior was particularly sensitive to the timing of changes in income.

In a reevaluation of these theories, Robert Hall (1976) used the Euler Equation[1] to argue that the consumption function as it related to data from the United States, could be modelled as a random walk. He proposed that consumers attempt to maximize their intertemporal utility when the real interest rate is assumed to remain constant. Recall that in the context of a random walk model, the best predictor of consumption in the next period is the change in consumption in the previous period. Despite its simple construct, tests of Hall's Hypothesis have been statistically intractable (see Yuan Mei, 2012).

In a more formative study, Princeton economist Hseih (2003, pp. 397-405) used micro data from household spending in response to changes in income was only predictable when income changes were "large and transparent."

More recently, Carrol, Slecalek and Tokuoka (2014) demonstrate that in developing countries with skewed distribution of wealth, the consumption function is concave which evidently implies that low wealth families have a higher MPC when compared to their wealthier cohorts. Furthermore, they report that the "aggregate MPC is considerably lower than the estimates reported in the empirical literature (p.2). These authors suggest that the aggregate MPC does not vary over the business cycle. Furthermore, they report that" neither the mean value of MPC nor the distribution of MPC changes much when the economy switches from one state to another" (p.5).

Recent Evidence from CES Data

We now seek to evaluate the recent dynamics of the MPC using both the conventional consumption function model as well as our construct. We use annual data from the US Consumer Expenditure Survey [CES]. This data is available from the Bureau of Labor Statistics [BLS] website. The CES measures spending habits, income levels and various characteristics of US

[1] Euler's equation is based on the assumption that consumers typically attempt to equalize the marginal rate of situation between consumption in the current year and the present value of consumption in the coming year.

households. Two particular series are relied upon: average disposable income (income after taxes) and average total consumer expenditure.

To begin with, we explore properties of these series for the 1985 – 2014 period, but choose to pay particular attention to the 2001 – 2014 time period (where more comprehensive data is available). The BLS data retrieval tool allows us to sort the surveyed households into different categories before extracting their average disposable income (income net of taxes) and spending levels. We choose to group the households by pre-tax income ranges with an additional group consisting of all the households.

Consumption data (C) consists of real personal consumption expenditure, annual, billions of chained 2009 dollars. Income data is real disposable personal income, annual, billions of chained 2009 dollars.[2]

Methodology

We begin by testing the input data for stationarity. The ADF statistic for both income and consumption series are greater than the test critical values leading us not to reject the null hypothesis and conclude that the level data is nonstationary. We also test the data for stationarity in first differences. For both income and consumption data the first differences with the trend included, the null hypothesis of a unit root is rejected at 99% level of significance. Logarithmic transformation of data in levels are non-stationary and stationary in first-differences. An error correction model fitted to the aggregate data was estimated to evaluate the aggregate MPC from 1930 through 2015.

$$\Delta \text{Log}(C) := c0 + c1\Delta \text{Dlog}(Y) + c2[(\text{Log } Y_{(t-1)} - \text{Log } C_{(t-1)}] + e_t \quad (1)$$

ΔLog(C): The first difference of Log C, so it is approximately the growth rate of consumption spending.
ΔDlog(Y): The first difference of Log Y, so it is approximately of the growth rate of disposable income.
Gap(-1) = Log $Y_{(t-1)}$ - Log $C_{(t-1)}$ = The difference between log disposable income and log consumption last period.

The estimated results shown in the following table are for the error correction model shown above.

Dependent Variable: D(LSPD)
Method: Least Squares

[2] US Bureau of Economic Analysis, Real Personal Consumption Expenditures [PCECCA], retrieved from FRED, F US Bureau of Economic Analysis, Real disposable personal income [A067RX1A020NBEA], retrieved from FRED, Federal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/A067RX1A020NBEA, June 10, 2016.ederal Reserve Bank of St. Louis https://research.stlouisfed.org/fred2/series/PCECCA

Date: 06/10/16 Time: 17:16
Sample (adjusted): 1930 2015
Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001147	0.005922	-0.193632	0.8469
Δ(LogY)	0.518417	0.058650	8.839172	0.0000
GAP(-1)	0.130655	0.041667	3.135678	0.0024

R-squared 0.509363 Mean dependent var 0.030980 Adjusted R-squared 0.497541 S.D. dependent var 0.029465
S.E. of regression 0.020886 Akaike info criterion 4.865209
Sum squared resid 0.036207 Schwarz criterion 4.779592
Log likelihood 212.2040 Hannan-Quinn criter. 4.830752
F-statistic 43.08395 Durbin-Watson stat 1.216851

Prob(F-statistic) 0.000000

The "factor of proportionality" = exp[(coefficient on constant / coeff on Gap(-1)] = 0.99126 = prop = 0.922619. According to this estimate, US consumers in the aggregate spend 92% of their disposable income in the long-run. Nonetheless, this result masks the true relationship between change in income and change in consumption for different income brackets. When compared to the long-run estimate of MPC in a simple regression of spending on income (shown below), the approximate MPC from the error correction model is approximately 13% higher.

We also estimated the parameters of the two other models of the consumption function shown below:

$$C_t = c_0 + MPC_{LR} \times Y_t \quad (2)$$

where C_t represents consumption spending, c_0 represents an autonomous level of consumption and Y_t represents disposable income. We note that equation (2) is representative of the formulation of the relationship between income and consumption in much of the undergraduate textbooks. To correct for spurious results (stemming from trended data) we also considered the parameters of equation (3) below which is bsed on first diffrences of income and consumption.

$$(3)\ \Delta C_t = a_0 + MPC_{SR} \times \Delta Y_t \quad (3)$$

where a_0 is a proxy stochastic parameter. These two formulations differ in that the first equation assumes a fixed level of autonomous consumption, c_0, while the second equation accommodates movements in autonomous consumption within the parameter a_0. Speculation about shifts in autonomous consumption was first raised by Peter Temin's *Did Monetary Forces Cause the Great Depression?* (1976) who posited that shifts in the consumption function was central in the intensification of the contraction from 1929 to 1933. In a paper published by the National Bureau of Economic Research, Robert Hall (1986, pp. 237-266) produced results similar to Taman's work. He showed that significant shifts in the consumption/GNP relation played a decisive role in setting off the great depression. Previously, Temin's critics, Thomas Mayer (1978) and Barry Anderson, Barry L., and Butkiewicz, James L. (1980)) had demonstrated that consumption functions of various types had important negative residuals in 1930.

We might think of equation (2) as representing aggregate consumption over the longer term which is used in Keynesian economic models. We might think of equation (3) as that reflecting consumer behavior and how spending patterns change in response to immediate income shifts. As such, they produce different estimates of the MPC, with the estimate from equation (1) sometimes called the "long-run MPC" (MPC_{LR}) and the estimate from equation (2) called the "short-run MPC" (MPC_{SR}). If the MPC is constant, we would expect data points for spending and disposable income to fall on a straight line for at least one of the two linear functions. We can construct simple scatter plots (with linear trend lines) to visually identify if this is true and perform simple OLS to construct estimates of the MPC.

MPC estimates based on Income Brackets

Early data (1985 – 2000) covering all income groups shows a strong linear relationship between consumption spending and disposable income both in the context of an error correction model and ordinary least squares regression (see the left graph of Figure 1). It appears that equation (1) fits the data quite well during this period. The OLS estimate for the long-run MPC at this time is 0.793 and is highly significant (see Table 1). A weaker linear relationship appears to exist between changes in spending and changes in disposable income (see the right graph of Figure 1). We would hesitate to immediately assume equation (2) is an appropriate model. It is highly plausible that a potentially-omitted factor such as a measure of income distribution that influences consumption changes needs to be incorporated. In the second specification. Moreover, stochastic spending/income shocks are quite strong which consistently impact the short-run MPC. Despite the additional variation, our enquiry produces a significant OLS estimate of the short-run MPC of 0.48. These numbers are consistent with the overall expectations of a significant MPC value between 0 and 1.

Figure 1: Consumption Spending and Disposable Income in the US, 1985 – 2000, $thousands

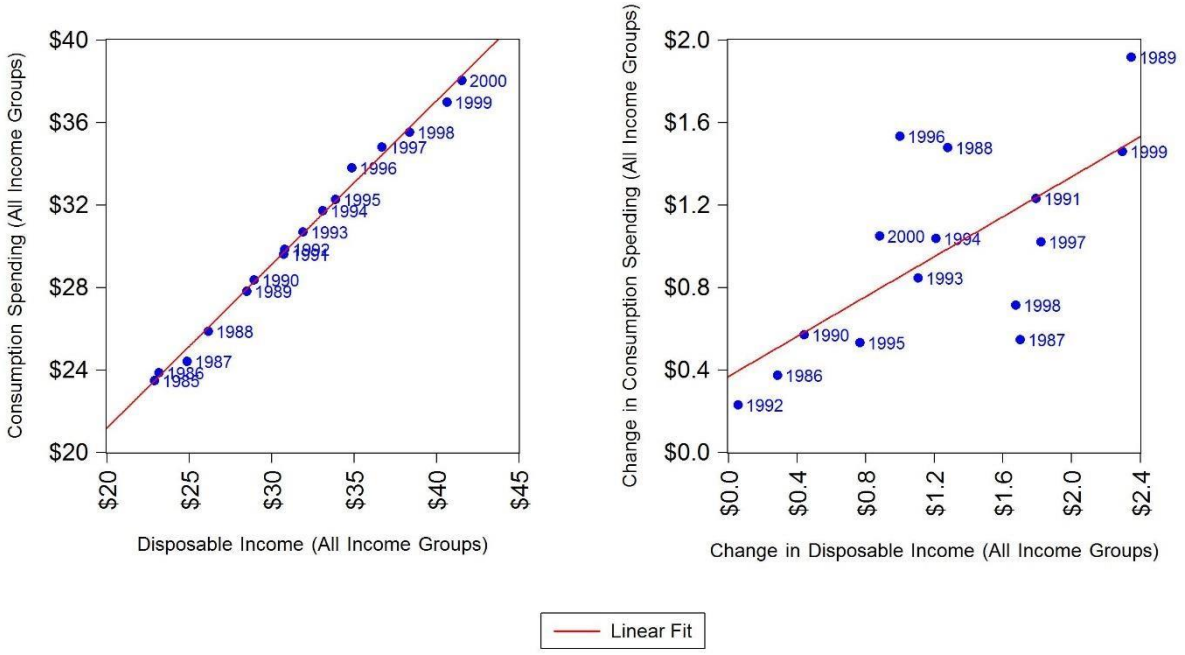


Table 1: OLS Estimates of MPC

	Level [Equation (1)]			Difference Level [Equation (1)]		
	OLS Estimate of Long-run MPC	SE	Significance	OLS Estimate of Short-run MPC	SE	Significance
1985 - 2000:						
All	0.793	0.016	***	0.484	0.140	***
2001 - 2014:						
Income Group						
All	0.662	0.093	***	0.325	0.104	***

< $5K	-0.459
$5K - $10K	7.196
$10K - $15K	1.923
$15K - $20K	2.065
$20K - $30K	1.368
$30K - $40K	0.733
$40K - $50K	-0.616
$50K - $70K	-0.333
$70K - $80K	-0.143
$80K - $100K	-0.165
$100K - $120K	-0.190
$120K - $150K	-0.133

0.341 -0.085 0.400 1.486 1.113 2.522 0.756
** 0.275 1.266 0.763 ** 0.836 1.470 0.384
*** -0.255 0.562 0.525 -0.500 0.582 0.465
-0.393 0.556 0.201 -0.103 0.281 0.181 0.120
0.250 0.145 0.080 0.234

0.107 -0.091 0.145

0.121 -0.010 0.205

> $150K -0.018 0.070 0.089
0.058

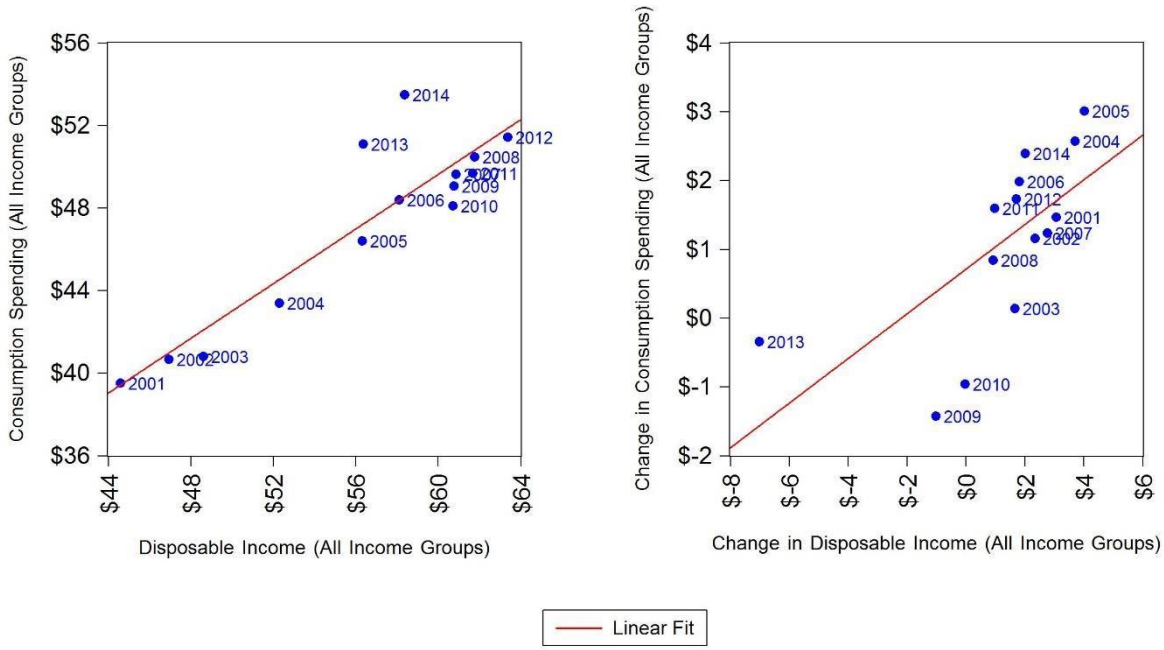
*** = Significant at 1% level, ** = Significant at 5% level, * = Significant at 10% level.

SE (standard error of the estimate coefficient)

When we focus only on the most recent period (2001 – 2014), a somewhat different picture emerges. Visual inspection of the data again shows a strong relationship between consumption and disposable income described by equation (1), but there is much more additional variation in consumption to explain, with particularly extreme movements in 2009 – 2010 and 2013 – 2014 (see the left graph in Figure 2). We might hesitate to adopt equation (1) for this period without further testing. Results for changes in consumption and changes in disposable income are similar to those for the early period. Because of too much variation in the data, it is implausible that equation (2) captures the real but unobserved relationship between the two variables. (See the right graph in Figure 2).

Estimates of the long-run and short-run MPCs (covering all households) are 0.66 and 0.33 respectively (see Table 1). Both are highly statistically significant, but they are lower than those from the 1985 – 2000 period. This suggests that the MPC has drifted. A simple t-test that the long-run MPC estimate from this latter period equals that from the earlier period can be rejected at the 5% level (but not at the 10% level). For the short-run MPC, we can reject the hypothesis that the latter period estimate equals the earlier period estimate at the 1% level (but not at the 5% level). The different estimates contradict the hypothesis that the MPC is fixed.

Figure 2: Consumption Spending and Disposable Income in the US, 2001 – 2014, $thousands



When we evaluate equation (1) and equation (2) for separate income groups, we fail to achieve consistent and, in many cases, significant estimates of the long-run and short-run MPCs. For simplicity, we focus only on the latter 2001 – 2014 period for this exercise. Table 1 reports the OLS estimates. Notably, estimates of the long-run MPC generally decline with income level (see Figure 3a for a visual assessment). Significant, positive estimates are found only for low income levels ($10,000 - $30,000 in pre-tax income). These MPC estimates all exceed 1 (likely due to the role of credit for low-income households). For income levels greater than $30,000, estimates of long-run MPC are not statistically different from zero. As shown in figure 3b, MPC for higher income groups have turned negative in recent years.

Note that estimates for the short-run MPC are never statistically different from zero. Once again, either there are more explanatory variables to consider, extremely volatile stochastic shocks to consumption/income, or the MPC is not constant. We would not immediately accept equation (1) or equation (2) at a more "micro" level without further analysis. This exercise also shows that the relationship between spending and disposable income evident at more "micro" levels (outside the 0-1 range, to be statistically insignificant in many cases. By contrast, estimates of MPC at more "macro" levels (within the 0-1 range) turn out to be highly significant. Once again, it is apparent from our investigation that modeling the behavior of the whole fails to provide an objective understanding of the behavior of the constituting parts.

Conclusion

John M. Keynes consumption theory and the multiplier effect has gained much traction in much of macroeconomics literature due to his convincing observation that when a fraction of marginal income is spent by consumers it creates an long-lasting stream of marginal revenues for vendors

and *producers* who provide the products and services. However, Keynes' proposition far from being a universal certainty. Much of the empirical research and our investigation strongly contradicts the prevalent view that the MPC can be assumed to remain fixed either in the shortrun or the long run. Decades after the publication of the *General Theory*, macroeconomic theorists and practitioners appear to have reached some consensus that there is a critical need for a paradigm shift in macroeconomic theory and application of policy. As Professor Deaton (2010) has put it there is no assurance that a fiscal and monetary experiment that worked once will produce the same results if tried again. The evidence presented in our paper questions the validity of some fundamental aspects of the Keynesian Consumption theory. Several noted economists, among them the former Governor of the Federal Reserve System (the Fed) questioned the soundness of massive debt financing of home ownership. In his testimony before the US Senate Banking Committee, he admitted that "we were wrong". Alan Greenspan, was uncharacteristically candid when he stated that *"an ideology is a conceptual framework with the way people deal with reality. Everyone has one. You have to — to exist, you need an ideology. The question is whether it is accurate or not. And what I'm saying to you is, yes, I found a flaw. I don't know how significant or permanent it is, but I've been very distressed by that fact*." As stated at the outset, we have affirmatively discovered that the Keynesian ideology is empirically flawed at the disaggregated level.

Since the crash of 2008, governments and central banks in the U.S. the European Union, China, Japan and elsewhere, have been using unprecedented fiscal and monetary stimulus to revive their respective economies. Although marginally effective, these interventions do not seem to have turned the corner. The recession that began in late 2007, has resulted in massive income and wealth redistribution from the lower and middle brackets with high MPC to high income earners who have been reluctant to put their newly gained fortune to work. As a result, there has been little progress in revitalizing consumption, formation of high-wage jobs and real economic growth. What is worse, these policies have produced more uncertainty, fear, loss of confidence in government and in some cases total anarchy.

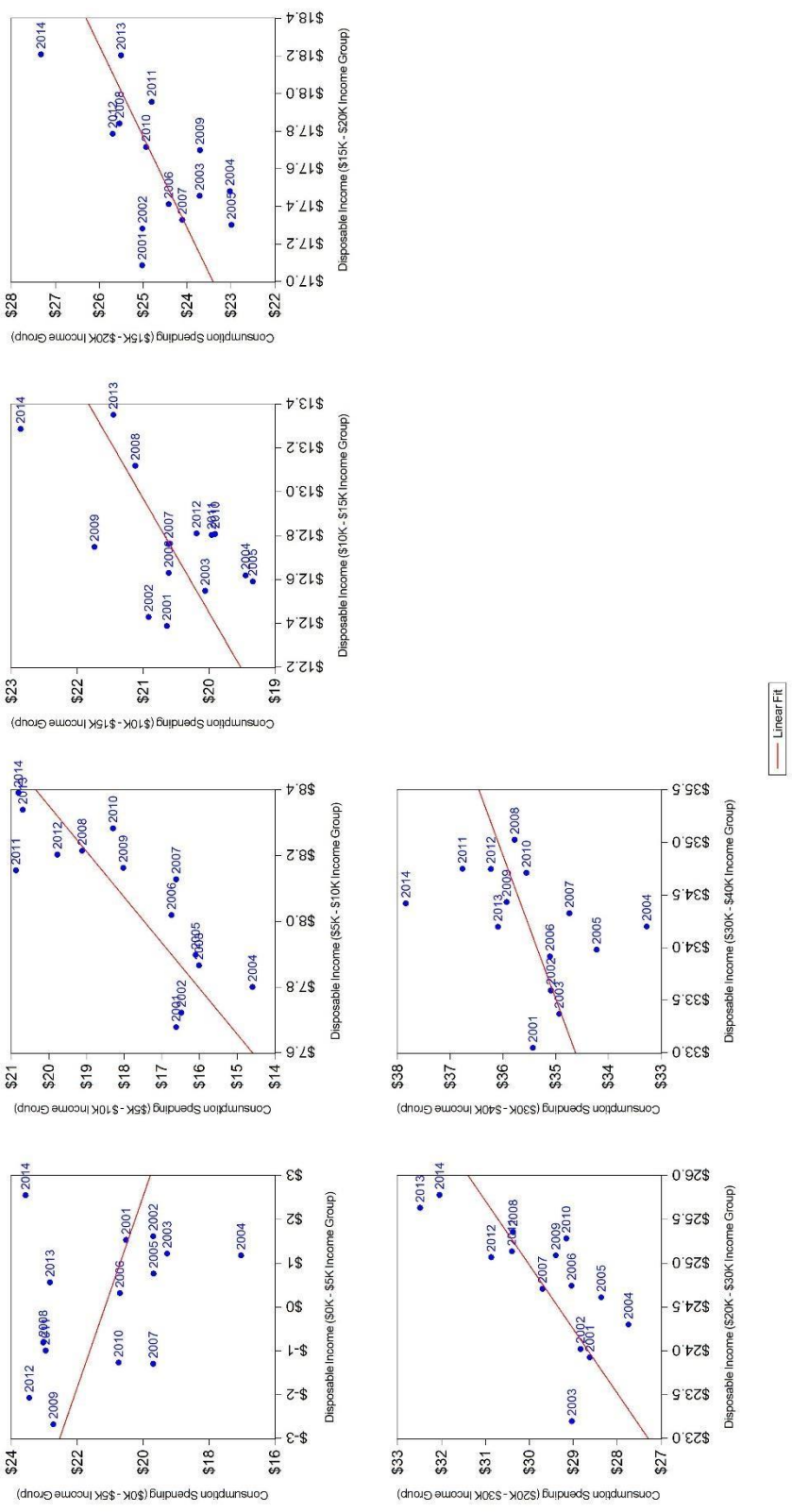


Figure 3a: Consumption Spending and Disposable Income in the US, 2001 – 2014, $thousands, Lower Pre-tax Income Levels ($0 - $40,000).

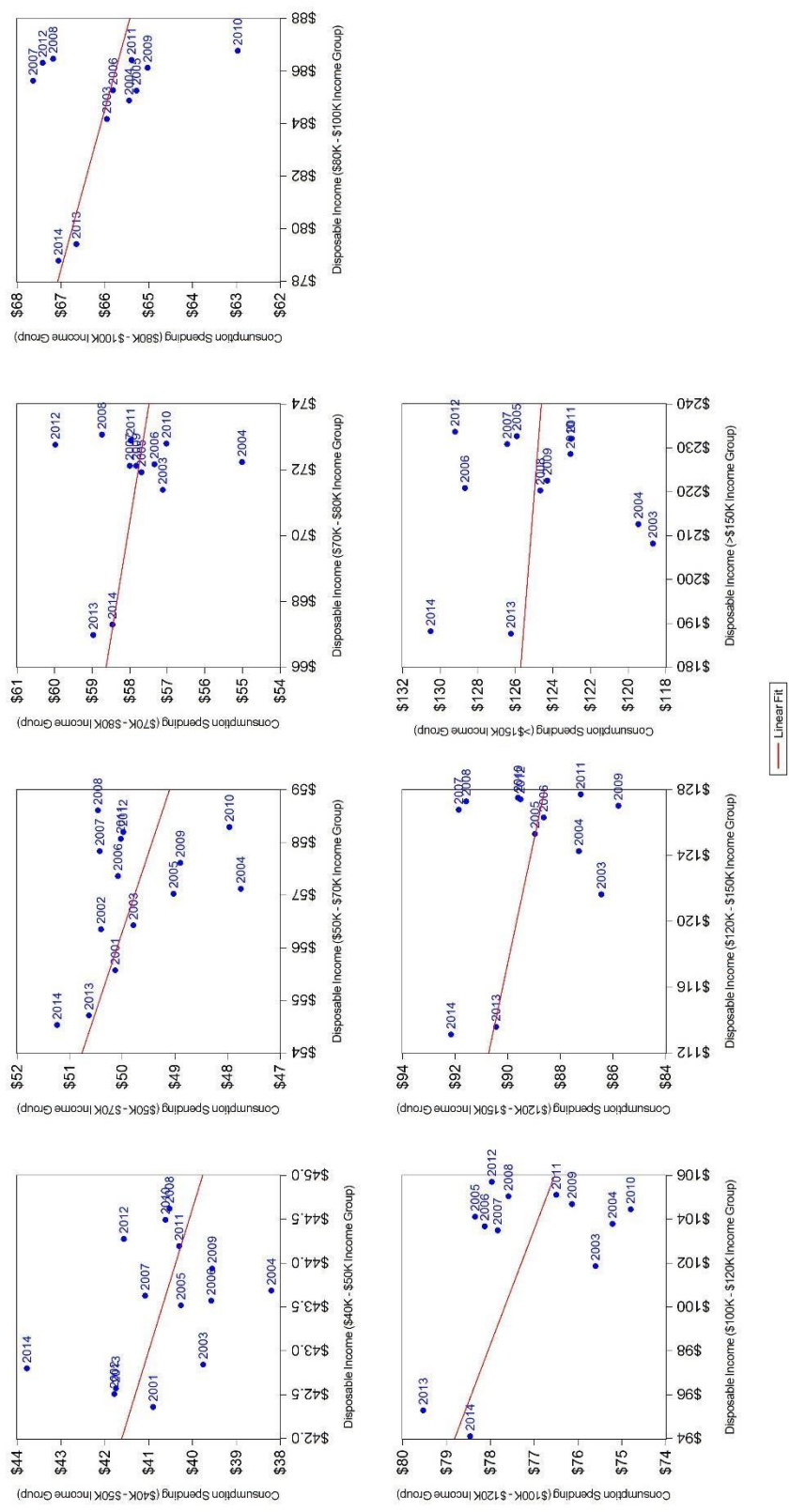


Figure 3b: Consumption Spending and Disposable Income in the US, 2001 – 2014, $thousands, Higher Pre-tax Income Levels (> $40,000).

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Contemporary Issues in Cybersecurity Research for Business and Management

Harry Katzan, Jr.,
Webster University
Director, Institute for Cybersecurity Research
U.S.A.

Abstract

The effectiveness of modern computer applications is normally regarded as a function of five basic attributes of secure computer and information systems: availability, accuracy, authenticity, confidentiality, and integrity. The concepts generally apply to government, business, education, and the ordinary lives of private individuals. The considerations normally involve extended Internet applications – hence the name *Cybersecurity*. Achieving and maintaining a secure cyberspace is a complicated process, and some of the concerns involve personal identity, privacy, intellectual property, the critical infrastructure, and the sustainability of organizations. The threats to a secure operating infrastructure are serious and profound: cyber terrorism, cyber war, cyber espionage, and cyber crime, to which the technical community has responded with safeguards and procedures, usually supplied by the private sector. This paper provides a comprehensive view of security in the cyber domain with the ultimate objective of developing a science of cybersecurity.

KEYWORDS: Cybersecurity, information assurance, critical infrastructure protection.

Introduction

The Internet is the newest form of communication between organizations and people in modern society. Everyday commerce depends on it, and individuals use it for social interactions, as well as for reference and learning. To some, the Internet is a convenience for shopping, information retrieval, and entertainment. To others, such as large organizations, the Internet makes national and global expansion cost effective and allows disparate groups to profitably work together through reduced storage and communication costs. It gives government entities facilities for providing convenient service to constituents. The Internet is also efficient, because it usually can provide total service on a large variety of subjects in a few seconds, as compared to a much longer time for the same results that would have been required in earlier times (Katzan, 2012).

From a security perspective, the use of the term "cyber" generally means more than just the Internet, and usually refers to the use of electronics to communicate between entities. The subject of cyber includes the Internet as the major data transportation element, but can also include wireless, fixed hard wires, and electromagnetic transference via satellites and other devices. Cyber elements incorporate networks, electrical and mechanical devices, individual computers, and a variety of smart devices, such as phones, tablets, pads, and electronic game and entertainment systems. The near future portends road vehicles that communicate and driverless automobiles. A reasonable view would be that cyber is the seamless fabric of the modern information technology infrastructure that enables organizations and private citizens to sustain most aspects of modern everyday life.

Cyber supports the commercial, educational, governmental, and critical national infrastructure. Cyber facilities are pervasive and extend beyond national borders. As such, individuals, organizations, and nation-states can use cyber for productive and also destructive purposes. A single individual or a small group can use cyber for commercial gain or surreptitious invasion of assets. Activities in the latter category are usually classed as penetration and include attempts designed to compromise systems that contain vital information. In a similar vein, intrusion can also effect the day-to-day operation of critical resources, such as private utility companies.

Interconnectivity between elements is desirable and usually cost effective, so that a wide variety of dependencies have evolved in normal circumstances, and cyber intrusions have emerged. Thus, a small group of individuals can compromise a large organization or facility, which is commonly known as an *asymmetric* threat against which methodological protection is necessary. In many cases, a single computer with software obtained over the Internet can do untold damage to a business, utility, governmental structure, or personal information. Willful invasion of the property of other entities is illegal, regardless of the purpose or intent. However, the openness of the Internet often makes it difficult to identify and apprehend cyber criminals – especially when the subject's illegal activities span international borders.

Cybersecurity Operations

It is well established that cybersecurity is a complicated and complex subject encompassing computer security, information assurance, comprehensive infrastructure protection, commercial integrity, and ubiquitous personal interactions. Most people look at the subject from a personal perspective. Is my computer and information secure from outside interference? Is the operation of my online business vulnerable to outside threats? Will I get the item I ordered? Are my utilities safe from international intrusion? Have I done enough to protect my personal privacy? Are my bank accounts and credit cards safe? How do we protect our websites and online information systems from hackers? Can my identity be stolen? The list of everyday concerns that people have over the modern system of communication could go on and on. Clearly, concerned citizens and organizations look to someone or something else, such as their Internet service provider or their company or the government, to solve the problem and just tell them what to do.

So far, it hasn't been that simple and probably never will be. The digital infrastructure based on the Internet that we call cyberspace is something that we depend on every day for a prosperous economy, a strong military, and an enlightened lifestyle. Cyberspace, as a concept, is a virtual world synthesized from computer hardware and software, desktops and laptops, tablets and cell phones, and broadband and wireless signals that power our schools, businesses, hospitals, government, utilities, and personal lives through a sophisticated set of communication systems, available worldwide. However, the power to build also provides the power to disrupt and destroy. Many persons associate cybersecurity with cyber crime, since it costs persons, commercial organizations, and governments more than a $1 trillion per year.[1] However, there is considerably more to cybersecurity than cyber crime, so it is necessary to start off with a few concepts and definitions.

Cyberspace has been defined as the interdependent network of information technology infrastructure, and includes the Internet, telecommunication networks, computer systems, and embedded processors and controllers in critical industries.[2] Alternately, cyberspace is often regarded as any process, program, or protocol relating to the use of the Internet for data processing transmission or use in telecommunication. As such, cyberspace is instrumental in sustaining the everyday activities of millions of people and thousands of organizations worldwide. The key terminology is that in a security event, a *subject* executes the crime against an *object* and that both entities incorporate computer and networking facilities.

Cyber Attacks

Cyber attacks can be divided into four distinct groups:[3] cyber terrorism, cyber war, cyber crime, and cyber espionage. It would seem that cyber crime and cyber espionage are the most pressing issues, but the others are just offstage. Here are some definitions:[4]

[1] Remarks by the U.S. President on Securing Our Nation's Cyber Infrastructure, East Room, May 29, 2009. [1]
[2] National Security Presidential Directive 54/Homeland Security Presidential Directive 23 (NSPD-54/HSPD-23). [2]
[3] Shackelford, Scott L., In Search of Cyber Peace: A Response to the Cybersecurity Act of 2012, Stanford Law Review, March 8, 2012, (http://www.stanfordlawreview.org). [20]
[4] Lord, K.M. and T. Sharp (editors), America's Cyber Future: Security and Prosperity in the Information Age (Volume I), Center for New American Security (June 2011), (http://www.cnas.org). [16]

Cyber crime is the use of computers or related systems to steal or compromise confidential information for criminal purposes, most often for financial gain.

Cyber espionage is the use of computers or related systems to collect intelligence or enable certain operations, whether in cyberspace or the real world.

Cyber terrorism is the use of computers or related systems to create fear or panic in a society and may result in physical destruction by cyber agitation.

Cyber war consists of military operations conducted within cyberspace to deny an adversary, whether a state or non-state actor, the effective use of information systems and weapons, or systems controlled by information technology, in order to achieve a political end.

As such, cybersecurity has been identified as one of the most serious economic and national security challenges facing the nation.[5] There is also a personal component to cybersecurity. The necessity of having to protect one's identity and private information from outside intrusion is a nuisance resulting in the use of costly and inconvenient safeguards.

Cyberspace Domain, its Elements and Actors

Cyberspace is a unique domain that is operationally distinct from the other operational domains of land, sea, air, and space. It provides, through the Internet, the capability to create, transmit, manipulate, and use digital information.[6] The digital information includes data, voice, video, and graphics transmitted over wired and wireless facilities between a wide range of devices that include computers, tablets, smart phones, and control systems. The Internet serves as the transport mechanism for cyberspace. The extensive variety of content is attractive to hackers, criminal elements, and nation states with the objective of disrupting commercial, military, and social activities. Table 1 gives a list of areas at risk in the cyberspace domain.[7] Many cyber events, classified as cyber attacks, are not deliberate and result from everyday mistakes and poor training. Others result from disgruntled employees. Unfortunately, security metrics include non-serious as well as serious intrusions, so that the cybersecurity threat appears to be overstated in some instances. This phenomenon requires that we concentrate on deliberate software attacks and how they are in fact related, since the object is to develop a conceptual model of the relationship between security countermeasures and vulnerabilities.

Table 1. Areas at Risk in the Cyberspace Domain

Commerce
Industry
Trade
Finance
Security
Intellectual property
Technology
Culture
Policy
Diplomacy

Many of the software threats can be perpetrated by individuals or small groups against major organizations and nation-states – referred to as *asymmetric attacks,* as mentioned previously. The threats are reasonably well known

[5] National Security Council, The Comprehensive National Cybersecurity Initiative, The White House, (http://www.whitehouse.gov/cybersecurity/comprehensive-national-cybersecurity-initiative). [2]
[6] McConnell, M., *Cyber Insecurities: The 21st Century Threatscape,* Chapter II in Lord, K.M. and T. Sharp (editors), America's Cyber Future: Security and Prosperity in the Information Age (Volume II), Center for New American Security (June 2011), (http://www.cnas.org). [18]
[7] Stewart, J., *CompTIA Security+ Review Guide,* Indianapolis: Wiley Publishing, Inc., 2009. [21]

and are summarized in Table 2. It's clear that effective countermeasures are both technical and procedural, in some instances, and must be linked to hardware and software resources on the defensive side. The security risks that involve computers and auxiliary equipment target low-end firmware or embedded software, such as BIOS, USB devices, cell phones and tablets, and removable and network storage. Operating system risks encompass service packs, hotfixes, patches, and various configuration elements. Established counter measures, include intrusion detection and handling systems, hardware and software firewalls, and antivirus and anti-spam software.

Table 2. Security Threats

Privilege escalation
Virus
Worm
Trojan horse
Spyware
Spam
Hoax
Adware
Rootkit
Botnet
Logic bomb

The cybersecurity network infrastructure involves unique security threats and countermeasures. Most of the threats relate to the use of out-of-date network protocols, specific hacker techniques, such as packet sniffing, spoofing, phishing and spear phishing, man-in-the-middle attacks, denial-of-service procedures, and exploiting vulnerabilities related to domain name systems. Countermeasures include hardware, software, and protective procedures of various kinds. Hardware, software, and organizational resources customarily execute the security measures. There is much more to security threats and countermeasures, and the information presented here gives only a flavor to the subject.

There is an additional category of threats and countermeasures that primarily involves end-users and what they are permitted to do. In order for a threat agent to infiltrate a system, three elements are required: network presence, access control, and authorization. This subject is normally covered as the major features of information assurance and refers to the process of "getting on the system," such as the Internet or a local-area network. A threat agent cannot address a system if the computer is not turned on or a network presence is not possible. Once an end user is connected to the computer system or network, then access control and authorization take over. It has been estimated that 80% of security violations originate at the end-user level.[8] *Access control* concerns the identification of the entity requesting accessibility and whether that entity is permitted to use the system. *Authorization* refers to precisely what that entity is permitted to do, once permitted access. There is a high-degree of specificity to access-control and authorization procedures. For example, access control can be based on something the requestor knows, a physical artifact, or a biometric attribute. Similarly, authorization can be based on role, group membership, level in the organization, and so forth. Clearly, this category reflects considerations which the organizations has control over, and as such, constitutes security measures that are self-postulated.

Cybersecurity Collaboration

A *collaboration group* exists when a set of service providers ***P*** supplies a totality of services for a specific operational domain to a set of clients ***C***. Not every provider p_i performs the same service but the members of ***P*** can collectively supply all of the service needed for that domain. The client set ***C*** constitutes the functions in the operational system that require protection.

The controls that constitute a cyber security domain form a collaboration group. Diverse elements of hardware and software are used for network and operating system security. Clearly, processes are necessary for gaining network presence, access control to a given resource, and user authentication. Intrusion detection and prevention

[8] Stewart, ***op cit.***

systems (IPDS) are implemented to perform continuous monitoring and cyber protection. Access roles and operational rules are developed to facilitate use of cyber security procedures and elements.

When a client adopts cybersecurity principles for network presence, access control, and authentication, for example, it applies the inherent methods for and by itself, thereby assuming the dual role of provider and client. Similarly, when an organization installs a hardware or software firewall for network protection, it is effectively applying a product for its own security.

In a security system, security controls exchange information and behavior in order to achieve mutually beneficial results. As security systems become more complex, the security entities adapt to optimize their behavior – a process often referred to as *evolution* (Mainzer, 1997). Differing forms of organization emerge such that the system exhibits intelligent behavior based on information interchange and the following nine properties: emergence, co-evolution, sub-optimal, requisite variety, connectivity, simple rules, self organization, edge of chaos, and nestability. Systems of this type are usually known as *complex adaptive systems* (Katzan 2012). Complex adaptive systems are often known as "smart systems," and cybersecurity researchers are looking at the operation of such systems as a model for the design of cybersecurity systems that can prevent attacks through the exchange of information between security elements.

Distributed Security

The major characteristic of a cybersecurity system designed to prevent and mediate a cyber attack is that the totality of security elements in a particular domain are organized into a smart service system. This characteristic refers to the facility of cyber elements to communicate on a real-time basis in response to cyber threats. Currently, threat determination is largely manual and human-oriented. An intrusion detection system recognizes an intrusion and informs a security manager. That manager then contacts other managers via email, personal contact, or telephone to warn of the cyber threat. In a smart cybersecurity system, the intrusion detection software would isolate the cyber threat and automatically contact other elements in the domain to defend their system. Thus, the security service would handle intruders in a manner similar to the way biological systems handle analogous invasions: recognize the threat; attempt to neutralize it; and alert other similar elements.

In a definitive white paper on distributed security, McConnell (2011) recognizes the need for cyber devices to work together in near real-time to minimize cyber attacks and defend against them. This is a form of continuous monitoring and referred to as a *cyber ecosystem* in which relevant participants interact to provide security and maintain a persistent state of security. Clearly, a cyber ecosystem would establish a basis for cybersecurity through individually designed hierarchies of security elements, referred to as security devices. Ostensibly, security devices would be programmed to communicate in the event of a cyber attack. The conceptual building blocks of an ecosystem are automation, interoperability, and authentication. *Automation* refers to the notion of security devices being able to detect intrusion detection and respond to other security devices without human intervention. Thus, the security ecosystem could behave as a security service and provide speed and in the activation of automated prevention systems. *Interoperability* refers to the ability of the cyber ecosystem to incorporate differing assessments, hardware facilities, and organizations with strategically distinct policy structures. *Authentication* refers to the capability to extend the ecosystem across differing network technologies, devices, organizations, and participants.

Thus, the cyber ecosystem responds as a service system in requests for security service to participants that are members of the ecosystem, namely private firms, non-profit organizations, governments, individuals, processes, cyber devices comprised of computers, software, and communications equipment.

Monroe Doctrine for Cybersecurity

Internet governance refers to an attempt at the global level to legislate operations in cyberspace taking into consideration the economic, cultural, developmental, legal, political, and cultural interests of its stakeholders (Conway, 2007). A more specific definition would be the development and application by governments and the private sector of shared principles, norms, rules, decision-making, and programs that determine the evolution and use of the Internet (Conway, op cit.). Internet governance is a difficult process because it encompasses, web sites, Internet service providers, hackers, and activists, involving differing forms of content and operational intent ranging from pornography and terrorist information to intrusion and malicious content. Cybersecurity is a complex form of service that purports to protect against intrusion, invasion, and other forms of cyber terrorism, crime, espionage, and war. But, attacks can be carried out by anyone with an Internet connection and a little bit of knowledge of hacking techniques. NATO has addressed the subject of cyber defense with articles that state the members will consult

together in the event of cyber attacks but are not duty bound to render aid (Cavelty, 2011). It would seem that deterrence, where one party is able to suggest to an adversary that it is capable and willing to use appropriate offensive measures, is perhaps a useful adjunct to cybersecurity service. However, successful attribution of cyber attacks is not a fail proof endeavor so that offensive behavior is not a total solution to the problem of deterrence.

Cybersecurity is a pervasive problem that deserves different approaches. Davidson (2009) has noted an interesting possibility, based on the volume of recent cyber attacks. The context is that we are in a cyber war and a war is not won on strictly defensive behavior. A "Monroe Doctrine in Cyberspace" is proposed, similar to the Monroe Doctrine of 1823 that states "here is our turf; stay out or face the consequences."

Summary

The Internet is a seamless means of communication between organizations and people in modern society; it supports an infrastructure that permits cost effective commerce, social interaction, reference, and learning. The use of the term "cyber" means more than just the Internet and refers to the use of electronics in a wide variety of forms between disparate entities. Cyber facilities are pervasive and extend beyond national borders and can be used by individuals, organizations, and nation states for productive and destructive purposes. A single individual or small group can use cyber technology for surreptitious invasion of assets to obtain vital information or to cause the disruption of critical resources.

Cybersecurity is conceptualized as a unique kind of service in which providers and clients collaborate to supply service through shared responsibility, referred to as *collaborative security*. Cybersecurity is achieved through distributed security implemented as a smart system with three important attributes: automation, interoperability, and authentication. A Monroe Doctrine for Cybersecurity is proposed.

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Author Information

Professor Harry Katzan, Jr. is the author of books and papers on computer science, service science, and security. He teaches cybersecurity in the graduate program at Webster University and directs the Institute for Cybersecurity Research.

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Curriculum Revision to Address a Changing Health Care Environment

Peggy Johnson, Lander University, pjohnson@lander.edu
Sam Tolbert, Lander University, stolbert@lander.edu

Health care reform, the Affordable Care Act, and changes in the U.S. health care system have necessitated modifying the scope and content of existing courses in the health care management curricula at Lander University. Lander is a university in upstate South Carolina with an enrollment of about 2500 students. The HCMT enrollment in the Lander school of management represents approximately 25% of the total enrollment for the School of Management. Recently, deficiencies in the quality of patient care, as well as patient safety issues, have led to calls for change in health professions education by healthcare organizations and the Institute of Medicine (IOM) (Berwick, 2002). The foundation for any proposed curricular revision or changes in teaching practices must be firmly grounded in a comprehensive review of the literature and input from students, alumni, and the professional health care community. [illegible] field and input form stakeholders will assist faculty with the curriculum evaluation and revision process. The process for curriculum change in the Lander University health care emphasis is described in this article.

Key Words: Healthcare Reform, Affordable Care Act, Curriculum, Healthcare Emphasis

Introduction

The Lander University School of Management, Bachelor of Science in Business Administration provides an emphasis in Health Care Management which prepares students for careers working in healthcare systems. Students enrolled in the Healthcare Management emphasis are challenged to identify and provide solutions for the unique problems and issues

facing healthcare organizations today. The four-year curriculum gives student a broad base of knowledge and skills and was designed to help students gain the necessary general business, analytical, communication, and management competencies needed for professional jobs in the field of healthcare management. The curriculum for this emphasis has not been reviewed or changed since 2003 and needs to encompass the changing demands of a healthcare system that has undergone drastic change within the last few years. Any curriculum revision process is well served to examine the trends in health administration programs. Curriculum revision is either being considered or is in process in many health care management programs across the country in response to the dynamic changes occurring in the health care industry. The consideration for curriculum revision is also the result of the emphasis coordinator, faculty, and Dean of the College of Business making the decision to pursue the Association of University Programs of Health Administration accreditation. The process used by Lander University for this curriculum review include researching the AUPHA requirements for accreditation, a curriculum mapping process to determine how much of these requirements are already being met, a comparison of the Lander course offerings in health care management (HCMT) to other programs in the state and region, a survey of alumni and the healthcare professionals and preceptors in the internship program, a literature review of trends at the national level in undergraduate education in healthcare administration and developing a plan for curriculum transition.

According to Dr. Don Berwick, the *Quality Chasm* report, which calls for improvements in six dimensions of health care performance: safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity; asserts that those improvements cannot be achieved within the constraints of the existing system of care. The report provides a rationale and a framework for the redesign of the U.S. health care system at four levels: patients' experiences; the

"microsystems" that actually give care; the organizations that house and support microsystems; and the environment of laws, rules, payment, accreditation, and professional training that shape organizational action. Many of these redesign initiatives have been implemented since Berwick's article in 2002 through the Affordable Care Act (Berwick, 2002).

Reform of health education is not new. There have been three generations of educational reforms during the twentieth century. The first reforms were introduced at the beginning of the 20th century resulted in a science-based curriculum. The second group of reforms introduced problem-based instructional innovations. During the last decade or so, a movement toward the third reform has occurred with a focus on systems based education to improve the performance of health systems by adapting core professional competencies to specific contexts according to then Global Independent Commission on Education of Health Professionals for the Twenty-first Century (Frenk, et al, 2010). The Affordable Care Act (ACA) has changed the landscape of health care delivery, expanding health care coverage and making it affordable to more Americans. The last five years has been spent restructuring health care delivery, executing new strategies to improve health care quality throughout the system, and working to slow the rising cost of health care. The ACA has created value based purchasing systems to hopefully replace fee-for-service, generated an increase in risk sharing such as bundled pricing, shared risk contracting and capitation and also implemented a movement towards clinical integration and healthcare systems such as Accountable Care Organizations (ACOs), Physician Hospital Organizations (PHOs), and Independent Physician Associations (IPAs). New skills and competencies are needed by health care administrators to function successfully in a vertically integrated delivery system. These competencies include management skills across hospitals, ancillary providers, physician practices, ambulatory settings, risk management skills, and skills

in quality. The healthcare industry is also moving away from procedure based fee-for-service medicine toward prevention and wellness and population management (Love & Ayadi, 2015). Many health care administration programs across the county are struggling to adapt curriculum to prepare students to succeed in this dynamic environment.

The healthcare managers of today must have management ability superior enough to parallel the increased complexity of the healthcare environment. Academic health care management programs must produce graduates able to match these demands. The Healthcare Leadership Alliance (HLA), a consortium of six major professional membership organizations, used the research from and experience with their individual credentialing processes to posit five competency domains common among all practicing healthcare managers: (1) communication and relationship management, (2) professionalism, (3) leadership, (4) knowledge of the healthcare system, and (5) business skills and knowledge (Stefl and Bontempo, 2008). Curriculum for the 21st century managers should consider the development of these competencies when changing curriculum.

The only thing that appears certain is the need for change, however, academia may be even more resistant to change than other segments of society, as academics often feel protective of their courses and consider the content and delivery as a part of their academic freedom. Changing the focus from curriculum revision to a process of transitioning to new conditions, rather than change, may help faculty become more willing to consider all activities needed to develop a new curriculum for the 21st century.

In 2012, a Harvard professor named Regina Herzlinger conducted interviews with 58 leading global health care sector CEOs about their future needs. The CEOs wanted people who could solve problems, work as part of a diverse team, understand and learn from failure, manage

change, and innovate through processes, systems, and organizations. The words they used most were leadership, change, and innovation. Both undergraduate and graduate programs in healthcare management have the daunting task of providing curriculum that adjusts to the dynamic healthcare environment and provides students with the skills that prepared them for the challenges of the twenty-first century healthcare environment. Herzlinger's " comparing the feedback from academics and CEOs who attended several conferences revealed that one of the areas of strongest agreement between our academic conferees and the CEOs interviewed was that modern health care needs innovation in processes and systems more than it needs new inventions". Herzlinger commented that a chair/CEO of a health care cost-effectiveness company stated that, "Innovation, in our world, is not going to be necessarily about the thing, it is going to be about the way you do it. Although we make some products, it is largely a service business and that means innovating around services is just as powerful." Professor Herzlinger also stated that a related point of agreement in her study was the importance of the ability to solve problems and improve performance across a range of business processes. Though traditional classroom teaching continues to offer a great deal of value according to the study results, the responses of both CEOs and academics reflect the strong belief that other modes of learning and teaching are required. Healthcare management programs should continue to pursue and improve classroombased pedagogical strategies, but project-centered education, field study, and mentorships offer invaluable real-world experience and respond directly to the CEOs' request for more practical education (Shetty & Bagali, 2015).

The foundational competencies that any curriculum change should include have received a great deal of research in healthcare administration graduate programs. And even though competency-based program assessment has become a fundamental part of the accreditation

process for graduate health administration, as well as a method for program assessment by deans and department directors, undergraduate competency based curriculum has not been widely investigated or implemented. However, curriculum changes that focus on preparing students for work in the 21st century healthcare system should be mindful of providing opportunities to develop the competencies to meet market demands. The focus on measurable outcomes and competencies did not happen quickly. The general acceptance of evidence-based medicine was a natural antecedent to an evidence-based approach to healthcare management (Kovner and Rundall 2006). Competency-based assessments can be employed to pinpoint specific program strengths and weaknesses in order to make program changes to ensure students are adequately prepared to enter the field. (Stifl & Bontempo, 2012). The insight provided by this study and others concerning issues to consider in developing appropriate curriculum changes warrants consideration in Lander's process.

According to Sylvia Burwell, the Secretary of the Department of Health and Human Services (HHS), efforts have already been initiated to bring about these changes, with intentions to augment reform in three important and interdependent ways: providing incentives to motivate higher-value care, by tying payment to value through alternative payment models; and by altering the delivery of care through greater teamwork, integration, and more effective coordination of providers across settings. Additionally, there will continue to be the call for greater attention by providers to population health; and by also harnessing the power of information to improve care for patients. These changes in the way health care is delivered in the United States necessitate a review of the knowledge base necessary to be adequately prepared for these dramatic shifts in the healthcare system. Healthcare Administration authors cannot be counted on to produce text books that provided a didactic contribution that will publish changes

quickly enough to provide a comprehensive understanding of the present dynamic nature of the industry. Successful programs must diligently monitor the industry to remain current.

In addition to the research and work concerning the competencies (usually directed to graduate students) health care managers need to be successful, the accrediting body for Health Care Administration Programs, the Association of University Programs of Healthcare Administration (AUPHA), has authored a Body of Knowledge whose purpose is to delineate the content that students in health management programs should learn during the course of their study. According to AUPHA, the Body of Knowledge differs from competencies in that it refers to the knowledge base, or content, rather than the student's ability to demonstrate skill in use of the content. It assumes that competency in application requires a basic knowledge of facts, theories and analytical approaches. The Body of Knowledge is distinct from accreditation requirements of CAHME or CEPH in that it encompasses detailed subject matter in addition to broad topics. This Body of Knowledge is used as a guide in the Lander University curriculum revision process in order to assure that the curriculum in Lander's Health Care Administration program is adequate to AUPHA recommendations. The final phase of the process will be review of the curriculum mapping process, and summarizing the data gathered from program comparisons, alumni and health care professional and preceptors, and the development of a plan for curriculum change using all this research. The curriculum mapping process, which is the last piece before plan development will be completed Fall of 2016. Recommendations based on the above process will be given to the curriculum committee by Spring 2017.

In April of 2016, the Lander Business Administration Curriculum surveys were conducted online using survey monkey. Three nearly identical surveys were conducted with different target sample groups:

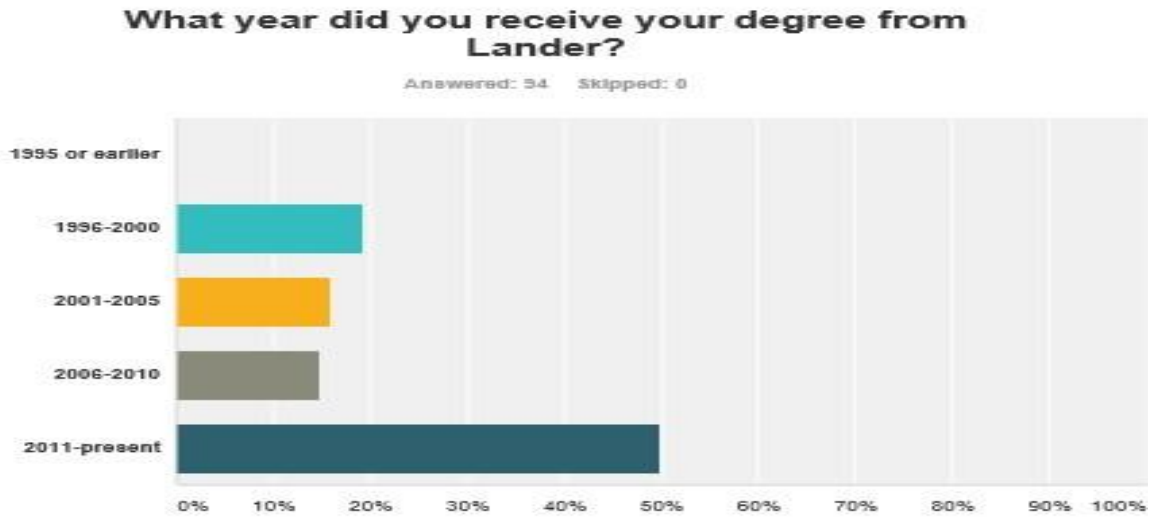
1. Graduates since 2008 with a BS in Business Administration; we will use email addresses provide by alumni affairs.

2. Seniors in Business Administration who are taking BA 499 – Business Seminar and who will graduate in May or August 2016.

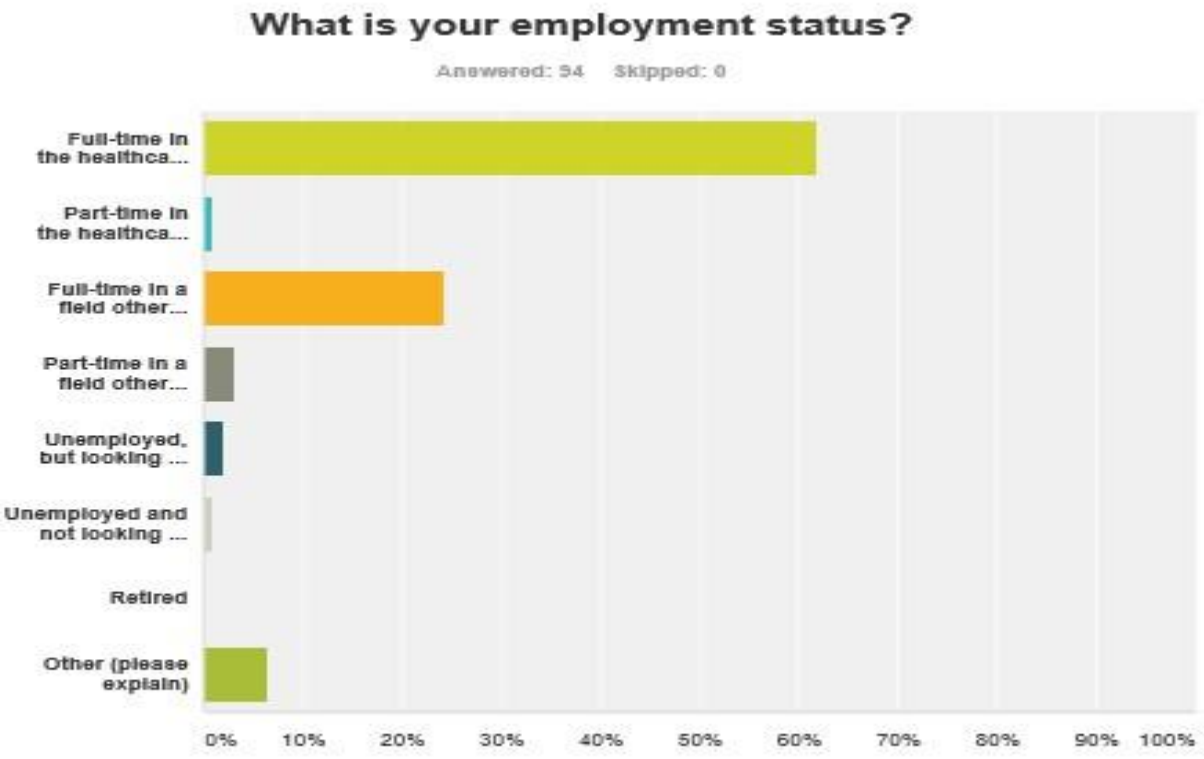
3. Business professionals in the Greenwood area; we will use an email list through the Greenwood Chamber of Commerce.

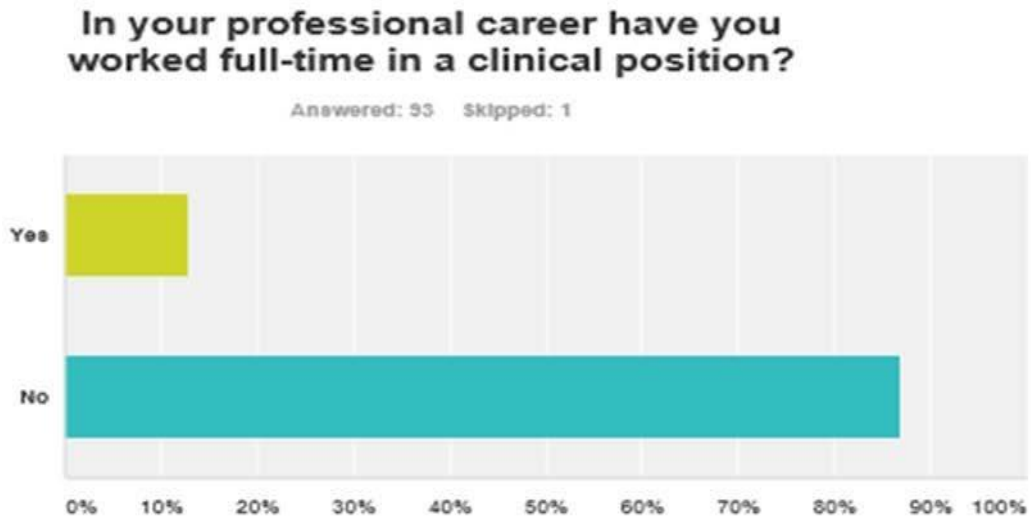
There were over 281 invitations sent to Alumni to participate in the survey, and there were 98 completed surveys from this group, or a response rate of 26 %. HCMT Professional Survey 36 responses of 66 invitations (54%). The professional invitations were to recent HCMT preceptors and other health care professionals in SC.

The survey results from the alumni participants revealed consistent information concerning courses they would consider important additions from the perspective of former graduates of the program. Around 65 percent of the responses came from individuals who had graduated from the program since 2006 and that group had the benefit of the most recent curriculum changes of 2005. Approximately 61% of respondents currently work in health care and 81% are non-clinical professionals. Alumni Results from the survey:



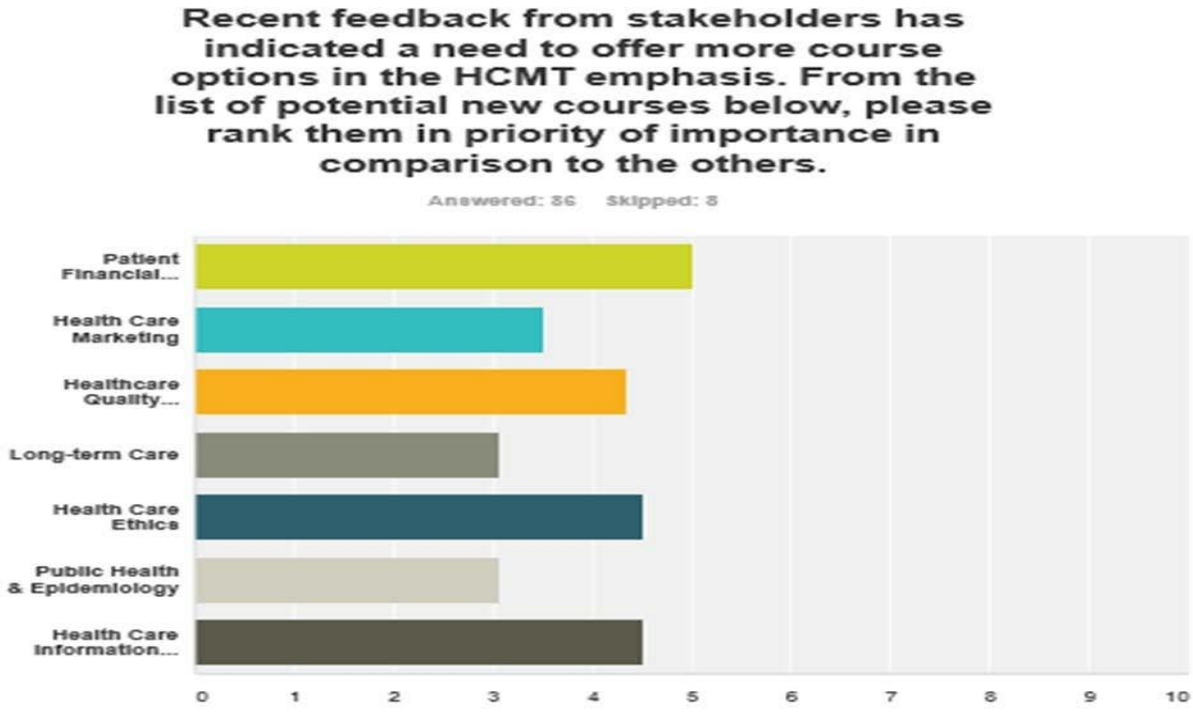
Answer Choices	Responses	
1995 or earlier	0.00%	0
1996-2000	19.15%	18
2001-2005	15.96%	15
2006-2010	14.89%	14
2011-present	50.00%	47
Total		94

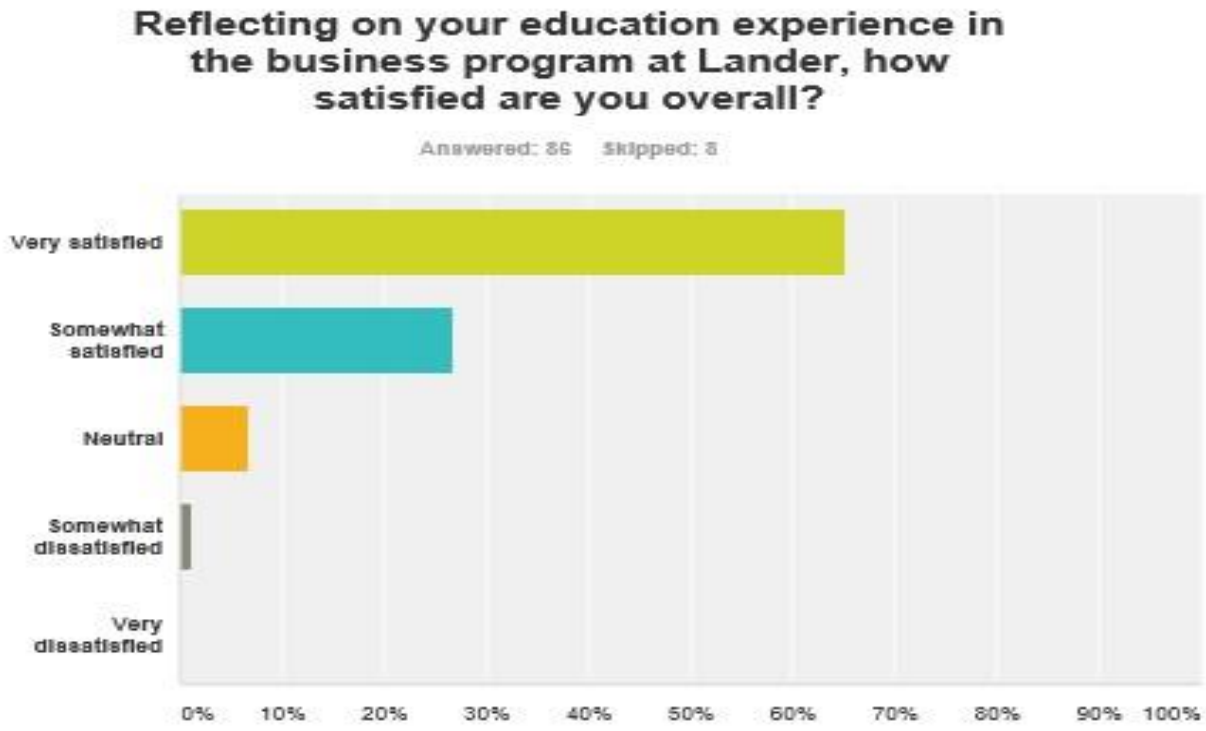




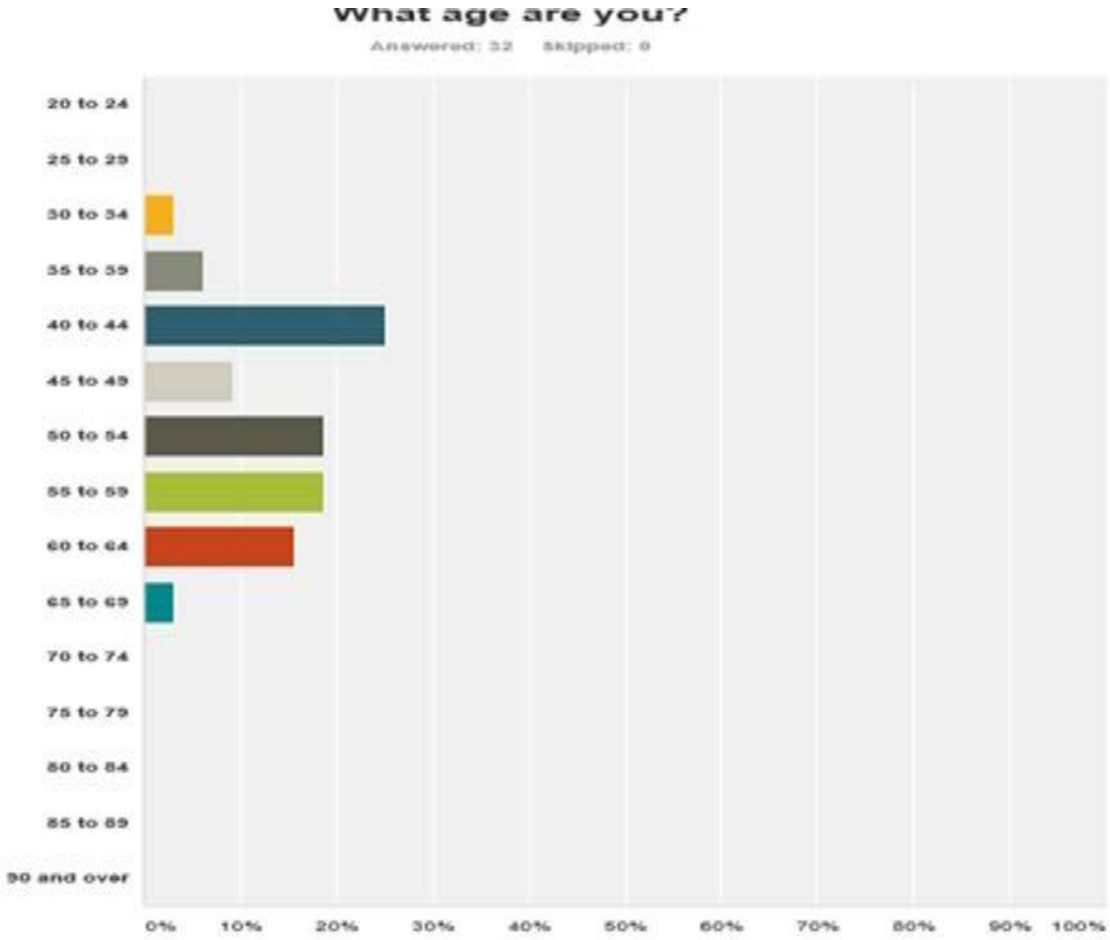
Answer Choices	Responses	
Yes	12.90%	12
No	87.10%	81
Total		93

Concerning questions about their satisfaction and the expansion of the current curriculum, the responses from alumni were interesting as seen below.





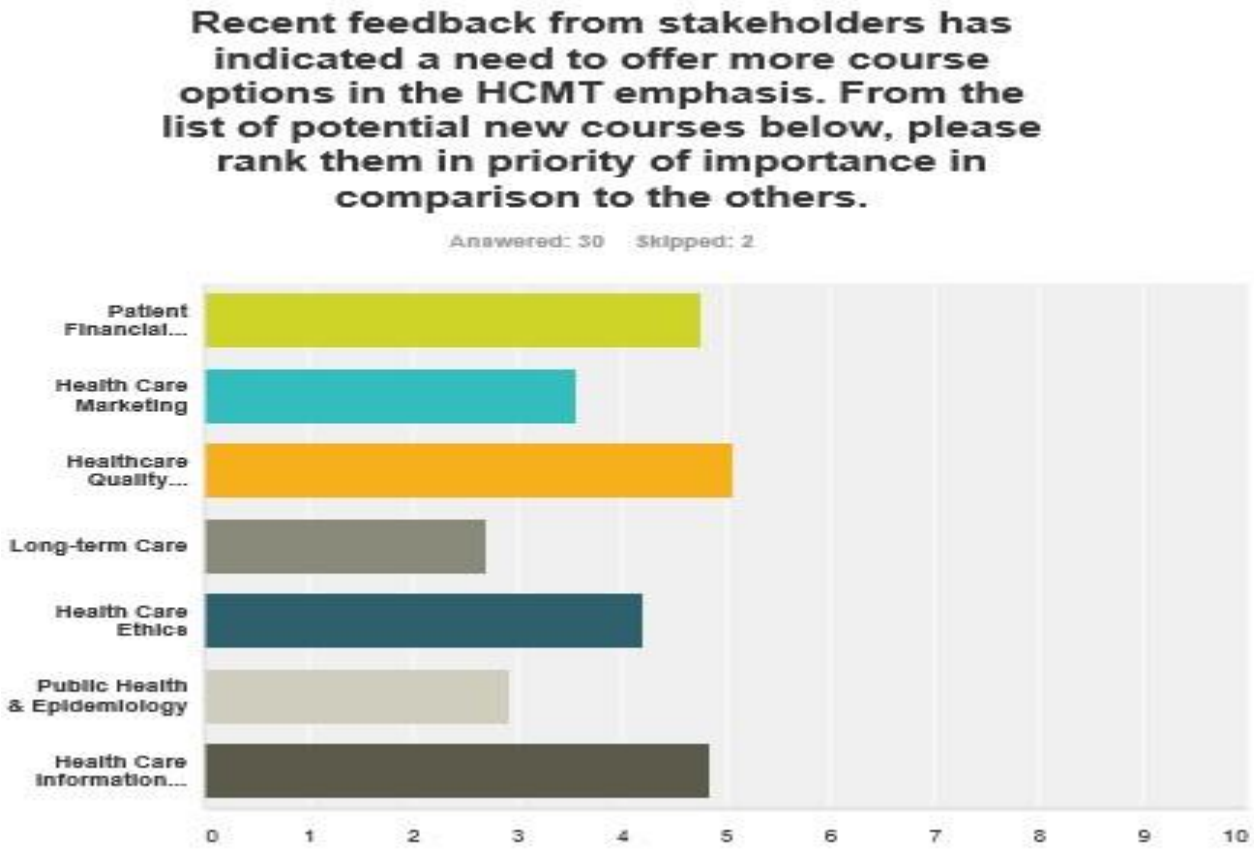
Members of the professional community who responded to the survey consisted of health care professionals many of whom are preceptors for HCMT students. The majority of respondents to the professional survey are over 40 years of age and representative of many different health care settings and positions.

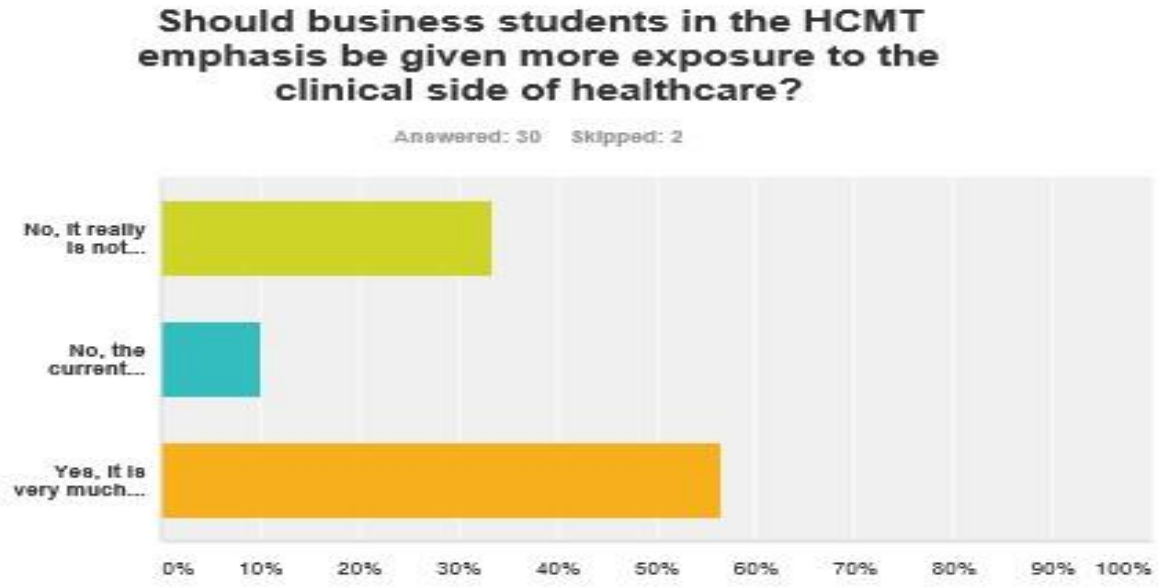


What is your current job title?

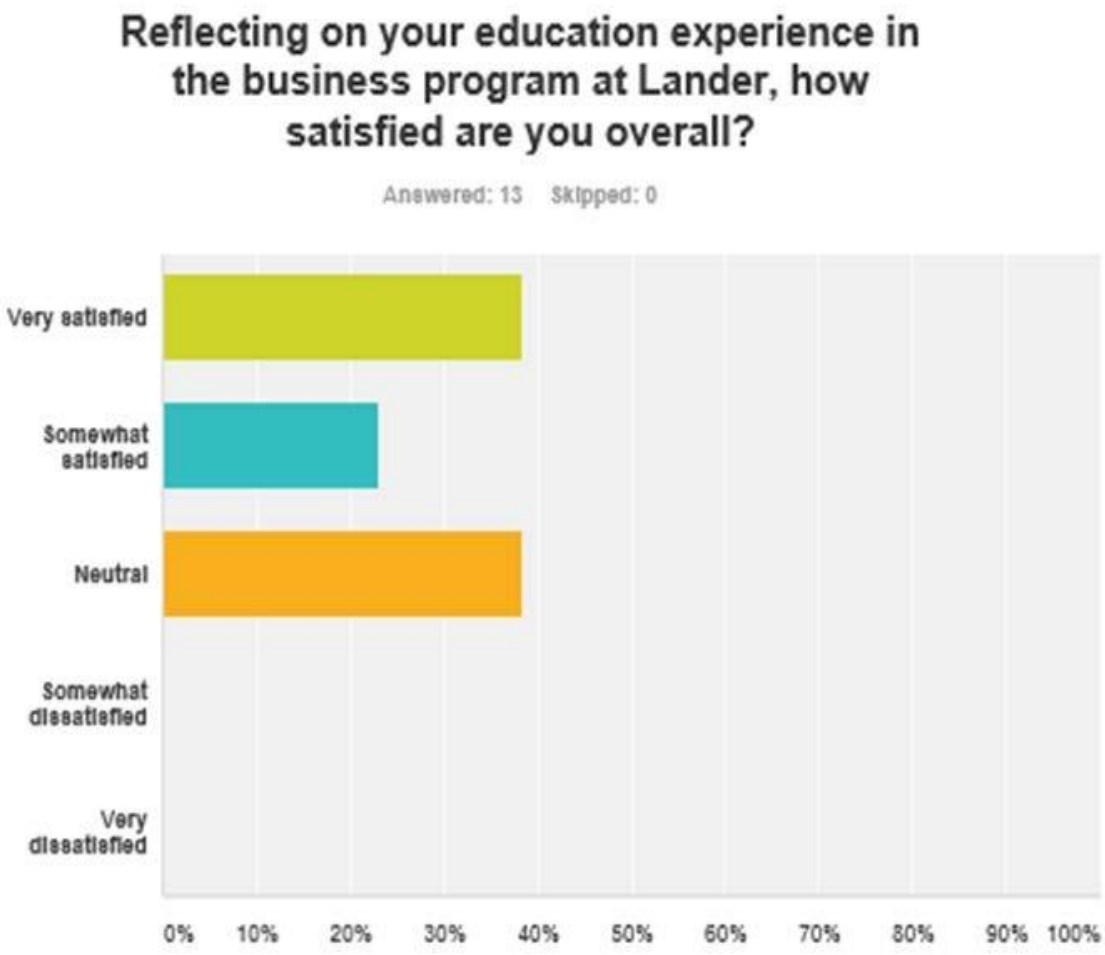
Answered: 31 Skipped: 1

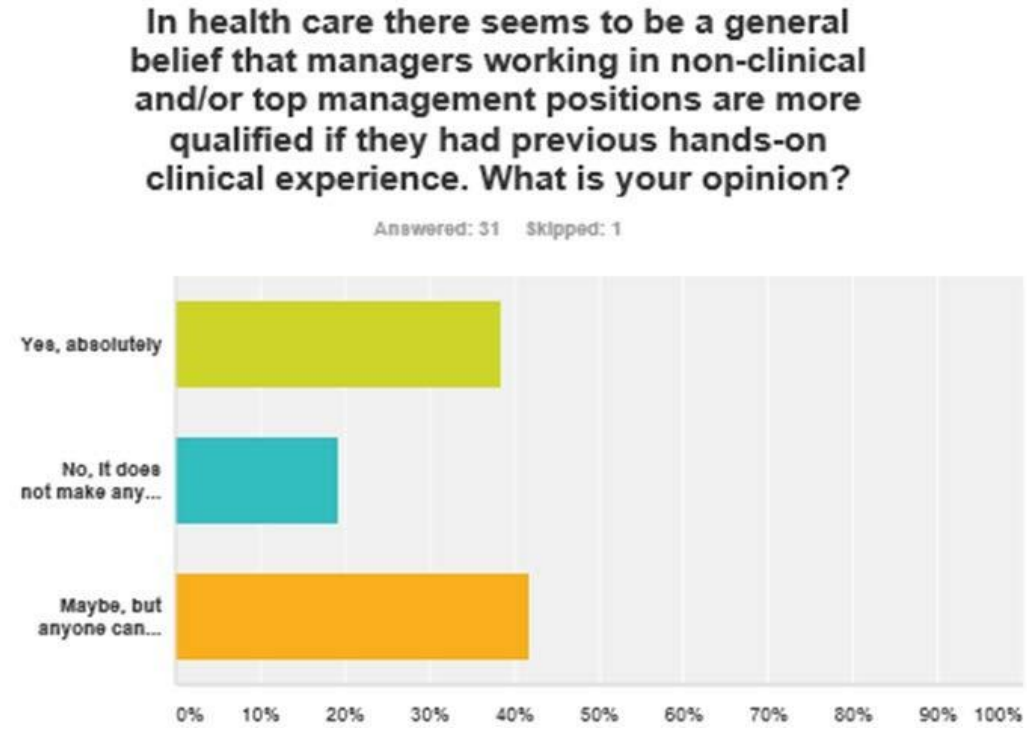
Practice Administrator/CFO 4/25/2016 1:33 PM
VP of Operations 4/20/2016 11:21 AM
Organizational Development Director 4/19/2016 1:12 PM
VP Professional Service/Chief Quality Officer 4/18/2016 10:47 AM
Retired 4/16/2016 12:12 PM
Emergency Management Coordinator 4/15/2016 7:33 PM
Director, Strategic Planning 4/15/2016 2:55 PM

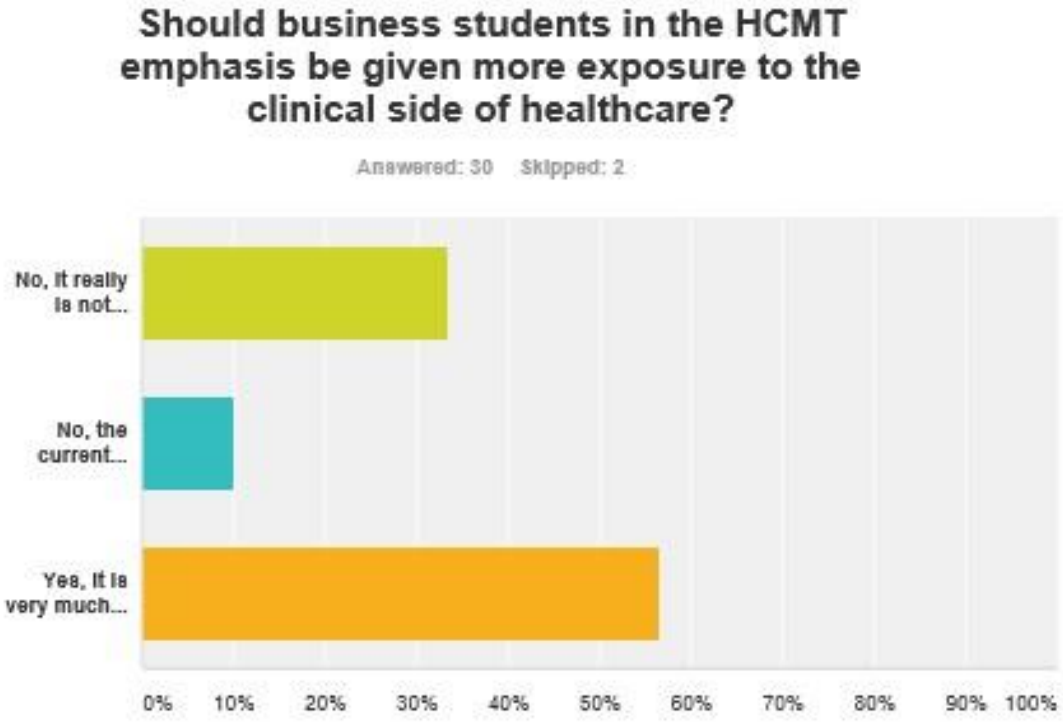

Recent feedback from stakeholders has indicated a need to offer more course options in the HCMT emphasis. From the list of potential new courses below, please rank them in priority of importance in comparison to the others.
Answered: 30 Skipped: 2
Patient Financial...
Health Care Marketing
Healthcare Quality...
Long-term Care
Health Care Ethics
Public Health & Epidemiology
Health Care Information...
0 1 2 3 4 5 6 7 8 9 10


Should business students in the HCMT emphasis be given more exposure to the clinical side of healthcare?
Answered: 30 Skipped: 2
No, it really is not...
No, the current...
Yes, it is very much...
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Twenty-nine Lander HCMT students who are seniors and in the 499 capstone course were invited to participate in the survey. There were 13 responses that provided the following:




In health care there seems to be a general belief that managers working in non-clinical and/or top management positions are more qualified if they had previous hands-on clinical experience. What is your opinion?
Answered: 31 Skipped: 1
Yes, absolutely
No, it does not make any...
Maybe, but anyone can...
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%


Should business students in the HCMT emphasis be given more exposure to the clinical side of healthcare?
Answered: 30 Skipped: 2
No, it really is not...
No, the current...
Yes, it is very much...
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Discussion

The courses identified by all stakeholders as needed additions to the curriculum included more course content concerning reimbursement and changing financial structures and health care marketing. The other courses that were mentioned most often as needed additions included health care quality management, healthcare information management, public health, health care ethics and long-term care.

Additional data concerning curriculum revision was obtained in a comparison study of 17 health care administration programs that have earned AUPHA accreditation located mostly in the southeastern United States. The data gathered included courses offered and credit hours per course. Please see appendices for the complete list. The comparison provided information on which courses were commonly offered in the larger and comparable programs of schools that would be considered leaders and competitors. Eight schools offered health care operations, quality management, healthcare research methods, and introduction to long-term care. Ten schools offered public health courses and health information management. Nine schools taught courses in healthcare ethics and diversity.

Finally, curriculum mapping provided information on which courses contained overlap and which courses that are currently taught can be expanded to provide adequate coverage of the identified gaps. The results revealed that the HCMT 301 course can be revised to cover health care regulations and policy and will also cover ethics. The HCMT 410 course will become the capstone and include a module on healthcare ethics case studies.

Both the professional respondents and the alumni surveyed indicated they believe that HCMT students would benefit from greater exposure to clinical settings in their internships. One health care professional used an interesting analogy, "Possibly this will make sense: It would be like a business owner selling lawn mowers and has never cut grass before; or at least sat on a lawn and appreciated it's beauty after a fresh cut. So the HC manager who has done a clinical rotation (walked side by side with a nurse/Doctor) will understand work flows (check-in, patient visit, EMR documentation, ordering tests, ordering e-Rx, check-out). Without this experience they lack the skills to tie both together." The faculty responsible for managing the internships is planning to develop a clinical shadowing component to the internship curricula. Meetings with preceptors will provide opportunities for their input as to how to expand the internship experience to include more clinical exposure for HCMT students.

Developing effective assessment strategies for the new additions to the curriculum and the historical courses in the emphasis. Specific outcome measures for the previous curriculum are not available making it very difficult to assess the compare student learning outcomes in each phase of curriculum. However, several mechanisms are being implemented to assess the curriculum going forward including the following model from the American College of Health Care Executives.

BUSINESS SKILLS AND KNOWLEDGE
Know, apply and integrate the content of the major[1].

KNOWLEDGE OF HEALTH CARE ENVIRONMENT
Ability to discuss and apply knowledge of the healthcare system and the environment in which healthcare managers and providers function;
Demonstrate and understanding of the interrelationships among cost, quality, access, resource allocation, accountability and community;
Ability to incorporate a patient perspective and knowledge of patients' rights and responsibilities in evaluating a management/service provision issue;
Ability to apply basic problem solving skills along with knowledge of healthcare funding and payment mechanisms;
Demonstrate an understanding of the complexity associated with interacting and integrating among health care sectors to improve service efficiency and quality.

COMMUNICATION AND RELATIONSHIP MANAGEMENT
Ability to communicate clearly and concisely, establish and maintain relationships, and facilitate constructive interactions with individuals and groups;
Demonstrate effective written, oral and presentation skills;
Prepare and deliver business communications including meeting agendas, presentations and business reports;
Provide and receive constructive feedback;
Demonstrate effective interpersonal relations.

PROFESSIONALISM
Ability to align personal conduct with ethical and professional standards that include a service orientation and a commitment to lifelong learning;
Be attentive, proactive and ready to learn;
Meet commitments and complete tasks according to assigned requirements;
Treat others with respect; show sensitivity to their views, values and customs;
Demonstrate ethical behavior consistent with professional codes of ethics;
Assume responsibility for one's own career management and goal-setting;
Demonstrate effective resume and interview skills;
Prepare for lifelong learning and career planning.

LEADERSHIP AND TEAMWORK
Ability to inspire individual and group excellence;
Participate in and lead teams;
Focus on goal achievement;
Guide team toward achievement of common goals;
Maintain group cohesion, follower satisfaction and productivity;
Incorporate and apply management techniques and theories.

[1] Adapted directly from American College of Healthcare Executives http://www.ache.org/pdf/nonsecure/careers/competencies_booklet.pdf unless otherwise noted.

In conclusion, the summary of all the data revealed opportunities to expand the HCMT curriculum in addition to course revisions that eliminated overlap and provided opportunities to add missing and relevant course content. The expanded curriculum will include four new courses beginning fall 2017 including Public Health, Quality Management, Long-term care, and Health Care Information Management. The planned addition on one faulty member will provide adequate course coverage and enable the emphasis to meet the criteria for moving forward with the accreditation process.

As the health care delivery system evolves, colleges and universities will continue to have new opportunities to provide students with the knowledge, skills, and competencies to be wellprepared managers in health care organizations. The assessment, evaluation, and revision of the health care administration curriculum at Lander University will be ongoing to assure that Lander graduates can successfully manage the challenges that are coming in the health care system of the 21st Century.

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Determining Baselines for Evaluating a Horse Racing Prediction Process

Robert L. Andrews,
Virginia Commonwealth University,
Department of Supply Chain Management and Analytics,
Richmond, VA. 23284-4000, 804-355-4645, randrews@vcu.edu

Andrew S. Bristow,
Virginia Commonwealth University,
Department of Mathematical Sciences,
Richmond, VA. 23284, bristowas@vcu.edu

Shane R. Olson,
Virginia Commonwealth University,
olsonsr2@vcu.edu

ABSTRACT

This paper examines the establishment of a baseline that can be used to determine the value of a model for predicting the outcome of an uncertain event. The event of interest for this paper is predicting the three horses that will be one of first three horses to finish a race and win a "Show" bet. Two baselines are established. One baseline is based on randomly selecting horses from the field. The other is based on a crowdsourcing prediction using the betting odds just prior to the race. To account for the difficulty of predicting becoming more difficult as the number of horses in the field increases, a table is created for tabulating outcomes for races to determine the value of the model relative to the baseline. The table will have a row of results for each of the number of horses in a race for the data in the evaluation data set. A criterion for determining the value of a model is proposed using this table of results for a particular baseline.

INTRODUCTION

Mathematical and statistical models are used to represent and provide information about natural phenomena. These models are often used for games and gambling and can range from being rather simple to very complex. A simple model can be used for calculating the probability of a number coming up when a typical six-sided die is rolled. More complex models are required for predicting the probability of the outcome of an event when the outcome can be influenced by one or more variables.

In this paper we consider predicting probabilities for a horse race. Knowing the probabilities for the horses in a particular race can be of value for those who bet on the outcome. Once a model has been developed then a method is needed to determine if this model has any value. This paper will address appropriate baselines for determining the value of a model-based process for predicting the outcome of a specified event. To be of value, the prediction process must produce results that are better than the baseline.

In a horse race, one obvious event of interest is winning the race, but there is also interest in being able determine the other finishing places. In this paper the event of interest will be

finishing the race in one of the top three places of first, second or third. When placing a bet on a horse, this is equivalent to betting that a horse would "Show" in a race.

We will address building a model and a process for selecting the three horses that will ultimately win a show bet for a particular race. A primary measure of interest for the model and the process is the number of correctly selected horses for a race. It is obvious that correctly selecting the horses to "Show" will become more difficult as the number of horses in the race increases. For example, any selection of three horses will always have at least one correct if there are five or fewer horses in the race. Hence a baseline for measuring the ability of a process for predicting the horses that will "Show" in a race must take the number of horses in the race into consideration.

PREDICTION PROCESS AND MODEL

The proposed process will predict the three horses that will be in the top three "Show" finishing positions. The prediction process will involve developing a statistical model to predict the probability of an individual horse winning a "Show" bet for a race. Once a probability has been predicted for each horse in the race by the model then the three horses with the highest probability will be selected for the "Show" prediction. Bivariate or binary logistic regression can be used to build a model to estimate the probability of each horse being in the top three and "Showing." The focus of this paper is not on building the logistic model but on establishing a baseline or baselines to determine if the combined effect of the process that uses the model is of value. The baseline could be used for other model building methods other than a binary logistic regression. The model uses information that can be obtained prior to the start of a race to predict whether a horse will "Show" or not for the race. The modeling procedure can potentially use information about the horse, the trainer, the jockey, the track, the field for the race or the weather conditions as predictors. The model will be built with a training set of data for previous races and outcomes.

When building a binary logistic regression model the minimum baseline for determining the value of the model is to use the proportion or percent for the bivariate categorical response that occurs most frequently. This is something that we often see with something like the placement of the computer mouse relative to the computer keyboard. Most likely the mouse will be to the right of the keyboard. Since 90-some percent of the population is right-handed then this default prediction is correct 90-some percent of the time. This type of baseline will not be applicable for our process since the process is predicting the three horses that will finish in the top three and therefore "Show." The response of interest for our process is not a categorical variable. The response is a quantitative variable that is the count of the number of horses correctly predicted to win a "Show" bet for a race. The possible values for this response are 0, 1, 2 or 3.

USING THE HYPERGEOMETRIC TO DETERMINE A PROCESS BASELINE

We have established that a baseline for the prediction process must be for a quantitative variable that is a count of the number correctly predicted. Also, the baseline should be conditional on the number of horses in the field for the race. The baseline that we propose is to use the expected number of correct picks if the three horses are randomly picked from the horses in the field. The probability distribution for the random selection of horses can be described by the hypergeometric distribution.

For our situation, the hypergeometric probability mass function can be described by

$$P(X = k) = \frac{\binom{K}{k}\binom{N-K}{n-k}}{\binom{N}{n}}$$

where k = Number correctly predicted to "Show" (k = 0, 1, 2, 3),
N = Number of horses in the field that start for the race ($N \geq 3$),
K = 3 = Number of horses that will actually finish in the top three and "Show,"
n = 3 = Number of horses that will be selected to finish in the top three and "Show."
The mean or expected value of the hypergeometric is E(X) = n*K/N [6]. Using this, the expected value for the number correctly predicted for a race with N horses in the field to start the race is 9/N. For the 2016 Kentucky Derby that had 20 horses in the race, the expected number correct is 9/20 = .45, if one randomly picked three by chance. As can be seen, this baseline number is conditional on the number of horses in the field for the race. To be of value, a process for selecting the three horses that will "Show" for a race must have an average number correct higher than the expected number correct of 9/N.

USING THE BETTING ODDS TO DETERMINE A PROCESS BASELINE

Another way to establish a baseline is to use the results of a simple process to predict the three horses that will "Show." The proposed simple process is one that uses crowdsourcing [7] to provide the probability estimates. The crowd that will be the source of these estimates is the group of people who have bet on the horses to establish the odds of winning the race for each horse. These odds of winning are determined by a pari-mutuel system. With this system, a track typically uses a track handicapper to establish initial odds for each horse in a race. The final odds in this system are the odds determined by the amount of money that the crowd of betters has bet on each horse relative to how much has been bet on the other horses. To understand the relationship between money bet and odds, the greater the belief that a particular horse will win the race will result in more money being bet on the horse, which causes the odds to be lower. The odds of winning for each horse can be converted to an estimate of the probability of the horse winning the race. Hence these probabilities are determined by crowdsourcing. This model may not seem simple but the calculation of the probabilities from the odds is relatively simple. In horse racing, odds are typically expressed with (chances against winning) being first followed by (chances for winning). For example, if the odds are 2 to 1 (2:1), which was the final odds for Nyquist in the 2016 Kentucky Derby, then the estimated probability of winning is 1 / (2 + 1) = 1/3 = .333 or 33.3%. Similarly, if the odds are 17 to 3, then the estimated probability of winning is 3 / (17 + 3) = 3/20 = .15 or 15%. Once the probabilities of winning are calculated then this baseline procedure will pick the three horses with the three highest probabilities of winning. For the 2016 Kentucky Derby, this crowdsourcing based procedure would have picked Nyquist, Exaggerator and Gun Runner. These were, in fact, the top three finishers in that race, so another model would not be able to perform better than this crowdsource odds-based process for this particular race. However, to properly assess a process using a model, one has to consider the number correct over a series of races. One can compare a total or average number correct to the total or average number correct for this simple crowdsource based process.

USING THE BASELINES TO EVALUATE A MODEL FOR THE PROCESS

The challenge is to develop a model to effectively predict the probabilities for a horse finishing in the top three of a race. Once a model is developed using training data then it can be tested on races that were not part of the training data. Then the results for the non-training data can be compared to the previously discussed baselines. However, this is not a simple matter since we have concluded that the baseline should be conditional on the number of horses in the field for the race. This means that missing by one horse out of three for a race with 20 horses is expected to be more likely than missing by one out of three for a race with only eight horses. Hence all misses should not be weighted the same if one attempts to create an overall summary measure using races with varying numbers of horses running in the races. At this time, we do not have a weighting scheme that we feel confident in presenting. Consequently, we merely propose creating a table of outcomes for each race that would record how the process prediction compared to both the hypergeometric distribution expected value and the crowdsource betting odds-based process prediction. For each process prediction, the number correctly predicted would be compared with the expected value baseline to record if the predicted number for the process using the prediction model is less than (<), equal to (=) or greater than (>) the expected value baseline on the row with the number of horses in the race. Then, on the same row, the process prediction number correct is similarly compared to number correct based on the crowdsource determined betting ODDS. The columns can be totaled and the totals can be used to calculate the percent for each of the less than (<), equal to (=) and greater than (>) categories. If there is enough data, then the percent for each category can be recorded for each row in the illustrative table below. These percentages can be used as a summary measure to determine the value of the process using the proposed model. For example, for the process with the model to be of value relative to the baseline, the percent of results being greater than the baseline (> E(X) or > ODDS) must be larger than the percent less than the baseline (< E(X) or < ODDS). By using this table one can evaluate the overall value of the model for the process using the totals. If there is adequate data one can compare across the number of horses to see if the value of the model appears to vary as the number of horses varies.

Proposed Example Evaluation Table (N = 9, 16)

	E(X) Baseline			Betting ODDS Baseline		
N = # Horses	< E(X)	= E(X)	> E(X)	< ODDS	= ODDS	> ODDS
9						
10						
11						
12						
13						
14						
15						
16						
Total						
Percent						

SUMMARY

We have laid what we believe to be two very realistic baselines that can be used to evaluate the value of a process based on a model that predicts the three horses that will finish in the top three and win a bet to "Show" in the race. We have considered using a bivariate logistic regression model but this proposed method of evaluating against the baselines would be equally effective for any model that would estimate the probability of a top three or "Show" finish in a race. To accommodate for the belief that correctly predicting the three horses is more difficult when there are more horses in the field running the race, an example table is laid out. This table can be used to evaluate the value of process. For the table, ideally one would like to use race results that were not in the training set used to build the model. However, using the training data and comparing the results across the differing number of horses in the race should be able provide evidence to determine if predicting becomes more difficult as the number of horses increases. This type of comparison for determining value can be used in other situations, but the crowdsourcing betting odds baseline would only be useable if betting odds are available for the situation.

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DISCOUNT RATE CHANGES AND THEIR EFFECTS ON MARKET RETURNS DURING RECENT U.S. RECESSIONS

Lili Chen, Lander University, lchen@lander.edu

ABSTRACT

This paper explores the market response to the discount rate changes during the recent U.S. recessions and finds that the response of market rates to discount rate changes varied during the recent two recessions. The different responses of market rates to discount rate changes are due to the various economic and policy circumstances that the market was facing. This conclusion is consistent with Thornton's finding (1998). Thornton (1998) found that the different market responses to the discount rate changes mainly depend on the information content that people believed contained in the announcements of the discount rate changes. It's interesting to point out that during the "Great Recession", market rates were not sensitive to discount rate changes.

BACKGROUND

Discount rate as an important monetary policy instrument

The public is already getting used to consider the federal funds rate as a major monetary policy instrument. Many people were shocked when the Federal Reserve announced to raise the discount rate by 0.25 percent on February, 19, 2010, what is the implication of the Federal Reserve's action? Is it simply a technical change to keep discount rate certain level with the federal funds rate or is it a tightening monetary policy? This study was motivated by these questions and tried to further explore the related area of the discount rate.

The discount rate became monetary instrument in the United States as early as 1907. When the Federal Reserve was first established to fight the Panic of 1907, discount window and discount rate were the only monetary policy instruments.

A new method of establishing the discount rate from 2003

Before 2003, the discount rate was set below the target federal funds rate. From January 2003 up to the crisis in 2007, the discount rate was one percentage point above the target federal funds rate. A bank could borrow at the discount window if it was financially sound and willing to pay a relatively high interest rate.

More frequent changes in discount rates during recessions

As an important monetary policy instrument, discount rate was used much more frequently in recessions. The history of discount rate data shows that usually the discount rate is lowered as soon as the recession starts. As the recession gets deeper and deeper, the discount rate is lowered again and again. Once the recession is close to an end, the discount rate is raised accordingly.

A unique problem in the discount window borrowing and the creation of TAF

If the discount rate is higher than the federal funds rate, then borrowing from the Federal Reserve is more expensive than borrowing at the federal funds market, which is fine during normal times. However, during the recent financial crisis, although the discount rate was cut 12 times, it was never below the federal funds rate, which means the discount window could no longer ease the liquidity problem during the time of crisis. This is a unique problem that occurred in the recent crisis, because never in the U.S. history was the discount rate higher than the federal funds rate during any recessions. Usually before 2003, the discount rate was much lower than the federal funds rate during recessions, compared to normal times.

It is quite obvious that the Fed was facing a unique problem in the discount window borrowing during the "Great Recession". Partly in response to this problem, the Federal Reserve created TAF borrowing and other borrowing facilities to allow banks borrow money from other channels rather than the discount window. As it was well known, banks were not willing to borrow from the discount window anyway, because it may signal the bank's poor condition and the possibility of insolvency. Just as Cecchetti (2008) said in his paper, "Realizing that their traditional instruments were inadequate for responding to the crisis that began on August 2007, Federal Reserve Officials improvised." The Fed started to implement a variety of changes to make sure that the banking institutions which needed the most funds can get the liquidity. For instance, the Federal Reserve initiated TAF borrowing.

The relationship between a recession and a financial crisis

In the United States, it is the National Bureau of Economic Research (NBER) that defines the beginning and ending dates of the U.S. recessions. The NBER defines a recession if there is a significant decline in GDP, real income, employment, industrial production, and wholesale-retail sales.[1] The recent sub-prime mortgage crisis is usually called a "financial crisis", which is also a recession. One might ask what the difference between financial crisis and recession is. A financial crisis must be a recession, but a recession is not necessarily a financial crisis. We consider a recession a "financial crisis", if some financial institutions or assets suddenly lose a large part of their value. The recent sub-prime mortgage crisis is considered as a "financial crisis", since it associated with stock market crash, bankruptcies of large investment banks, and banking panics. Many recessions are financial crises, since usually those phenomena occur at the same time.

Another breaking point: 1960s

Before the early 1960s, the Federal Reserve normally did not explain why they changed the discount rate. They just simply changed it with no any further interpretation of policy indication. After the early 1960s, the Federal Reserve announced the reasons for the change of the discount rate so that the public is able to

[1] See Wikipedia for more details about the definition of "recession".

better understand the movements of the Fed and make a better decision. This is an indication that the Federal Reserve indeed improved its transparency.

Classification of discount rate changes

Discount rate changes can be considered either technical or nontechnical according to Thornton (1982): if the discount rate is simply adjusted to keep certain level of difference with market rates such as the federal funds rate, then it is a technical change. Otherwise, it is a non-technical change. Later, some other researchers such as Cook and Hahn (1988) did a more complicated classification. They classified discount rate changes into three types. "Type 1" is technical changes; "Type 3" is non-technical changes, meaning that the Federal Reserve changed the discount rate to deal with the inflation, economic growth, growth rate of money, and some other macroeconomic variables; "Type2" is the mixture of "Type 1" and " Type 3".

This paper follows Thornton's (1982) straightforward way of classification: discount rate changes are divided into technical, $\Box DR_T$, or non-technical, $\Box DR_{NT}$, depending on whether the discount rate changes were made purely to keep the discount rate a certain level of difference with market rates or otherwise.

MOTIVATION

Discount rate changes were much more frequent in the recession times compared to normal times. Thus it is worth exploring the discount rate changes and their effects on market rates during the recessions. From 1996 to 2011[2], the discount rate has been resettled 52 times, among which, only two times were technical changes, and the rest were non-technical changes. Generally speaking, when the economy was in a good shape, the Fed will increase the discount rate to fight inflation. However, If the economy was facing a downturn, the Fed will reduce the discount rate to accommodate the unfavorable situation. During the years 1996 through 2011, there have been two U.S. recessions, early 2000s recession and the "Great Recession" respectively. The early 2000s recession covered the period from March, 2001 to November, 2001, totalling eight months. At that time, Green Span was in charge of the Federal Reserve, the discount rate was reduced 7 times in those short 8 months, and this frequency is very high. The "Great recession", also known as sub-prime mortgage crisis, started in December, 2007 and ended in June 2009, totalling one year and six months, which occurred when the Federal Reserve was under the charge of Bernanke. The discount rate was cut 12 times during this period. In conclusion, among 52 changes during the years 1996 through 2011, 19 occurred during the recession time. There were 16 years or 192 months in total, during which 26 months were in recession. That is, 13.5 percent of the time was in recession and 36.5 percent of the discount rate changes occurred during the recessions. Therefore, the discount rate changes were more frequent during the recessions compared to normal times. Many existing literatures have studied the discount rate, but no literature has tried to explore the discount rate changes during different U.S. recessions. In fact, it is important to understand the market's response patterns to discount rate changes in recessions, because it will help the Fed to make a more efficient monetary policy during that

[2] The "Press Release" of the Federal Reserve can be found back to 1996, which explained why the the Fed changed discount rate. According to the announcement, this paper further classified the discount rate changes into technical changes or non-technical changes.

period of time. This paper will explore the discount rate changes and their impacts on market rates for recent U.S. recessions.

LITERATURE REVIEW

Many researchers found that the market rates often respond to the non-technical discount rate changes rather than technical discount rate changes. Batten and Thornton (1983) found that announcements of non-technical discount rate changes have significant impact on the dollar's exchange rate. Thornton (1994) investigated why the market rates responded to non-technical discount rate changes. His finding contradicts Cook and Hahn's (1988) hypothesis that Treasury bill rates respond to discount rate changes simply because it signals the changes in the federal funds rate. Cook and Hahn (1988) found evidence that announcements of the discount rate changes signal the changes in the federal funds rate and hence had a significant effect on Treasury bill rates. Thornton (1998) found that the discount rate changes do not signal the changes in monetary policy. The announcement effect is different mainly depending on the information that people believed contained in those announcements. He also pointed out that the direct effect on the markets rates is near to zero. Smirlock and Yawiz (1985) found that markets do not respond to the technical discount rate changes and only react to the discount rate changes when people believed that there is a shift in the monetary policy. This finding is consistent with Thornton's findings (1998). The "markets" that Smirlock and Yawiz checked are stock returns and bond rates with different maturities. Goodfriend's (1991) evidence showed the Federal Reserve control the short-term interest rates by using the discount rate often. Chen, Mohan and Steiner (1999) found that stock market returns respond to the non-technical announcements in discount rate changes significantly.

Thornton (1996) explores the discount rate policies of five Federal Reserve chairmen: Martin, Burns, Miller, Volcker and Greenspan. He checked the market responses to discount rate changes under those five chairmen respectively and found Burns and Volcker's discount rate policies were the most effective and Miller's the least effective. The reason for this different response is that Burns and Volcker provided the market with more complete information when they changed the discount rate than other chairmen. This conclusion is consistent with another Thornton's paper (1998), which suggested that market response varied to the change of the discount rate over time, mainly depending on the information content contained in the announcements of the discount rate changes.

This paper will study the sub-prime mortgage crisis and the early 2000s U.S. recession. Because the discount rate policy is not the same under different Federal Reserve chairmen suggested by Thornton (1996), this paper divided recessions based on the terms of different chairmen. When Greenspan became chairman, he dealt with the early 2000s recession. The "Great Recession" occurred as Bernanke took charge of the Federal Reserve one year later.

THE DATA AND MODEL

The data on interest rates are daily (business day only) from 1996 to 2010. The change in the discount rate is the percentage change in the discount rate on the day that a discount rate change was announced. The market interest rates are 3-month Treasury bill rates, 3-month mortgage repo rates, 3-month agency repo rates and 3-month government repo rates.

This paper follows Thornton's (1982) straightforward way of classification: discount rate changes are divided into technical, ΔDR_T , or non-technical, ΔDR_{NT} , depending on whether the discount rate changes were made purely to keep the discount rate a certain level of difference with market rates or otherwise. To test the hypothesis of whether the market responses to the discount rate changes were significantly different during the period of different recessions, this paper will apply Thorton's model (1998):

$$\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \gamma(L)\Delta FR_t + \delta_{NT}\Delta DR_{NT} + \delta_T \Delta DR_T + \varepsilon_t$$

Δi is the percentage change in 3-month Treasury bill rates or 3-month repo rates. Equation (1) represents that the change in market rates may depend on the change in previous market rates, the change in both current and lagged federal funds rates, the technical change in the discount rate and the nontechnical change in the discount rate. All of the changes here are percentage changes.

$\beta(L)$ and $\gamma(L)$ are in the lag forms.

We can compare the sign and the magnitude of the estimated coefficients for different U.S. recessions in general, and then further check these coefficients under different chairmen.

THE RESPONSES RESULTS OF 3-MONTH TREASURY BILL RATES

Result 1 (1996-2010)

Firstly, this paper ran the regression on the following equation over the period from 1996 to 2010. Since among 52 changes in the discount rate, only two of which are technical changes, occurred in 2003 and 2010 respectively, I combined all the discount rate changes together as non-technical changes for simplicity. Equation (1) becomes equation (2):

$$\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \gamma(L)\Delta FR_t + \delta_{NT}\Delta DR + \varepsilon_t$$

The dependent variable is the percentage change in the 3-month Treasury bill rate. The independent variables are the percentage change in the lagged 3-month Treasury bill rate, both current and lagged federal funds rates, and the discount rate. This paper found that there are 5 lags in the 3-month Treasury bill rate, which indicates that the change of the 3 month Treasury bill rate correlates to the the change of the 3-month Treasury bill rate, up to 5 business days before. Moreover, this paper found coefficients on both discount rate changes and changes in the federal funds rate are not significantly different from zero.

Result 2 (Early 2000s recession: March, 2001 to November, 2001)

Because from the first result, this paper found evidence that the coefficient on the change in the federal funds rate is not significantly different from zero, so the term of the percentage change in federal funds rate can be ignored. Furthermore, there is no technical change in the discount rate during this period of time. Equation (1) now becomes equation (3):

$$\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \gamma_{NT}\Delta DR_{NT} + \varepsilon_t$$

This paper found that the 3-month Treasury bill rate moves the same direction with the discount rate. The coefficient on the discount rate is significantly different from zero.

Result 3 (Great Recession: December, 2007 - June, 2009)

Coefficients on both discount rate and federal funds rate change are not significantly different from zero. It might have something to do with the TAF borrowing, or the new method of establishing the discount rate. Since 2003, there is a new method of establishing the discount rate, which set the discount rate 100 basis above the federal funds rate, which made the discount rate higher than the federal funds rate. In other words, the discount window borrowing lost its functions during the recent financial crisis. Hence, the Federal Reserve created TAF borrowing and other borrowing facilities to accommodate the recent financial crisis. This helps explain the fact that market rates were not sensitive to the discount rate changes during the "Great Recession".

That the coefficient on the discount rate is not significantly different from zero indicates that the change in the discount rate has no significant impact on the change in the 3-month Treasury bill rate. Since there are no technical changes in this recession either, the equation (1) becomes equation (4) :

$$\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \varphi(L)\Delta FR_t + \gamma_{NT}\Delta DR_{NT} + \varepsilon_t$$

This paper also tried to run regression on equation (5):

$$\Delta i_t = \alpha + \beta(L)\Delta i_{t-1} + \gamma_{NT}\Delta DR_{NT} + \varepsilon_t$$

Removing the term of the federal funds rate in equation (5), the coefficient on the change in the discount rate is not significantly different from zero either.

THE RESPONSE RESULTS OF 3-MONTH REPO RATES

From Chapter 2, we know that the 3-month repo rate is one of the important market rates for forecasting monetary policy. Therefore, this paper tests the 3-month repo rates response pattern to discount rate changes. Besides 3-month Treasury bill rates, this chapter will test how three types of 3-month repo rates responded to discount rate changes during the two recent U.S. recessions.

The responses of 3-month government repo rates

Using different estimation equations, this paper shows that during the early 2000s recession, 3-month government repo rates did not respond to either federal funds rates or discount rate changes significantly at both 1% and 5% significance levels.

During the "Great Recession," 3-month government repo rates did not respond to either discount rate changes or changes in federal funds rates significantly at both 1% and 5% significance levels. However, the significance levels of the coefficients of both federal funds rates and discount rate changes were higher during the early 2000s recession than during the "Great Recession." This may suggest that the 3month government repo rates are less responsive to both discount rate changes and federal funds rates during the "Great Recession" than during the early 2000s recession.

The responses of 3-month agency repo rates

During both early 2000 recession and the "Great Recession," 3-month agency repo rates did not respond to either discount rate changes or federal funds rates at both 1% and 5% significance levels.

The responses of 3-month mortgage repo rates

During early 2000 recession, 3-month mortgage repo rates responded only to discount rate changes at a 5% significance level. At 1% significance level, 3-month mortgage repo rates did not respond to either discount rate changes or federal funds rates.

During the "Great Recession," 3-month mortgage repo rates did not respond to either discount rate changes or federal funds rates significantly at both 1% and 5% significance levels.

The summarization of the responses results of 3-month repo rates

At a 1% significance level, 3-month government, agency and government repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and the "Great Recession." This provided evidence that the response patterns of 3-month repo rates to discount rate changes were quite similar. From the second chapter, we know that the forecasting ability of three types of 3-month repo rates for monetary policy are also similar. This provided evidence for future researchers that the three types of 3-month repo rates have similar characteristics.

At a 5% significance level, both 3-month government and agency repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and the "Great Recession." However, 3-month mortgage repo rates responded to discount rate changes during early 2000s recession and did not respond to discount rate changes during the "Great Recession." To be more specific, 3-month mortgage repo rates moved the same direction with discount rate changes during the early 2000s recession and were not responsive to discount rate changes during the "Great Recession." This is consistent with the response patterns of 3-month Treasury bill rates. This result further provids evidence that the market rates tended to be less responsive to discount rate changes during the "Great Recession." It is due to the fact that the discount window borrowing has lost its function during the "Great Recession."

CONCLUSIONS

The responses of market rates to the discount rate changes during U.S. recessions

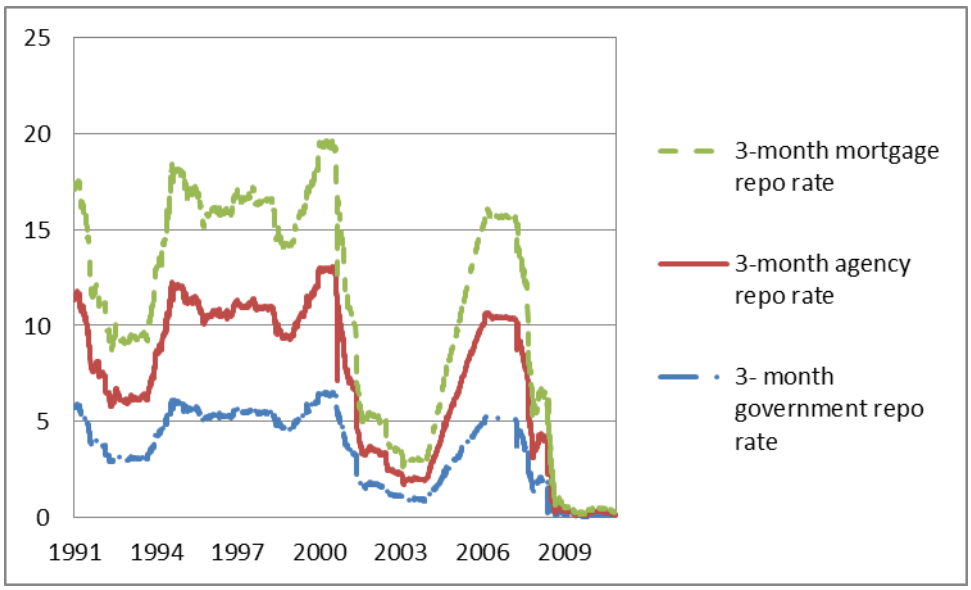
Firstly, this paper shows that the responses of 3-month Treasury bill rates to the discount rate changes varied during the recent two recessions. During the early 2000s recession, the 3-month Treasury bill rate responded significantly to the discount rate changes. More specifically, the 3-month Treasury bill rate moved the same direction as the discount rate. However, the reaction of the 3-month Treasury bill rate to the discount rate changes was not significant during the "Great Recession." Why are the responses of the 3-month Treasury bill rate to the discount rate changes different between the two recessions? One of the reasons could be that the discount window borrowing has lost its function during the "Great Recession," since the discount rates were above the federal funds rates during the recent recession. Banking sectors borrowed funds from other channels instead, for instance, TAF facilities. In this case, market rates were no longer sensitive to the discount rate changes. To sum up, the different responses of market rates to the discount rate changes are due to the various economic and policy circumstances that the market was facing. This conclusion is consistent with Thornton's finding (1998). He found evidence that the announcement effect of the discount rate changes varied because of the information that people believed contained in the announcement.

Secondly, this paper showed that at a 1% significance level, 3-month government, agency and government repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and "Great Recession." At a 5% significance level, both 3-month government and agency repo rates did not respond to either discount rate changes or federal funds rates significantly during both early 2000s recession and "Great Recession." However, 3-month mortgage repo rates responded to discount rate changes during early 2000s recession and did not respond to discount rate changes during "Great Recession." To be more specific, 3-month mortgage repo rates moved the same direction with discount rate changes during early 2000s recession and were not responsive to discount rate changes during the "Great Recession." This is consistent with the response patterns of 3-month Treasury bill rates. This result further provided evidence that the market rates tended to be less responsive to discount rate changes during the "Great Recession." It is due to the fact that the discount window borrowing has lost its function during the "Great Recession."

Last but not least, this paper supports Thornton's (1994) finding, which contradicts Cook and Hahn's (1988) Hypothesis that the Treasury bill rates respond to discount rate changes simply because it signals the changes in the federal funds rate. The estimation results of this paper show that both the 3-month Treasury bill rate and 3-month repo rates did not significantly respond to the changes in federal funds rates at both 1% and 5% significance levels during both recent recessions.

Some findings on the Characteristics of three types of 3-month repo rates

First of all, three types of 3-month repo rates have similar trends over the recent two decades. In other words, they move together at the same time.



Notes: The above figure used a stacked line chart to show the trend of the three types of repo rates. It is very obvious that they tend to move together. The 3-month mortgage repo rate has the highest value of all the three types of repo rates, because a mortgage repurchase agreement is more risky than the other two repurchase agreements. Both government and agency repurchase agreements enjoy protections from U.S. Government.

Secondly, when using three types of 3-month repo rates as long term rates respectively, expectation theory is found to perform extremely well in all the three cases.

Thirdly, three types of 3-month repo rates have very similar forecasting ability for federal funds rates.

Last but not least, three types of 3-month repo rates were not responsive to discount rate changes during the recent U.S. recessions at a 1% significance level.

To sum up, three types of 3-month repo rates have similar characteristics. They have similar moving trends over time, similar performances in expectation theory, similar forecasting abilities for future federal funds rates, and similar response patterns to discount rate changes.

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DO BUSINESS SCHOOL TEAM PROJECTS MEET STUDENT LEARNING OUTCOMES AND PREPARE STUDENTS FOR THE WORLD OF WORK?

MICHAEL LATTA, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

MERRILL BOYCE, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

P. DICK DRASS, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

DAVID FINK, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

J. KAY KEELS, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

ABSTRACT

The new AACSB standards have brought change to the definitions of Student Learning Outcomes (SLOs). One of the key questions for business schools raised by these changes is: why are team projects important? Typically, schools of business are not focused on educating theorists or academics, but rather on future practitioners who will work in businesses that have structured and unstructured teams. If team work in the "real world" is so important, then teamwork in business classes must add value; otherwise, the business school fails in its mission. It is important for business schools to recognize the opportunity to utilize teams as a teaching tool that can be assessed effectively. However, the teamwork experience must have value beyond the classroom; otherwise, the quality and capability of graduates is not enhanced.

Background

In the AACSB Assurance of Learning Standards: An Interpretation AACSB White Paper No. 3 issued by: AACSB International Accreditation Coordinating Committee AACSB International Accreditation Quality Committee 20 November 2007 and Revised 3 May 2013, example Learning Goals are defined. The following were included in those examples:

Learning Goal: Our graduates will be effective communicators.

The corresponding objectives for the goal are:

1. Our students will produce professional quality business documents.
2. Our students will deliver a professional quality presentation accompanied by appropriate technology.
3. Our students will demonstrate effective interpersonal communication skills in a team setting.

As a consequence of this change in standards, an outcomes assessment must be devised to assess student success in these learning outcomes.

According to the AACSB Assessment Resource Center, the outcomes assessment process should include:

1. Definition of student learning goals and objectives
2. Alignment of curricula with the adopted goals
3. Identification of instruments and measures to assess learning
4. Collection, analysis, and dissemination of assessment information
5. Use of assessment information for continuous improvement including documentation that the assessment process is being carried out in a systematic, ongoing basis (AACSB Assessment Resource Center, 2007).

This panel is concerned with effective implementation and assessment of the new AACSB Standards (2013) Standard 9 as it relates to team projects.

Equipping Students to Deal with Problems in Teams

Some of the traditional problems students have in teams include team formation and function including the following issues:

Goals, purpose, and mission: What are the team's goals? What is the team's purpose and/or mission? How well do the team's goals support the organization's mission and goals?

Roles and responsibilities: Who will play what roles and be responsible for what tasks? How will team members be aided and held accountable for their responsibilities? How will the team assume collective responsibility for its work?

Relationships: How will relationships be formed and maintained within the team? How will relationships be managed with individuals and groups outside the team? How will the team find the time to form supportive relationships while working on its assigned tasks?

Leadership: Who will lead the team? How will leadership roles be shared or rotated? Who will facilitate the team meetings?

Power and influence: Who has authority over and influence upon the team? How is this authority and influence exercised? How do team members react and respond to those with power and influence? How do members influence the team? How does the team influence powerful individuals and groups outside the team?

Skills: What mix of skills is needed to do the team's work? What technical or functional skills are needed? What problem-solving and decision-making skills are needed? What interpersonal skills are needed?

Communication: How will team members communicate with one another? What communication processes and systems will be used? How will the team communicate with individuals and groups outside the team?

Problem-solving and planning methods: What problem-solving and planning methods will the team use to do its work? What methods and processes will the team use to conduct its meetings?

Conflict: How will the team manage disagreements and conflicts?

Progress and results: How will progress and results be measured?

Risk and rewards, successes and failures: How much risk is the team allowed to take? What rewards will the team receive for its results? How will the team handle successes and failures?

Creativity and innovation: In what sense does the team see its role as being creative? What brainstorming and problem-solving processes will the team use to create innovative ideas and alternatives?

Motivation: Why do members want to be on the team? What do team members gain personally from membership? How can team members help the team? How can they be involved in and challenged by the work the team is doing? How does the team help to motivate its members?

Celebrations: How will the team celebrate its ability to work as a team and the results it achieves?

The panel will address each of these issues.

Non-traditional problems include how to deal with problem team members:

- Hitch Hikers
- Couch Potatoes
- Lone Wolves
- Powerful Members

The panel will address ways to deal with these problem team members that can be used in coaching teams.

Assessing Student Engagement through Peer Evaluations

Why do students hate peer evaluations and remain unengaged in team projects? The answer may be that students do not understand how they will be evaluated by their peers. It may also be that qualitative evaluations are more valuable in student teams than are quantitative (rating) evaluations.

The panel will address this issue.

Student Reactions to Team Projects

Why do students say they hate working in teams? A survey at San Jose State University found that 72 percent of instructors in the business school assigned students to team projects in at least one class, but 81 percent gave modest, limited, or no support to students assigned to teams. Unfortunately such lack of support may be typical (Bolton, 1999).

The panel will address this problem in business school teams.

Do Team Projects Prepare Students for the World of Work?

Several of the panelists have long and successful backgrounds in operating business teams. They bring perspective and solutions in all discussions concerning student team problems and solutions.

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Essentials of Ransomware for Business and Management

Harry Katzan, Jr.,
Webster University
Director, Institute for Cybersecurity Research
U.S.A.

Abstract

Ransomware is one of the most vicious and troublesome forms of cyber terrorism to surface in recent years, and the reported incidents of it are increasing rapidly. In this form of cyber crime, a malicious program takes over a victim's computer making use of the computer and access to files unavailable unless a victim pays a ransom. The problem affects individuals and organizations, including in one instance, a health-care facility. Typically, the victim does not know how to respond when a ransomware attack takes place, since payment of the amount of the requested ransom does not necessarily resolve the situation. This paper describes the various forms of ransomware and gives insight on effective countermeasures. This is a short paper on a new subject in cybersecurity.

KEYWORDS: Cybersecurity, cyber terrorism, countermeasures.

Introduction

Any incident that affects the continued operation of a person's or an organization's computer facilities can be annoying, frustrating, and even terrifying. In the case of health-care facilities, it can be life threatening. Even though your computer – including tablets and smartphones – may not contain personal identifiable information (PII), any event that prevents access to *your* information can be a serious matter.

Here is how it happens. A user clicks on a hot link or a web site that places an element of malware, i.e., a malicious program, on the computer to be affected. That program then executes the encryption of or prevents access to the stored data files on that computer. The malware program then effectively locks the computer and displays a message on the screen informing the user that access is denied unless a ransom is paid.

If and when the user pays the requested sum of money, procedures are then given to unlock the data files. The cyber criminal may be reputable or not. If the object pays the ransom amount and the criminal is reputable, then the user is back in business. If not, then the situation requires the services of a data recovery specialist. The total cost and the operational downtime can be significant.

The subject of ransomware has become a major cybersecurity issue, because the cyber criminals have networks of server programs, i.e., botnets to facilitate the operation of ransomware, that can affect thousands of computers. There are potentially large sums of money involved.

Protection from Randomware

Protection against ransomware is relatively straightforward. The FBI and Department of Homeland Security have given the problem some attention, and here is a short list of safeguards:

- Have updated antivirus software on your computer.
- Accept automated software updates to your operating system and web browser.
- Use strong passwords and change them regularly.
- Do not operate your computer in the "administrator" mode.

- Turn on the pop-up blocker on your system.
- Only download software from trusted sites.
- Do not open attachments to unsolicited emails.
- Never click on an URL, but copy and paste it into your browser.
- Use the same procedures for tablets and mobile phones as you do with your browser.
- Conduct a regular back up to an offline backup device.

If a case of ransomware is experienced, you can contact the FBI's Internet Crime Complaint Center or the Department of Homeland Security's U.S. Computer Emergency Readiness Team (CERT). (FBI, 2015) (CERT, 2014)

Types of Ransomware

There are two basic forms of ransomware, even though minor variations exist: crypto ransomware and locker ransomware. The objective of cryto ransomware is to encrypt personal data and files making them unavailable to the user. The malware of locker ransomware purports to lock the computer so it is unavailable for use. There are two aspects to the study of ransomware: how the method works from a technological standpoint and the psychological impact of its use.

Locker ransomware, also known as "computer locker," prevents access to the computer interface rendering the underlying computer and data files unchanged. In the execution of a computer locker, the user is allegedly threatened by law enforcement to have committed an online indiscretion or other criminal activity, and the computer is locked from subsequent use unless a fee is paid to the cyber criminal. The ransomware program is in control of the computer and permits limited facilities for using the keyboard but enough to specify a payment code. This form of ransomware is particularly effective in cases where the end user has limited facilities for accessing the underlying system through as additional computer. With locker ransomware, the malware is easily removed through the use of tools and techniques available from security vendors. (Savage, 2015)

Crypto ransomware, also known as "data locker," detects and encrypts valuable data stored on the computer. Supposedly, the user obtains the decryption key when the ransom is paid. In the best case, the crypto ransomware detects and encrypts only critical data, such as reports and financial information. Otherwise, crypto ransomware resides beneath the surface until an appropriate time or at a point when the critical data is needed. The malware does not affect the underlying system software, such as the operating system, so that the computer can be used for normal operations.

Typical Scenarios

The number of potential victims of ransomware attacks is extremely large and includes private individuals, students, military personnel, government employees, and business workers. There may be untold additional groups that are potential victims. So there is a very large amount of revenue just waiting to be picked up by unscrupulous persons in local and remote locations. Most private individuals have neither the time nor inclination to be concerned with persons halfway around the world attempting to load illegal software on their computer. In short, ordinary people are ostensibly too busy to be worried about cybersecurity. It is the same with students and military personnel, many of whom simply do not care about what is happening with regard to their computer. Government employees and business workers, typically operating in a complex environment, are otherwise too occupied with productive activities to be concerned with security; it is not reasonable for organizations to have to finance a totally safe workplace. Many ransomware criminals are outside of the domain of federal and local law enforcement. It is very

difficult, if not impossible, to apprehend cyber criminals in foreign countries. Perhaps, the notion of the much aligned "kill switch" should be given additional consideration.

It would seem that locker ransomware would be most appropriate wherein an individual user clicks on a hot link from within a web site where he or she should not be in the first place. The ransomware installation facility places software on the target computer making the system unavailable for productive use. No files are stolen or modified, but the computer is essentially not usable by its owner or user. The ransom fee is typically $200 to $300. The amount is low enough so the victim would often just pay the amount without calling in law enforcement. Convenient facilities, such as bitcoin, are customarily used for payment. Commercial specialists, such as The Geek Squad[1], could be called in to free the system, but there is normally a fee involved.

Crypto ransomware is normally used by criminals to encrypt critical files in the operational domain of organizations that are able to pay relatively large amounts of money, such as $10,000. The name "data locker" is appropriate since the selected files are effectively locked up until the user pays the ransom amount to the criminal. Through social engineering techniques, the ransomware software is place on the target computer through the presentation layer or the server database. Crypto ransomware is exceedingly complicated and typically uses a symmetric cryptology algorithm to encipher and decipher the critical file and uses an asymmetric public key algorithm to manage the key. Usually the AES method is used for enciphering the critical data, and either RSA or elliptic curve methods for managing the public and private keys used to manage the symmetric key. The critical files reside on the home computer during the process and the symmetric cipher key is stored with the data in an asymmetric form. In this instance, the victim usually pays the ransom fee, because the data is critical for continued operation of the enterprise or the data is associated with an exceedingly large business endeavor.

Summary

Although the notion of ransom generating malware is not particularly new, its widespread use is recent. It is difficult to know how widespread it is because victims are reluctant to inform the authorities. The two main methods are locker ransomware and crypto ransomware. Locker ransomware locks up the whole system so the computer is unavailable for use. Locker ransomware is appropriate for small jobs including drive-by penetration. Crypto ransomware encrypts critical files and is difficult to crack, since advanced mathematics is involved, and time is often a critical factor.

There are two general approaches to the ransomware situation:

Ransomware attack response
Ransomware prevention

The Ransomware Hostage Rescue Manual (Alessandrini, 2015) gives operational checklists for each approach. The reality of the situation is inherent in the quote by Dustin Dykes (op cit., p.1): "The adage is true that the security systems have to win every time, the attacker only has to win once." Here is a summary of the ransomware attack response checklist:

Disconnect everything
Determine the scope of the infection
Determine ransomware strain
Determine response
-Restore your files from backup
-Try to decrypt
-Do nothing (lose files)
-Negotiate and/or pay the ransom
-Protect yourself in the future

[1]The Geek Squad group is owned by the Best Buy Corporation.

The ransomware prevention checklist similar:

Establish first line of defense: users
Establish second line of defense: software
Establish third line of defense: backups

Detailed information is clearly available from the stated reference.

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Author Information

Professor Harry Katzan, Jr. is the author of books and papers on computer science, service science, and security. He teaches cybersecurity in the graduate program at Webster University and directs the Institute for Cybersecurity Research.

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Evaluating the Complexity of Strategy Formulation within an Organization: A Phenomenological Perspective

Michael G. Brizek, Ph.D.
Lander University

Abstract

The problem addressed by this study was the misalignment between strategy formulation's current philosophical worldview of positivism and its true philosophical worldview of phenomenology, the consequences of which include cognitive bias, inapplicability of strategy tools, and unreliable and degrading results on organizational performance. The purpose was to develop a theory of strategy formulation apposite its complex social nature, thereby providing the appropriate philosophical lens for all strategist and strategy researcher thinking, activities, and behaviors. This was achieved via performance of a systematic review (augmented with phenomenological and root cause analyses), which has not previously been explored. The research target was a compilation of various published/unpublished and peer reviewed/non-peer reviewed documents representing an exhaustive review of the phenomenon, producing 364 cases of strategist and co-strategist experiences from 5,013 documents. Results of the analysis are exciting and significant, including expansion of the theoretical process of strategy formulation, discovery of the underlying causes of strategy's problems, and the first ever practice theory of strategy formulation apposite its complex social nature, i.e. in a low-abstraction, un-fragmented, and comprehensive manner. This Phenomenological Theory of Strategy Formulation (TOPS) describes the process as tumultuous and dangerous, overwhelmed by nastiness, cognitive bias, and miscomprehension of strategy its formulation process, albeit with some kindness, casting doubt on whether human beings can consistently perform the process successfully. Recommendations for overcoming strategy's barriers include training and education on the assumptions of phenomenological cognition and behavior, and on the complexities of strategy and its tumultuous formulation process. Results demonstrate the confluence of rationality and emotion/reflection to be *exponentially* superior to rationality alone, recommending a challenging shift in strategist cognition from positivistic to phenomenological, which enhances the iterative, interrelated web of human cognition, behavior, and relationships. Therefore, it is recommended that TOPS be utilized by strategy researchers and practitioners to guide their work, meaning that strategists must *think* like phenomenologists, must *become* phenomenologists. Also, the novel design utilized is recommended as a method of further low-abstract, un-fragmented, and comprehensive exploration and discovery required by the field, as well as phenomenological strategy and management education in order to break the positivistic research-practice-research cycle. These results demonstrate that said consequences of the strategy formulation process may now be significantly ameliorated.

Statement of the Problem

The specific problem addressed in this study is the misalignment between strategy's current philosophical worldview, which is described as positivism (Gavetti, 2011; Lafley et al., 2012; Locke, 2011a; Miller & Tsang, 2011; Powell et al., 2011), and its true nature, described as a complex social activity that does not align with positivism (Adler, 2010; Barney et al., 2011; Fisher & Stenner, 2011; Madjar et al., 2011; Whittington et al., 2011). Only a handful of authors have suggested strategy's true philosophical worldview is phenomenology (Golsorkhi et al., 2010; Heil, 2008; Klay, 1991; Sandberg & Dall'Alba, 2009), but there is no systematic review of strategy formulation, especially one augmented with phenomenological and root cause analyses, i.e. one that accounts for its complex social nature via strategist and co-strategist experiences with the process.

The consequences of maintaining the extant positivist view are continued cognitive bias in the strategy formulation process (Carmeli et al., 2012; Jarrett & Stiles, 2010; Küpers et al., 2013; Narayanan et al., 2011), inapplicability of strategy tools to practicing strategists (Bakir & Todorovic, 2010; Jarrett & Stiles, 2010; Sandberg & Dall'Alba, 2009), and unreliable or even degrading results on organizational performance (Andrews et al., 2009; Johnson et al., 2010; Poister et al., 2013). The new knowledge produced facilitated development of a more veracious and comprehensive theory of strategy formulation that accounts for its complex social nature, thereby providing the appropriate philosophical lens through which all strategy researcher, educator, and practitioner thinking, activities, and behaviors may be performed.

Purpose of the Study

The purpose of the systematic review (augmented with phenomenological and root cause analyses), was to develop a practice theory of strategy formulation that represents its complex social nature, thereby providing the appropriate philosophical lens through which all strategy researcher and practitioner thinking, behaviors, and activities may be performed. The domain of the study is strategy formulation that specifically regards its complex social nature, such as feelings, emotion, intuition, or physiological reactions, which is further explained and justified in the Research Method section. This is relevant and significant because the literature suggests strategy's current philosophical worldview is positivism (Adcroft & Willis, 2008; Durand & Vaara, 2009; Gavetti, 2011; Jarrett & Stiles, 2010; Johnson et al., 2010; Lafley et al., 2012; Locke, 2011a; Miller & Tsang, 2011; Powell et al., 2011; Sandberg & Dall'Alba, 2009), but that its true philosophical worldview is phenomenology (Golsorkhi et al., 2010; Heil, 2008; Klay, 1991; Sandberg & Dall'Alba, 2009), which represents a misalignment between how the activity is performed (i.e. positivism) and its true nature (i.e. phenomenology), resulting in cognitive bias in the process (Carmeli et al., 2012; Jarrett & Stiles, 2010; Küpers et al., 2013; Narayanan et al., 2011), inapplicability of strategy tools (Bakir & Todorovic, 2010; Jarrett & Stiles, 2010; Sandberg & Dall'Alba, 2009), and unreliable or even degrading results on organizational performance (Andrews et al., 2009; Johnson et al., 2010; Poister et al., 2013). The study also built upon and expand the theoretical concepts of integrative strategy formulation, which

conflates rational and emergent strategy formulation (Andersen & Nielsen, 2009; BalbastreBenavent & Canet-Giner, 2011; Poister et al., 2013), and the theoretical process of strategy formulation, which consists of environmental scanning, sensemaking, and decision-making (Narayanan et al., 2011). This study suggests the proper philosophical lens for strategy formulation, providing managers and other strategists with the benefit of learning how to formulate strategies with reduced cognitive bias and more effective use of tools, resulting in enhanced organizational performance.

The research design is a systematic review (augmented with phenomenological and root cause analyses) to develop a theory of strategy formulation that aligns with its complex social nature. The focus of the research domain was various documents that were published/unpublished or peer reviewed/non-peer reviewed such as magazine and news articles, books and textbooks, reports, dissertations, or conference proceedings, acquired from various sources such as electronic databases, independent authors, nonprofit research organizations, and governmental organizations, comprising approximately 500 to 5,000 documents.

Research Questions

Q1. What strategy formulation structure/process emerged from the systematic review analysis concerning its complex social nature?
Q1.1. What are the actual phases, steps, and activities engaged in by strategists and costrategists?
Q2. What is the theory of strategy formulation that aligns with its complex social nature?
Q2.1. How do strategists and co-strategists experience the phases, steps, and activities of the strategy formulation process (identified in Q1)?
Q2.2. How are those experiences (identified in Q2.1) interrelated?
Q2.3. Why did the strategists and co-strategists experience their strategy formulation activities as stated (identified in Q2.1 and Q2.2)?

Literature Review Strategy Theory as Related to the Study

Description of strategy. The field of strategy is portrayed as located within strategic management (Balbastre-Benavent & Canet-Giner, 2011; Gimbert, Bisbe, & Mendoza, 2013; Narayanan et al., 2011; Phelan, 2011; Poister et al., 2013; Sumer & Bayraktar, 2012). Strategy is described as complex and misunderstood (Bakir and Todorovic, 2010; Encyclopedia Britannica, 2014; Gray, 2007; Mintzberg, 1987b; Popescu, 2009; Strachan, 2005; Tovstiga, 2014; Yarger, 2008), which aligns with the descriptions herein of strategy *formulation* as a complex social activity. The poor comprehension of strategy is evident in the literature, as there are few works defining the topic of strategy itself. Interestingly, the national security and war literature seem to contribute more to the concept of strategy and defining it than the field of business, which seems to focus on the *doing* of strategy. Regardless, this miscomprehension results in misuse or misapplication of strategy (Encyclopedia Britannica, 2014; Grundy, 2012; Mintzberg, 1987b;

Porter, 1996; Strachan, 2005), producing poor results and sometimes dire consequences because not understanding it is a barrier to formulating it (Bakir & Todorovic, 2010; Gray, 2007; Grundy, 2012). These myriad definitions of strategy have resulted in its universality, robbing it of its true meaning (Strachan, 2005; Yarger, 2008).

Stating what strategy is *not* should help to delineate the following definition. Strategy is not organizational effectiveness or efficiency, strategy tools (Porter, 1996), policy, a plan, or tactics (Gray, 2007; Popescu, 2009; Strachan, 2005; Yarger, 2008). Strategy is referred to as having two key components: the process, known as strategy formulation; and the content, representing what results from the strategy formulation activity (Andersen & Nielsen, 2009; Andrews et al., 2009; Elbanna, 2006; Gavetti & Rivkin, 2007; Johnson et al., 2003; Poister et al., 2013; Sminia, 2009). However, strategy is also implemented as something organizations *do*, as evidenced by an organization's activities, rules, and routines, thereby occurring both in cognition and also in action (Gavetti & Rivkin, 2007). Therefore, strategy is suggested to have three components: a formulation process, a resulting content, and its performance. Based on this description, a synthesis of the definitions of strategy conceptually defines it as: the art and science of determining what needs to be achieved, why it needs to be achieved, and the best way to achieve it, resulting in a concept that requires coordination, synthesis, and mobilization of all resources in order to achieve the organizational mission in a passionate, superb, advantageous, and fantastical manner (Bakir & Todorovic, 2010; Krulak, 1997; Encyclopedia Britannica, 2014; Gray, 2007; Grundy, 2012; Krulak, 1997; Popescu, 2009; Porter, 1996; Strachan, 2005; Tovstiga, 2014; Yarger, 2008). Only three out of 11 articles describe achieving the overarching policies and mission in some exceedingly passionate, superb, or fantastic fashion (Grundy, 2012; Tovstiga, 2014; Yarger, 2008) as opposed to a *utilitarian* manner, which is how most definitions of strategy are stated (Bakir & Todorovic, 2010). However, that concept of passionate, superb, or fantastic achievement seems to represent that intangible yet identifying component of strategy that is missing and therefore contributing to its misunderstandings. Although this definition is long and cumbersome, it addresses the three identified components of strategy: the process is the art and science of determining what needs to be achieved, why, and how; the content is a concept, suggesting it is something deeper and more complex than simply an idea, policy, or plan; and the performance is the coordination, synthesis, and mobilization of all resources to achieve the mission in some advantageous and fantastical manner, suggesting performance superior to other organizations while achieving the mission, regardless of the strategy's level. Once again, although this definition is cumbersome, it is comprehensive and representative of strategy's complex social nature; its complexity indicates why it is often misunderstood and misapplied.

Because there is no one agreed-upon definition of strategy *formulation* (Bakir & Todorovic, 2010; French, 2009; Jarzabkowski et al., 2007), the following definition is espoused by this study because it is generalizable to all levels of strategy: it is a context driven social practice that is based on the premise of goal-directed reasoning, comprising a series of intended, partly instrumental and partly interpretive activities, that require resource deployment (Bakir &

Todorovic, 2010). This definition aligns with the characterization of strategy formulation as a complex social activity, and also with the integrative view of strategizing, viewing strategy as a rational activity where the CEO makes the decisions, but also where key contributors participate and flexibility is welcomed. Although other definitions include additional components and thoughts, usually applying to business level strategy, they also incorporate some or all of the key thoughts of this definition, including the complex social nature of strategy, its goal directed nature, and being both rational and flexible (Gimbert et al., 2013; Jarzabkowski & Balogun, 2009; Küpers et al., 2013; Rasche & Chia, 2009; Wolf & Floyd, 2013). Strategy is described as extremely complex, comprising environmental forces of tremendous breadth and depth, such as organizational, societal, cultural, and technological forces that affect strategists and the strategy process (Whittington et al., 2011); it is determined by social and cultural contexts, including individual and group psychology of strategy agents, organizational capacity building, and forces in the external environment (Bakir & Todorovic, 2010); and it is embodied and reified in a firm's activities, rules, and routines, thereby occurring both in cognition and also in action (Gavetti & Rivkin, 2007). These thoughts support propositions that strategy formulation, due to environmental changes, is now performed in the public sector much as in the private sector, and therefore represents a researchable domain (Kornberger & Clegg, 2011; van der Lugt, Dooms, & Parola, 2013), supporting the organizational strategists and co-strategists as a governmental organization, and therefore generalizability as described in the Research Methods and Design section. Interestingly, these definitions and thoughts highlight the misalignment between strategy and positivism, because strategy is clearly portrayed as complex and social with which positivism does not align. Also note, however, that none of these descriptions utilize specific terms representing a complex social nature, such as feelings, emotions, intuition, or interrelated relationships.

Levels and purposes. Three organizational levels of strategy are identified in the literature: corporate; business; and functional or operations (Gupta & Muita, 2013; Wahyudi, 2013). Each has its own goal or purpose. Corporate strategy is characterized as selecting, monitoring, and controlling performance of business units (Ahenkora & Peasah, 2011; Brunsman, DeVore, & Houston, 2011; Chen, Fabozzi, & Huang, 2013; Wahyudi, 2013) in order to create value in its businesses (Ahenkora & Peasah, 2011; Brunsman et al., 2011; Chen et al., 2013); this contributes to and controls business level strategy (Brunsman et al., 2011; Chen et al., 2013; Ren & Guo, 2011; Wahyudi, 2013). Corporate strategy is often referred to as managing the portfolio (Ahenkora & Peasah, 2011; Barney et al., 2011; Chen et al., 2013; Hamel & Prahalad, 1994; Porter, 1994; Whittington et al., 2011). Business level strategy has the goal of achieving competitive advantage (Andersen & Nielsen, 2009; Barney et al. 2011; Jarrett & Stiles, 2010; Narayanan et al., 2011; Nobre & Walker, 2011; Phelan, 2011; Porter & Siggelkow, 2008; Whittington et al., 2011), which implies interrelatedness between itself and corporate strategy. In other words, the corporate level and the business level both contribute to competitive advantage; therefore, the corporate level cannot perform its tasks without interacting with the business level, and business level cannot perform its tasks without considering the corporate

level. Functional or operations strategy has the goal of enhancing firm performance (Oltra & Flor, 2010; Gonzalez-Benito & Suárez-González, 2010; Kusaba et al., 2011; Schmuck, 2012; Tzu-Yang, Jersan, & Haw Ran, 2012; Gupta & Muita, 2013), which serves the purpose of or should align with business strategy (Gonzalez-Benito & Suárez-González, 2010; Gupta & Muita, 2013; Henriksen & Rolstadas, 2010; Oltra & Flor, 2010; Schmuck, 2012).

Strategy Formulation Theory as Related to the Study

Description of strategy formulation. Strategy formulation is often referred to as the black box of strategy because almost nothing is known about it (Barney et al., 2011; Boyd et al., 2001; Sussman, 2001; Johnson, 2009; Johnson et al., 2003); the research is located inside this black box. Strategy formulation has two overarching types: rational planning strategy, which is doing strategy in a top down, planned and prescribed manner; and emergent or logical incrementalism strategy, which is bottom up, spontaneous development (Andersen & Nielsen, 2009; Andrews et al., 2009; Balbastre-Benavent & Canet-Giner, 2011; Elbanna, 2006; Jarrett & Stiles, 2010; Kjærgaard, 2009; Poister et al., 2013; Sminia, 2009). Rational planning is also referred to as strategic planning (Andersen & Nielsen, 2009; Wolf & Floyd, 2013). The integrative view conflates the rational and emergent types of strategy, and is espoused by the study because it results in organizational performance superior to both rational planning and emergent (Andersen & Nielsen, 2009; Balbastre-Benavent & Canet-Giner, 2011; Poister et al., 2013). The integrated view is described as aligning with the concepts of strategic responsiveness and dynamic capabilities (Andersen & Nielsen, 2009; Teece, 2007) that are necessary in today's rapidly changing internal and external environments (Andersen & Nielsen, 2009; Balbastre-Benavent & Canet-Giner, 2011; Poister et al., 2013). It embodies formulation and implementation issues conflated into one (Balbastre-Benavent & Canet-Giner, 2011), in which middle management and other lower levels work within a broad framework that facilitates new communication channels through which the freedom for experimentation and new methods of work are communicated to top management to inform and adjust said framework (Andersen & Nielsen, 2009; Poister et al., 2013). The theoretical process of strategy formulation comprises three complex and iterative cognitive phases of environmental scanning, sensemaking, and decision-making, which is generalizable to any level of strategy formulated by middle or top managers (Narayanan et al., 2011). The study espouses this theoretical process of strategy formulation conflated with the integrative view as the official structure of strategy formulation (however, see the Phases, Steps, and Activities section for steps and activities within these phases, informed by the brief literature review). A competing view of the strategy formulation process includes sensing, seizing, and reconfiguring or transforming (Teece, 2007). This view was not selected for the study because it includes more than the formulation component of strategy. Since the study addresses the philosophical level of strategy formulation, which tacitly comprises cognition, it is more appropriate to select a philosophical view based in philosophy or cognition.

Research Method Data Collection, Processing, and Analysis

Data was collected via the systematic review method and its specific protocol defined herein, but was analyzed via the descriptive phenomenological method, infused with concepts of root cause analysis. The proposed systematic review has two overarching phases with several steps. Phase one represents the systematic review's document collection, which comprised seeking, gathering, and qualifying documents related to strategy formulation that specifically address its complex social nature via experienced feelings, emotions, intuition, and relationships, acquired from various sources such as electronic databases, independent authors, and governmental organizations. This included incorporation of procedural guidelines to both ensure that acquired documents adequately represented the phenomenon of interest, while also maintaining a manageable scope for the dissertation study. See the Sample section for details on this procedure. It was not possible to know a priori exactly how many documents would be discovered by the search parameters. If too few documents were discovered, the resulting data set would not perspicaciously represent the domain, but if too many were discovered, redundancy would simply enlarged the scope to a size unmanageable (and without additional benefit); therefore, in alignment with the principles of phenomenology, the researcher was allotted flexibility to either expand or reduce the scope, albeit with predetermined procedures, in alignment with the principles of a systematic review, as previously described. The following steps describe phase one in detail.

Step one of phase one comprised seeking and gathering documents to achieve exhaustive sampling and adequately represent the domain. This was achieved by searching electronic databases for: *strategy formulation*, *formulating strategy*, *strategy formation*, *forming strategy*, *crafting strategy*, *selecting strategy*, *strategy selection*, *developing strategy*, *strategy development*, *strategic planning*, or *strategic management* in the title, and searching for *feelings*, *emotion*, *intuition*, *reflexion*, *physiological*, *trust*, *honesty*, *integrity*, *dialog*, *conversation*, *interpersonal*, and *interrelated* in the abstract. These search terms were informed by the brief literature review conducted herein. The sources included published/unpublished or peer reviewed/non-peer reviewed such as magazine and news articles, books and textbooks, reports, dissertations, or conference proceedings. The databases searched are listed in the Sample section.

Step two determined whether gathered documents fit the domain by locating the search terms *feelings*, *emotion*, *intuition*, *reflexion*, *physiological*, *trust*, *honesty*, *integrity*, *dialog*, *conversation*, *interpersonal*, and *interrelated* within the documents and reviewing the context to ensure applicability, thereby qualifying or disqualifying them for inclusion in the study. For example, it is possible that a document concerned strategy for a medical procedure that used a search term such as *emotion* in relation to the patient. A brief review of such a document elucidated this fact and resulted in its disqualification. Step three constructed a list of all authors and their respective e-mail addresses from the qualified documents, and included contacting them to determine whether they had unpublished works qualified for inclusion in the study, even

if results were negative. It was estimated this step would require 30 days or more, and that only 10% of those contacted would provide their unpublished works (Keupp et al., 2012); the qualification performed in step three was repeated for unpublished works.

At this point, a substantive collection of qualified documents was achieved. Step four comprised evaluation of said documents to determine whether they adequately represent the domain and constituted a manageable scope. If additional documents were deemed necessary, gathered documents would be reviewed for additional terms relating to the complex social nature of strategy formulation, and the search process described at the beginning of phase one would be repeated with those newly discovered terms. If still additional documents were deemed necessary, the previously conducted word search was utilized to scan the reference sections of extant documents for acquisition of additional documents (which means repeating step two, i.e. qualifying each of them). It was thought this would produce additional documents within the domain, and represents the flexible and explorative nature of the phenomenological influence on this design, which enhances credibility. If the domain was accurately represented, but the scope or quantity of documents is too large to be managed in a reasonable time frame, documents were to be excluded based on whether they match the search terms related to the complex social nature to specific phases or steps of the strategy formulation process; those that do not match affect to said phases or steps were to be disqualified. Recall that the purpose of the study was to develop a theory of strategy formulation that aligns with its true nature, achieved by, in part, matching the theoretical process of strategy formulation, i.e. the context, with strategist and co-strategist experiences. Once a collection of documents was deemed to accurately and credibly represent the phenomenon of interest, and did so within a manageable scope for the research, phase two began.

Phase two represents the construction of the data set, and the root cause and phenomenological analyses, achieved via several steps. A Microsoft Access database was to be utilized to store and analyze the data set, as it has the ability to filter entries based on text, producing numerous configurations of the data set in a flexible manner. Step one of phase two comprised copying and pasting text directly to the Microsoft Access database that regard: strategist and co-strategist experiences; the reasons for their experiences; and the phases, steps, or activities of the strategy formulation process, as identified in **Error! Reference source not found.**, within which experiences occurred. For example, the planning phase was identified if a strategy team discussed how to research their competition, who was responsible for doing so, and the analytic procedures to be employed. Therefore, a document (i.e. a strategist, co-strategist, or author) might not specifically state they are working within the planning phase, but it was inferred by contextual description. Within any particular strategy formulation phase, the steps and activities performed, including their linear order or iterative nature, was identified, representing the context of the domain. However, it was possible that some activities included components of two or more phases simultaneously, which would also be noted. This is an additional value of this comprehensive, un-fragmented research design, as focusing on the complex social nature without this context of the process would produce a fragmented view of the phenomenon.

When the data set was completely populated with all information, analyzing and making meaning began based on the descriptive phenomenological method outlined and described by Giorgi (2012). Once again, root cause analysis was infused into data collection, determining why participants experienced the strategy formulation activity as stated, which occurred during the data collection and prior to the phenomenological data analysis; therefore, analysis of the root cause *remained phenomenological*. The phenomenological analysis comprised six steps: (1) assumption of an attitude of phenomenological reduction which resists positing as existing whatever object or state of affairs is presented, refrains from bringing in non-given past knowledge, concentrates on the given as a phenomenon, assumes a psychological attitude toward the data, and applies special sensitivity toward the phenomenon being investigated; (2) reading of the whole description in order to get a sense of the whole; (3) constituting parts by rereading the description and making a mark everywhere a transition in meaning is experienced by the strategists and co-strategists, from within the aforementioned attitude (achieved by placing an asterisk (*) directly in Microsoft Access adjacent to the appropriate text); (4) data transformation via free imaginative variation: still basically in the words of the subject, paraphrasing into expressions that are more directly revelatory of the subject's comments; (5) writing of an essential structure of the experience by reviewing the direct and indirect expressions with the help of free imaginative variation; and (6) clarification and interpretation of the raw data via writing of the essential structure (Giorgi, 2012). Because the data set contains the context and root cause of strategist and co-strategist experiences prior to the phenomenological analysis, the resulting written essential structure tacitly represents the new theory of strategy formulation.

Due to the emergent and exploratory nature of phenomenological analysis (Giorgi & Giorgi, 2003; Golafshani, 2003; Küpers, 2007; Scotland, 2012; Zexian & Xuhui, 2010), it was unknown precisely how the essences of strategist and co-strategist experiences would emerge as related to the strategy formulation process. For example, perhaps all strategists and co-strategists would have *essentially* similar experiences within a specific strategy formulation phases or steps; however, was also possible that strategists would have one set of experiences, while costrategists would have another set of experiences. These distinctions obviously had implications for theory development, and is therefore were critical to discover. Therefore, it could only be said at that point that determining the essence is to determine how the different phases and steps were experienced, resulting in a synthesis of psychological meanings about the phenomenon, not the essence of individual experiences (Sousa, 2014). Once again, the phenomenological analysis provided the *description* and the *explanation* of the phenomenon within its context of the strategy formulation process, as the analysis included data from the root cause analysis determining why strategists and co-strategists participants experienced the various phases and steps, i.e. the context, as stated. This section represents how data was to be collected and analyzed to develop the theory of strategy formulation apposite its complex social nature.

Results

This section is bifurcated into subsections addressing (1) the research process up to data analysis, which presents all steps and activities performed during data collection, data qualification, and data set construction, and (2) phenomenological data analysis, which presents all stages and steps of data analysis performed while answering the research questions. The purpose of the subsections is not only to present the results, but to do so in a transparent manner with the goal of enhancing credibility and dependability.

Three sources were utilized: Macmillan Dictionary (http://www.macmillandictionary.com/us/thesaurus-category/american/words-used-to-describeintelligent-thought-or-actions); Thesaurus.com (http://www.thesaurus.com/browse/thinking); and Your Dictionary (http://grammar.yourdictionary.com/word-lists/list-of-words-that-describebehavior.html). These sites produced approximately 250 terms. An initial search of one library database for 10 or 20 said terms produced ideal results, i.e. the principal investigator was led to statements of strategist and co-strategist behavioral, cognitive, and physiological experiences. This represented the complex social component of strategy formulation sought and required by this study. Searching for these new adjectives identified additional adjectives, which were then added to the list; this process continued until the list was reasonably saturated. Furthermore, the principal investigator brainstormed additional search terms, inspired by extent search terms. For example, several search terms provided by the previously mentioned web sites and the databases were: *critic*, *conniving*, *conning*, etc. This investigator noticed these are negatively connoted, inspiring the development of more positively connoted terms, such as: *mindful*, *impudent*, *competent*, and *bright*. The process was halted at the point of saturation, and each database was re-searched for the new terms discovered and developed (three databases were searched for the initial search terms at that point). Additionally, the root form of each word was utilized in searches, meaning that all (or nearly all) forms of each word were included in the search, thereby multiplying the number of search terms by perhaps three or four. Approximately 20% (200) of all authors were initially contacted so that any responses, questions, or concerns could be reasonably managed. Responses and questions from several of these authors indicated the e-mail could be enhanced to improve comprehension; therefore, an improved email was developed and utilized for the remaining 80% of authors. Those remaining authors were re-emailed in groups of 500 each, one group per week, so that any responses and requests for additional information could be adequately and timely managed. Many emails, approximately 15%, were returned undeliverable due to expired addresses, and most responding authors stated they either did not possess such unpublished works, or their works did not address strategy formulation. These authors were re-emailed in order to elucidate that this principal investigator seeks textual descriptions of strategist and co-strategist experiences with the strategy formulation process, which said authors working in the sphere of education or health care might possess without necessarily labeling it as such. Only 6 authors (0.3%) provided documents for inclusion in the study, producing a total of 41 documents. These 41 documents (0.8% of the total) were collected in an *Authors'*

Contributions folder for later processing, contributing a total of 979 pages and 11 statements of experiences. That represents a contribution of 3.02% of all statements of experiences. This enormous quantity of documents and pages for review, comprising numerous document types and acquired from both published an unpublished sources, is posited to qualify as an exhaustive search (and sample) of the strategy formulation phenomenon. This step was actually begun before completion of step one in order to stagger the workload and make it more manageable. It was recalled, however, that such a list would be automatically developed in Microsoft Outlook's draft folder simply by clicking on each e-mail address in the MS Word documents. Further, all authors from every database were contacted, regardless of whether their document produced data; this resulted in several hundred emails sent for each database, and a total of 2,020 emails.

Step three of phase one comprised evaluation of the entire sample, including new documents acquired via e-mail from authors, to determine whether they adequately represent the domain and comprise a manageable scope. This step was also performed prior to the completion of step one and step two, therefore representing an iterative process. It was felt, upon completion of seeking and qualifying the first few databases, that the domain was accurately represented but that the scope was too large to be managed in a reasonable time for this study. Instead of excluding documents based on whether and how well complex social search terms were matched with the strategy formulation related search terms, as originally planned, only search terms were sought, without identifying the document title, year of publication, authors, etc. Additionally, because the sampling of documents was so large, as previously stated, sometimes producing hundreds (or even 1,000 or 2,000) of occurrences for each search term, they were semi-systematically skipped; instead, the principal investigator sought to review approximately a maximum of 30 occurrences per search term (as opposed to *every* occurrence) to make the scope of this dissertation study more manageable. To extrapolate, if a search term produced 90 occurrences, every third occurrence would be reviewed (90 divided by 3 = 30). For example, search terms such as *trust* often produced hundreds and hundreds of occurrences within *each Microsoft Word document*, which meant the qualification task was enormous, but also meant perhaps 95% to 99% of occurrences did not produce any results. Also, several databases contained three or four Microsoft Word documents with up to 10,000 pages each. For example, Google, Prager International Security, and ProQuest each contained three or more Microsoft Word documents that contained 8,000 or 10,000 pages each (the Word documents had to be divided at approximately 10,000 pages to prevent computer freezing), meaning each of those databases contained approximately 30,000 to 40,000 pages. Conversely, other databases such as Annual Reviews, Pub Med, and Wiley contained only one Microsoft Word document with only 500 to 800 pages. Therefore, when semi-systematically skipping to review a maximum of 30 occurrences per search term, as stated above, 30 occurrences were reviewed for *each Microsoft Word document*, meaning 60 occurrences were reviewed for databases with two Microsoft Word documents, 90 occurrences were reviewed for databases with three documents, and 120 occurrences were reviewed for databases with four documents. Finally, a large percentage (approximately 30% to 40%) of search terms did not produce hundreds of occurrences, but rather

only one, five, 10, or 20. For example, the search terms *crazy* and *idiot* seldom produced more than three occurrences in any document. In these cases, all occurrences were reviewed.

This procedure essentially resulted in a sampling of the sample, which has been coined as *semisystematic* sampling toward achieving the purpose of the study, because the principal investigator would often stop or backup to focus on documents or areas of interest, or skip through occurrences within reference sections. Often, one or two articles within a Microsoft Word document would contain many, many occurrences of a particular search term. As an example, terms such as *competent* might have 400 occurrences in a Microsoft Word document, but perhaps 300 occurrences were contained in one article that did not provide desired statements, while the other 100 were dispersed across 10,000 pages. In this case, the principal investigator quickly scrolled through the entire article, producing a search of 100 words instead of 400. Additionally, multiple search terms were often present within single statements of strategist and co-strategist experiences, so the statements had additional chances of being discovered if accidentally skipped. Finally, since the sample size is so large, virtually representing consensus of the entire strategy formulation literature, it is likely that the 5% of skipped, usable data might either be redundant or would not affect the theoretical, generalized results sought by this study. This does not mean that valuable and unique information was not skipped at all, but rather that the chances of skipping them and their impact on this study are far less than might be assumed at first glance. Therefore, generally speaking, it is felt this procedure does not damage phenomenon representation or its generalizability in a significant manner.

Phase two represents the construction of the data set and the phenomenological analysis, infused with root cause analysis, resulting in a new theory of strategy formulation accounting for its complex social nature. Step one of phase two comprised a review of the qualified documents to identify experiences, the reasons for them, and the phase, step, or activity within which they occurred. This step was essentially dissolved because the concept of qualifying documents was previously deleted in favor of simply searching for and identifying statements of experiences. Step two of phase two comprised transferring (i.e. copying and pasting) text from the Microsoft Word documents to the Microsoft Access database, but the 2013 version of Microsoft Access has only a *long text* field designation (the *memo* field designation has been removed), which means the maximum number of characters a field can contain his quite limited, i.e. shorter than most statements of participant experiences. Therefore, Microsoft Excel 2013 was used instead. Strategist and co-strategist quotes or statements were copied and pasted directly from the Microsoft Word comment bubbles to the Microsoft Excel data sheet. At the same time, the

phase or step within which each experience occurred (i.e. planning, scanning, sensemaking, or decision making) and the reason for its occurrence (i.e. the cause) were both determined by reviewing the Microsoft Word document, and entered directly into the Excel data sheet.

In step three, theory is developed via phenomenological analysis that constitutes the complex social nature of strategy formulation. This principal investigator prepared for each instance of this analysis by bracketing or setting aside his personal views and experiences with the process,

and by imagining himself as a co-strategist in each case. The investigator's views and experiences embody, generally speaking, negative experiences with the process, as well as sensing tremendously positive human capability. Imagining himself as a co-strategist first meant understanding the context of each case and the perspectives of those involved, and then imagining himself as present in the room, part of the process, and/or one of the specific strategists/co-strategists. In numerous cases this investigator experienced emotional highs and lows with the strategists/co-strategists, such as actual unhappiness and even stomach pains as well as the seldom exuberance and joy. The specific steps associated with descriptive phenomenological analysis are outlined in the Data Collection, Processing, and Analysis section, the results of which produced the new theory of strategy formulation, as described in the next subsection.

Table 1

Descriptive Statistics of Data Set

Phase(s) to Which Cases Related	Count	Percent of Total
Planning	45	12
Scanning	8	2
Sensemaking	73	20
Decision-making	48	13
All phases	123	34
Planning & Decision-making	1	0
Planning & Sensemaking	1	0
Planning, Scanning & Sensemaking	4	1
Planning, Sensemaking & Decision-making	10	3
Scanning & Sensemaking	17	5
Scanning, Sensemaking & Decision-making	12	3
Sensemaking & Decision-making	22	6
TOTALS	364	100%

Figure 1. The New Theoretical Process of Strategy Formulation

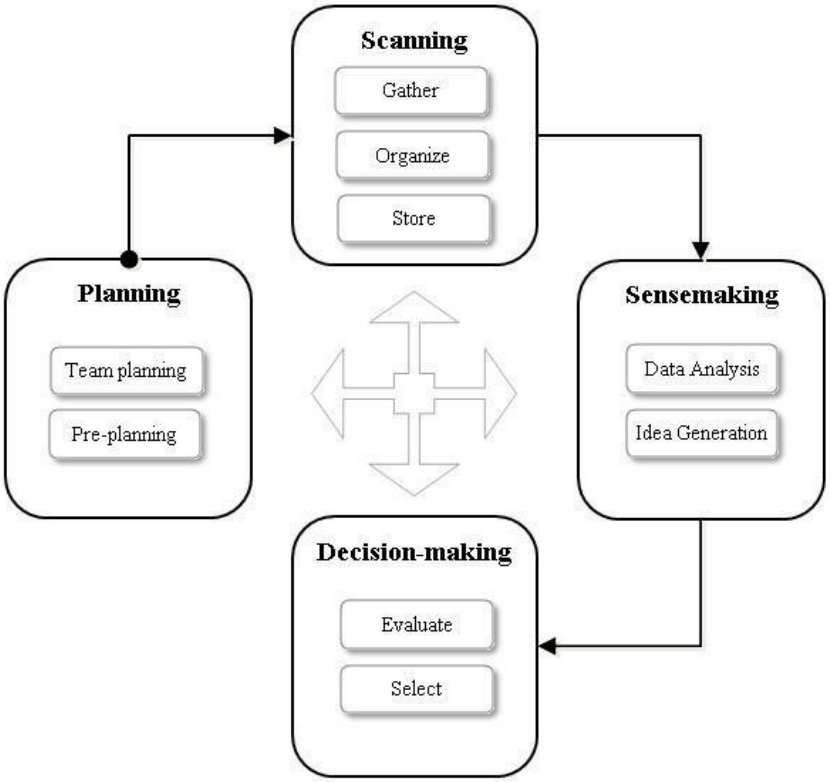

Table 2

Discovered Behavior Types and Their Operational Definitions

Behavior Type/Role	Operational Definition	Coined Names
1. Those Who Get It From Those Who Have The Ability To Cause Harm	Strategists, co-strategists, or process/tools who experience something extreme from others such as lies, deceit, tactics for control, or the complexities and difficulties of the process/tools	Susceptibles
2. Those Who Give It To Those Who Are Susceptible	Strategists, co-strategists, or process/tools who have the ability to cause harm to those who are susceptible, such as via lies, deceit or the very complex and difficult process/tools	Harmers
3. Those Who Give Good	Strategists, co-strategists, or process/tools who treat or interact with others in some benevolent or beneficial fashion that enhances the relationships, unitedness, togetherness, or process/tools	Benevolents
4. Those Who Get Good	Strategists, co-strategists, or tools/process who experience benevolent treatment or interactions from others or process/tools such as establishment of good relationships, unitedness, and togetherness	Beneficiaries

5. Those Who Protect Against Those Who Can Cause Harm	Strategists, co-strategists that protect themselves in some manner from others or process/tools that can cause them, their clique, depart., or org. harm via avoidance, aggression, or acquiescence	Protectionists
6a. Those Who Observe Others Getting It From Those Who Can Cause Harm	Strategists or co-strategists who observe those who are susceptible, including process/tools, being treated or interacted with in some detrimental manner, such as via lies, deceit, or using tactics to gain control	Susceptible Observers
6b. Those Who Observe Those Who Can Cause Harm Giving It To Those Who Are Susceptible	Strategists or co-strategists who observe those with the ability to cause harm, including process/tools, treating or interacting with others or process/tools in some detrimental manner, such as lies, deceit, or use power and authority	Harmer Observers
6c. Those Who Observe Those Who Are Susceptible Protecting Against Those Who Have The Ability To Cause Harm	Strategists or co-strategists who observe those who are susceptible, including process/tools, protecting themselves from some extreme and detrimental behavior or interactions in some manner, such as lies, deceit, or use power and authority	Protectionist Observers

Strategist and co-strategist experiences are expressed as those six behaviors/roles, which occurred within each of the four strategy formulation phases. See Table 3 for the Susceptible and Harmer experiences in each phase. The Susceptibles, those who are susceptible to harm from others and the process/tools, experienced the planning and scanning phases as tumultuous, and the sensemaking and decision-making phases as *intensely* tumultuous, including varied intense feelings with physiological symptoms. The Harmers, those who have the ability to do harm to others or the process/tools, experienced the planning and scanning phases as powerful and tactical with rare bouts of sympathy and physiological symptoms, and the sensemaking and decision-making phases as essentially the same but more intense, including protectionism.

Table 3

Sample of Susceptible and Harmer Experiences, by Phase

1. Those Who Get it From Those Who Have the Ability to Cause Harm (The Susceptibles)			
Planning	Scanning	Sensemaking	Decision-making

Disgust, subjugation, incredulity, fear, optimism, isolation, bitterness, sleeplessness, tumultuousness, intimidation, controlled, monstrousness, group belonging, insanity,	Insult, subjugation, fear, monstrousness, group belonging, submissiveness, bitterness, sleeplessness, tumultuousness, pounding heart, high blood pressure, shocked	Insult, subjugation, competition, monstrousness, fear, bitterness, sleeplessness, pounding heart, high blood pressure, panicked alert, self-doubt, low selfesteem, desire to run	Insult, shock, subjugation, fear, monstrousness, group belonging, competition, bitterness, sleeplessness, exhaustion, pounding heart, high blood pressure, fairness, panicked alert, stomachache, jumping
headaches, exhaustion, near death, sadness, grief, intolerance, selfdoubt, low self-esteem, reconciliation, fairness	panicked alert, self-doubt, low self-esteem, lack of learning, thrill, headaches, near death, grief, fairness,	away, lack of learning, burnout, insanity, headaches, near death, grief, loss of energy, fairness	through hoops, headaches, near death, grief, painful feedback, self-doubt, low self-esteem, desire to run away, lack of learning, confidence
2. Those Who Give it to Those Who are Susceptible (The Harmers)			
Crying, fear, emotional exhaustion, conniving, tactical, pride, large and in charge, chest pounding, superiority, openness, being torn, fun, deviance, happiness, superiority, control	Crying, fear, emotional exhaustion, conniving, tactical, pride, subjugation, selfabsorption, selfishness, isolationism, large and in charge, controlling, chest pounding, openness, being torn, superiority	Superiority, funny, embarrassing, crying, fear, emotional exhaustion, conniving, tactical, pride, subjugation, deviance, tactical, being in charge, large and in charge, chest pounding, self-absorption, being torn	Reflection, crying, fear, emotional exhaustion, conniving, tactical, benevolent, large and in charge, chest pounding, superiority, self-absorption, painful regret, pain and loss, excitement, pride, deviance, powerful, being in charge, being torn
2a Those who get it from AND give it to power/process/others (Susceptibles AND Harmers)			
	Bitterness, conflict, insult, superiority		

The Beneficiaries and Benevolents are the next pair of roles presented. The Beneficiaries, those who received good from others or the process/tools, realized changes in their experiences from the sensemaking and decision-making phases as compared to the planning and scanning phases, with a more mature, comprehensive, and self-controlled experience. The Benevolents, those who give good to others or the process/tools, do not realize any changes in their experiences across the four phases, experiencing benevolent superiority and passionate camaraderie. See 4 for a sample of the Beneficiary and Benevolent experiences across the four phases.

Table 4

Sample of Beneficiary and Benevolent Experiences, by Phase

3. Those Who Get Good from Others and the Process/Tools (The Beneficiaries)

Planning	Scanning	Sensemaking	Decision-making
Pride, flattery belonging, respect, relief, camaraderie, submission, painful satisfaction, passion, benevolent superiority, thrill, no intimidation, contribution.	Privilege, happiness, gratitude, camaraderie, enhanced focused/learning, humor, thrill, painful belonging, pride, benevolent	Honor, pride, camaraderie, humor, thrill, brutal selfconfrontation, energized, camaraderie, joy, enhanced focus/learning, powerful, committed,	Wariness, belonging, submission, painful passion, excitement, pride, benevolent superiority, thrill, camaraderie, enjoyment, shock,
	superiority, gratitude, pleasure, freedom	confidence, benevolent superiority, contribution	freedom, contribution, trust, joy
4. Those Who Give Good to Others and the Process/Tools (The Benevolents)			
Inspiration, excitement, awe, joy, impressed, deep involvement, uniqueness, comfort, pride, camaraderie, enlightenment, inspiration, friendship, flattery, eyes lighting up, gushing, affair of the heart, admiration	Awe, joy, deep involvement, uniqueness, pride, camaraderie, enlightenment, inspiration, friendship, eyes lighting up, gushing, affair of the heart.	Joy, pride, awe, impressed, deep involvement, uniqueness, overwhelm, dismay, pride, camaraderie, inspiration, flattery, eyes lighting up, gushing, affair of the heart.	Admiration, responsible, awe, joy, deep involvement, uniqueness, pride, camaraderie, enlightenment, flattery, amazement, eyes lighting up, gushing, affair of the heart.
4a Those who give to AND get good from power/process/others (Benevolents AND Beneficiaries)			
	Stress, pain, frustration, elucidation, reconciliation		

The Protectionists, those who protect themselves against those who can cause harm, also experienced more mature and self-controlled behavior in the sensemaking and decision-making phases as compared to the planning and scanning phases. Even though the sensemaking and decision-making phases are experienced as extremely tumultuous, the Protectionists still find benefit from them, and behave and interact with slightly more pride and dignity, as opposed to with primal wildness as in the planning and scanning phases.

Table 5

Sample of Protectionist Experiences, by Phase

5. Those Who Protect Against Those Who Can Cause Harm (The Protectionists)

Planning	Scanning	Sensemaking	Decision-making
Worry, fear, distrust, superiority, hopelessness, exhaustion, subjugated, deceived, ignored, backstabbing, belonging, rubber stamp, commitment to self, camaraderie, ambiguity, confidence, dominance.	Wariness, shyness subjugation, belonging, rubber stamp, commitment to self, camaraderie, superiority, uselessness, exhaustion, deceived, confidence, dominance, calculating, alliance building.	Overconfidence, wariness, shyness, subjugation, trials and tribulations, phony relationships, belonging, rubber stamp, camaraderie, superiority, uselessness, backstabbing, pride, calculating, alliance building	Empathy, wariness, shyness subjugation, threats, closed relationships, rubber stamp, commitment to self, camaraderie, superiority, uselessness, exhaustion, insult, backstabbing, dominance, angst.

The Susceptible Observers experience the planning phase with great intensity and shock, while the scanning and sensemaking phases are experienced with less shock and intensity, but still with concern and unhappiness. They experience the decision-making phase with concern and unhappiness, but also with a slight disconnection and control of a stranger. See Table 6 for a sampling of Susceptible Observer's experiences in each phase. The Harmer Observers did not have any experiences in the planning and scanning phases, and experienced the sensemaking and decision-making phases as nastiness, uselessness, and hopelessness. Also see Table 6 for a sampling of raw Harmer Observer experiences. The Protectionist Observers experienced all four phases with impatience, intolerance, and mild frustration. This concludes the response to sub question 2.1.

Table 6

Sample of Various Observer Experiences, by Phase

6a. Those Who Observe Others Getting it From Those Who Can Cause Harm (Susceptible Observers)			
Planning	Scanning	Sensemaking	Decision-making

Shock, amazement, dissatisfaction, unhappiness, empathy, pity, sympathy, dissatisfaction	Concern, pity, sympathy, empathy, conservatism, dissatisfaction	Concern, pity, sympathy, dissatisfaction, empathy, dissatisfaction	Nonchalance, disregard, concern, pity, sympathy, dissatisfaction, empathy, conservatism
6b. Those Who Observe Those With The Ability To Cause Harm Giving It To Others (Harmer Observers)			
		Uselessness, hopelessness, and subjugation.	Uselessness, hopelessness, and subjugation.
6c. Those Who Observe Others Protecting Against Those Who Have The Ability To Cause Harm (Protectionist Observers)			
Strategists and costrategists experience intolerance	Strategists and costrategists experience intolerance	Strategists and costrategists experience intolerance	Strategists and costrategists experience intolerance
Impatience, intolerance, and mild frustration	Impatience, intolerance, and mild frustration	Impatience, intolerance, and mild frustration.	Impatience, intolerance, and mild frustration.

Table 7

Sample of Various Observer Experiences, by Phase

6a. Those Who Observe Others Getting it From Those Who Can Cause Harm (Susceptible Observers)			
Planning	Scanning	Sensemaking	Decision-making
Shock, amazement, dissatisfaction, unhappiness, empathy, pity, sympathy, dissatisfaction	Concern, pity, sympathy, empathy, conservatism, dissatisfaction	Concern, pity, sympathy, dissatisfaction, empathy, dissatisfaction	Nonchalance, disregard, concern, pity, sympathy, dissatisfaction, empathy, conservatism
6b. Those Who Observe Those With The Ability To Cause Harm Giving It To Others (Harmer Observers)			
		Uselessness, hopelessness, and subjugation.	Uselessness, hopelessness, and subjugation.
6c. Those Who Observe Others Protecting Against Those Who Have The Ability To Cause Harm (Protectionist Observers)			
Strategists and costrategists experience intolerance	Strategists and costrategists experience intolerance	Strategists and costrategists experience intolerance	Strategists and costrategists experience intolerance
Impatience, intolerance, and mild frustration	Impatience, intolerance, and mild frustration	Impatience, intolerance, and mild frustration.	Impatience, intolerance, and mild frustration.

Research sub questions 2.2 and 2.3 are now addressed. Sub question 2.2 seeks how strategist and co-strategist experiences are interrelated, and sub question 2.3 seeks why strategist and costrategist experiences are as stated. Because these two sub questions are tacitly connected by the causes of experiences, i.e. answering how they are related (Q2.2) includes the reasons for their experiences (Q2.3), these two sub questions are answered together. There are two components of experience-interrelatedness: between and amongst the experiences themselves, and between and amongst the causes of those experiences. In fact, the first layer of experienceinterrelatedness has been partly provided by answering Q2.1 via the six behavior types or roles developed by exploring and discovering the interrelatedness between strategists/co-strategist, providing interrelatedness *within* each of those six behaviors/roles. Also, note that the process/tools are experienced as a unique and individual entity, as a strategist or co-strategist, with the same ability to cause harm, to be harmed, to give good, and to get good, although it cannot directly protect itself. Further, the Process/Tools (capitalized from this point forward to denote them as a role) are interrelated with the Protectionists, Susceptibles, Harmers, and Beneficiaries via several of their causes. To extrapolate, Protectionist experiences are due in part to their lack of trust in the Process/Tools during all phases, as well as interactions with Susceptibles and Harmers; Susceptible experiences are due in part to the complexities, difficulties, and tumultuous nature of the Process/Tools during all phases, as well as interactions with Protectionists and Harmers; and Harmer experiences are due in part to the tumultuous nature of the Process/Tools during the first two phases (i.e. planning and scanning), as well as interactions with Susceptibles and Protectionists. This interrelatedness of the Process/Tools with the other roles was established by examining strategist/co-strategist experiences with the possibility of being related to the Process/Tools to confirm such interrelatedness. For example, *being included but ignored* was deemed unrelated to the Process/Tools, whereas *complexities and difficulties with the process* was deemed related. Accordingly, Figure 2. The Behaviors/Roles and Their Interrelatedness presents the second layer of experienceinterrelatedness by visually depicting relationships *between* the types of behavior/roles (including the process/roles). Note that Figure 2. The Behaviors/Roles and Their Interrelatedness presents a direct interaction between the Beneficiaries and Benevolents, and between the Susceptibles and Harmers, but that there is no direct interaction between those two groups. Also note that there is bidirectional and direct interrelatedness between and amongst Protectionists, Susceptibles, and Harmers.

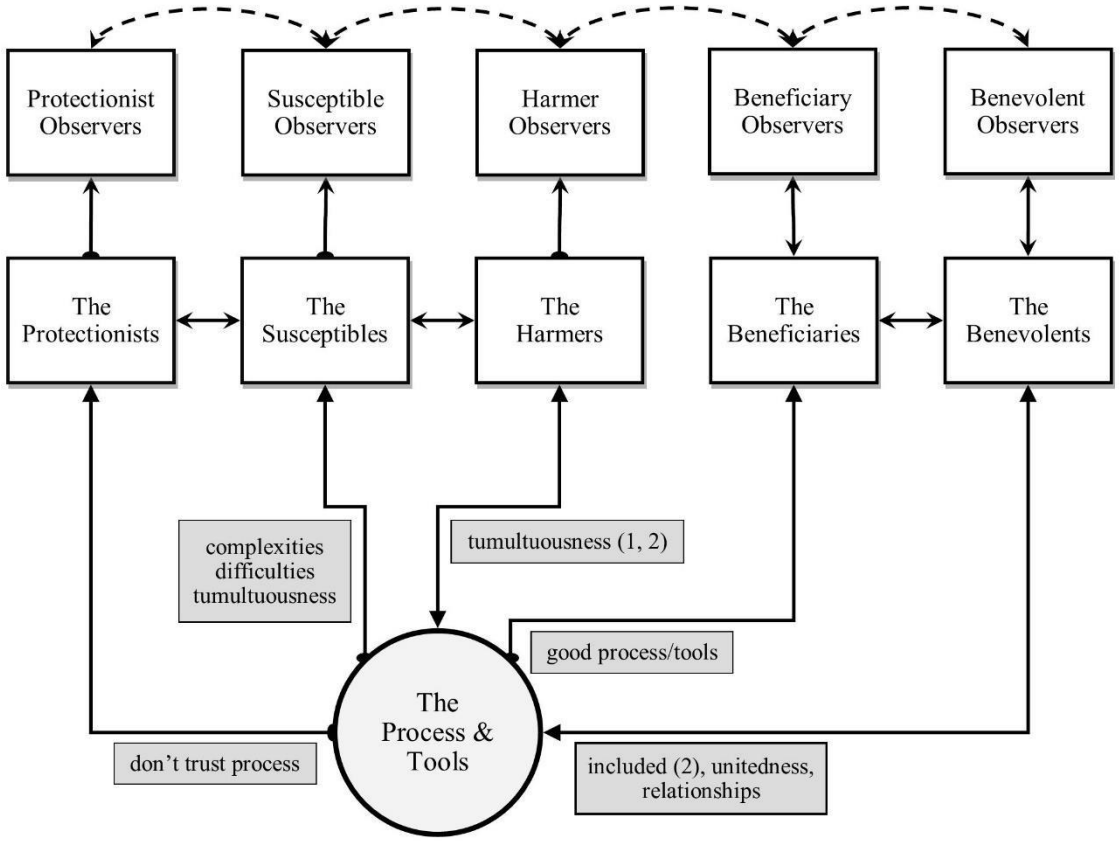

Figure 2. The Behaviors/Roles and Their Interrelatedness

Notice the arrows used between the players: a solid black line indicates a direct relationship; a dotted black line indicates an indirect relationship; bidirectional arrows indicate two-way relationships; and unidirectional arrows indicate a one-way experience/relationship. Also apparent from Figure 2 is all Observers have indirect and bidirectional relationships between and amongst themselves. Additionally, this principal investigator added two observer roles: Beneficiary Observer and Benevolent Observer. Although these two roles were not the primary focus of any statements of experience, they were secondary or tertiary within numerous statements of experience or their contexts. Finally, these six behaviors/roles actually represent one human being, i.e. one strategist or co-strategist. To extrapolate, although it is theoretically possible for one strategist/co-strategist to embody only one behavior/role, such as a Protectionist, results demonstrate that one person embodies multiple behaviors/roles at various times throughout the process, perhaps only minutes apart.

The causes of experiences was determined by reading and rereading the context of each statement of experience, which often included the paragraphs prior to and following the statements of experience, producing 25 different reasons for strategist and co-strategist

experiences. See Table 8 for a list of these causes and their operational definitions, and the count for each discovered in the experiences.

Table 8

Discovered Causes of Experiences

Cause of Experience	Operational Definition
Dishonesty & deceit	The deliberate use of lies and deceit in order to achieve personal, departmental, or organizational needs and desires
Protectionism	Engaging in everything from avoidance to acquiescence in order to protect oneself from others or the process/tools
Tactical control	Deliberate and premeditated planning and conniving carried out to control others or the process
Predetermined strategy	The conscious or unconscious adherence to an a priori developed strategy
Power & superiority	The direct, sometimes unfair, and usually counter effective use of hierarchical or institutional power and authority
Distrust process	Distrusting the process, especially inspired by nastiness, complexities and difficulties, and cognitive bias
Included & considered	Being sincerely included and considered in the process
Culture of fear	Being subject to an organizational culture of fear and dominance
Miscommunication	Direct and innocent miscommunication between strategists/co-strategists
Togetherness	*Exceptionally* positive, interconnected, and beneficial relationships/interactions with others
Emotional behavior	*Overly* emotional or unproductive behavior, as opposed to an appropriate amount of positive and sincere emotion
Using caution	Characterized as behavior utilized one protecting oneself from power and authority or others human nastiness
Alliance building	Creating a partnership with other individuals to protect oneself from others or the process/tools
Good relationship	The development of, or participation in, a positive and sincere relationship
Singularism	Holding and defending a singular review or position on anything, despite contradictory information or evidence
Resisting change	Resisting change proposed by leaders or the process itself
Nastiness or tumultuousness	Negative and deleterious experiences related to simple and plain nasty (animalistic) human behavior or tumultuousness from the process
Process first	Cognitive bias that puts the process, i.e. its steps and methods, before the good of the organization
Exclusion	Being purposefully and intentionally excluded from the process
No guidance	Intentionally or ignorantly not receiving any guidance from those in charge
Complexities	The natural complexities and difficulties of the process/tools
Forced strategizing	Being forced to strategize by someone or something

Pushing from weakness	Rising up from susceptibility to push aggressively against those who can cause harm or the process/tools
Timid & anti-conflict	Avoiding interactions and communications out of tepidness and the desire to avoid conflict
Good tool/process	Having a positive and beneficial experiences with the process/tool

Conclusions and Evaluation of Findings:

These roles and their interrelatedness between and amongst themselves and with their causes are characterized during the planning and scanning phases as dynamic, tumultuous, domination, abusive, benevolent, avoidance, and emotionally painful. During the sensemaking and decisionmaking phases, however, these roles are characterized as *intensely* dynamic and tumultuous with both emotional pain and physiological reactions, but also with, albeit seldom, more mature, cultured, refined, and beneficial behavior that can produce learning and improvement.

There are several, significant relationships between and amongst specific roles: the Harmers and Susceptibles are exceptionally interrelated by their experiences with each other; the Benevolents and Beneficiaries are also exceptionally interrelated by their experiences; all Observers are interrelated with each other and with the respective roles they observe; and the Process/Tools has unidirectional relationships with the Protectionists, Susceptibles, and Beneficiaries, having the ability to provide them harm or benevolence, and bidirectional interrelatedness with Harmers and Benevolents, having the ability to provide them both harm and benevolence, and receive both harm and benevolence, but does not have the ability to protect itself.

Concerning causes, *nastiness*, *complexities*, and *cognitive bias* are especially interrelated and influential, comprising all the causes of Susceptible, Harmer, and Observer experiences, and almost half the causes of Protectionists and their Observers. These causes therefore have a tremendous negative influence on those roles and the Process/Tools as well, via the Harmers; the Process/Tools then exert said influence back onto *all* roles. The causes of experiencing a *good process/tool* and *unitedness/togetherness* are also significantly interrelated and positively influential, comprising three of the four causes shared between Beneficiaries and Benevolents, and one additional cause of Beneficiaries. Finally, Protectionists are influenced by the relationship with Harmers and Susceptibles, which is partly how they learn to not trust the process (the other part comes directly from the complexities and difficulties of the Process/Tools itself). Once again, these causes are positively influential on these roles, albeit of a slightly smaller magnitude than the previous three causes mentioned, and on the entitative Process/Tools as well via the Benevolents, who once again exert said influence back onto *all* roles. Note that there are positive types of good and bad, and there are negative types of good and bad, and negative feelings or experiences are not always negative, i.e. they can be positive in terms of results. The cause of *avoiding the process* in some way is partly responsible for Protectionist experiences, along with *nastiness*, and Protectionist Observer experiences as well.

As previously stated, the only component not present in **Error! Reference source not found.** is the interrelatedness (with the experiences) in the context of the strategy formulation process. To that end, a phenomenological summary of the essence of strategist and co-strategist experiences, in terms of what was really being said and experienced, was written for each behavior type/role for each phase of the strategy formulation process. This was developed based on the experiences outlined in 4, 5, 6, and 7.

The Susceptible experiences are akin to an unsuccessful cage fighter, enduring punches in the gut, pokes in the eye, and stabs in the back; these experiences are obviously tumultuous, but become intensely tumultuous with physiological symptoms during the sensemaking and decision-making phases. Harmers experience the process as an especially authoritative king who connives and uses tactics via power and superiority to achieve his needs and desires at any cost, as well as the occasional episode of regret and sadness for such behavior; although these behaviors are already severe, they become even more extreme and nasty during sensemaking and decision-making. The Beneficiaries experience the planning and scanning phases like a toddler receiving candy, with all the accompanying pride, excitement, and thrill; these experiences become slightly more mature and beneficial during the sensemaking phase, characterized by selfreflection and learning, and becoming even more dynamic yet beneficial during the decisionmaking phase. The Benevolents experience the process like a 16th century pope, with benevolence, superiority, and passionate camaraderie equally across all phases. The Protectionists experience the strategy formulation process like a hunted animal who will do anything to survive, including hiding, peacefully submitting, or even attacking; these experiences become more mature and cultured (imagine a proud and majestic tiger being hunted as opposed to a wolf), and even beneficial, during the sensemaking and decision-making phases. Susceptible Observers describe their experiences as: witnessing a terrible crime, never to interfere or be forgotten, in the planning phase; a friend witnessing another friend's nasty family argument, with unhappiness and sympathy, in the scanning and sensemaking phases; and witnessing a complete stranger's nasty family argument, with a slight amount of nonchalance or disregard, in the decision-making phase. Harmer Observers do not have any experiences in the planning and scanning phases, and experience the sensemaking and decision-making phases like a child witnessing a nasty family argument. Finally, Protectionist Observers experience all phases equally, with frustration and intolerance. Once again, these are simple summaries of experiences, and **Error! Reference source not found.** contains the full phenomenological descriptions of strategist and co-strategist experiences.

These experiences describe the planning and scanning phases, generally speaking, as dynamic and tumultuous with domination, abuse of people and the entitative Process/Tools, shock, avoidance, emotional pain, and some kindness. They describe the sensemaking and decisionmaking phases, generally speaking, as *intensely* dynamic and tumultuous, with domination, abuse, shock, some kindness, greater maturity, refinement of behavior, tolerance or resiliency, as well as some small amount of personal and organizational enhancement or benefits.

All necessary information is now realized for theory development. Therefore, the final step in the prescribed phenomenological analysis is clarification of the entire phenomenon in written form to capture its entirety, resulting in the theory of strategy formulation that represents its complex social nature. This phase was not achieved by simply connecting the dots between relationships, but rather the primary investigator immersed himself once again into the process as a co-strategist, bracketing his personal biases, and experiencing what the strategists and costrategists experience, including the context and the reasons for stated experiences. This written form *describes* the phenomenon, including the strategy formulation process and experiences specific to each individual phase and with the Process/Tools, and *explains* the phenomenon, including the interrelatedness of said experiences, and their respective underlying causes. In order to achieve the practice-theory pillar of this study, the theory has been reified via components of an allegory, as opposed to conceptual and nebulous academic language.

The Theory of Phenomenological Strategy Formulation (TOPS) states the strategy formulation phenomenon is a tremendously tumultuous and dangerous journey into the unknown by a strategy team, characterized as a tribe seeking to ensure their survival and achieve an advantage over other tribes, accompanied by a Process/Tools that is also a member of the team. However, this member cannot be seen or touched, and is poorly understood, but nonetheless exists alongside the other members, having the ability to both ensure their survival with great bounties, which makes the journey enticing, or simply crush them via cannibalism. Unfortunately, the process becomes even more intense and tumultuous as it comes closer to completion, where individual, group, and organizational destinies are determined, and therefore shortsighted tribesmen scratch and claw in spurious and damaging attempts to ensure their survival. However, it is possible to survive and gain advantage over other tribes; the key is training on: complexities and difficulties with the process (the definition of strategy, the theoretical process, and the use of tools); biased human behavior (relationship bias in individuals and groups); instinctive human characteristics (instinctive bias, information processing capabilities, and cognitive limitations); and the assumptions of phenomenology versus positivism. As stated, it is possible to survive and gain advantage, but doing so implies use of this deep and wide training with perspicacity and fidelity.

Tribal members are not always nasty and aggressive: sometimes they are loving and kind, sometimes ill managed by leaders, and yet are bound together by the need for survival, therefore making the process inescapable. Making proper use of the Process/Tools requires team members to truly comprehend its breath and depth, which represents a near impossibility for the average organization. This means first overcoming their natural animalistic nastiness and primal cognition. Since this is extremely unlikely, behavior becomes an instinctive, biased pursuit of achieving shortsighted personal survival. Therefore, tribesmen who have the *ability* to cause harm to others, or to use and control the Process/Tools in their favor, will do so in the interest of said shortsighted protectionism. It is also likely that those who have witnessed or experienced harmful nastiness will find a way to eschew the process in some manner, either by simply not taking the journey or perfunctorily going along for the ride. This is their method of

protectionism. Those who are victims of nastiness experience the equivalent of a poke in the eye, punch in the gut, or being stabbed in the back by their fellow tribesmen, which is sometimes too much to bear, inspiring the desire to simply run away; but they are essentially trapped within the tribe, dependent upon it for survival. Although less probable, those with the *capability* to do good for others or the Process/Tools might do so, which enhances the exceedingly powerful Process/Tools by reducing its complexities and increasing inclusion and unitedness – when the team members work together with sincerity and benevolence they are capable of better comprehending the Process/Tools, overcoming their own instinctive nastiness and biased cognition, and also overcoming nasty treatment by their fellow tribesmen. This is because benevolence includes others via unitedness and togetherness, which supports and facilitates more maturity, refinement, and composure in the process.

Therefore, TOPS portrays the phenomenon as simply too complex and dangerous for the average organization, as instinctive nastiness, biased cognition, and process/tool complexities and difficulties, which are all exacerbated by positivism, are simply too wide and deep to overcome, even with the average facilitator. Organizations that can spend time better understanding the complex process and tools, who can somehow prevent harm and therefore prevent emotional pain and physical symptoms from damaging the entitative Process/Tools, who can enhance those who have the ability to do good so that others will be included and work with unitedness and togetherness, who can convince those who want to avoid the process to somehow participate and contribute with sincerity, and finally who can convince those who observe nastiness, poor cognition, and complexities with the process to somehow not seek protection, but rather to participate and contribute with sincerity… those who can do all that will grow and learn, achieving enhanced personal and organizational states.

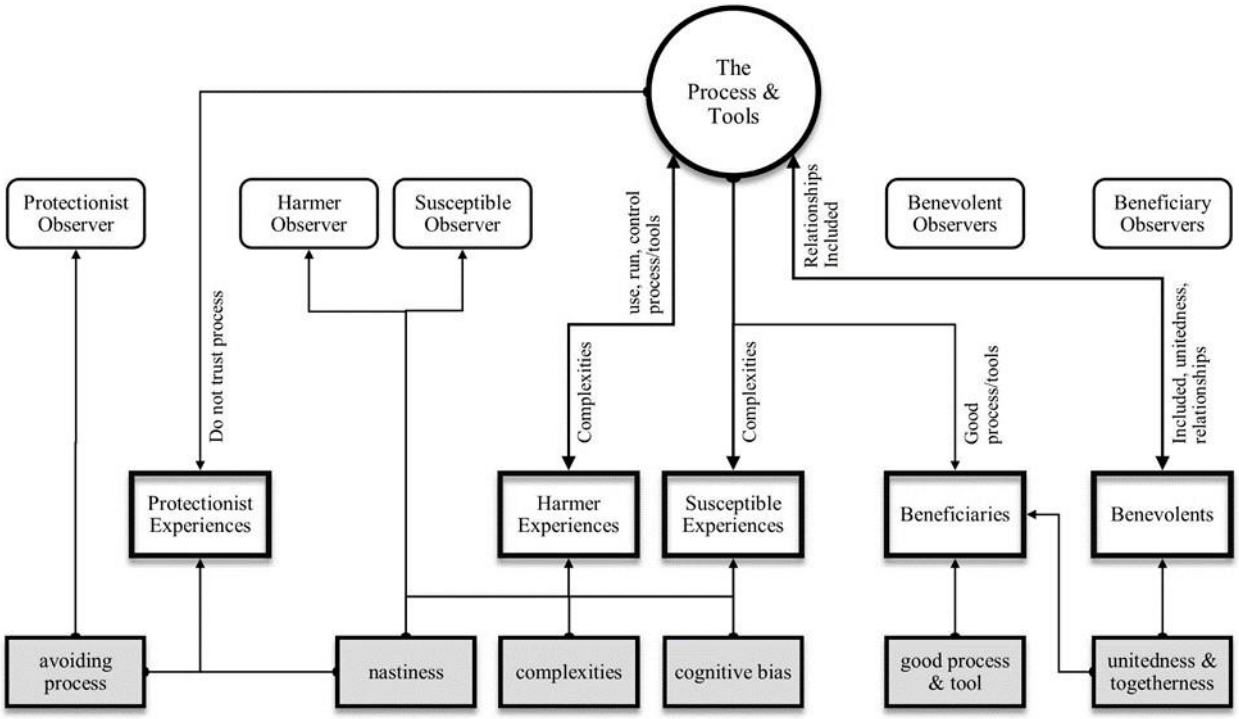

Figure 3. Causes of Experiences, and Interrelatedness of all Roles

The specific problem addressed by this study is the misalignment between strategy's current philosophical worldview, described as positivism, and its true nature, described as a complex social activity. The purpose of this systematic review, augmented by phenomenological and root cause analyses, was to develop a practice theory of strategy formulation that represents its complex social nature, thereby providing the appropriate philosophical lens through which all strategy researcher and practitioner thinking, behaviors, and activities may be performed. Recall that *practice* theory emphasizes emotion, cognition, human agency, and solving a problem, as opposed to *social* theory, which emphasizes the human mind and discrete elements (Blacker & Regan, 2009; Fisher & Stenner, 2011; Sandberg & Dall'Alba, 2009; Sandberg & Tsoukas, 2011). The problem was solved by discovering and identifying the true theoretical process of strategy formulation, including its phases, steps, and activities, which consolidate, support, and expand the extant theory and fragmented thoughts in the literature. Therefore, the ingrained researchpractice-research cycle of positivism now has the reasonable possibility of being broken. The ambitious purpose of this study was achieved via development of TOPS, which *explains* and *describes* how the process is experienced, the roles embodied by strategists and co-strategists, the causes of said experiences and behaviors, and the interrelatedness between all the aforementioned in a manner comprehensible and usable by practitioners. These results demonstrate that the current consequences of the strategy formulation process (i.e. cognitive bias, inapplicable tools, and unreliable and degraded organizational performance) may now be significantly ameliorated.

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EXPLORING WEB AND MOBILE DEVELOPMENT KNOWLEDGE, SKILLS AND ABILITIES: A CONSENSUS-BASED PILE SORT METHODOLOGY

Sam Wainford, Georgia Southern University
samwainford@georgiasouthern.edu

Adrian Gardiner, Georgia Southern University
agardine@georgiasouthern.edu

Cheryl Aasheim, Georgia Southern University
caasheim@georgiasouthern.edu

Paige Rutner, Texas Tech University
paige.rutner@ttu.edu

ABSTRACT

The increasing use of mobile devices, availability of wireless Internet, and growing consumerism on the web have created a need for information technology workers with the knowledge, skills and abilities to meet the demand for responsive websites and mobile applications. The proposed research will analyze a corpus of job advertisements—using both automated and non-automated methods—to provide a contemporary review of the most in-demand web and mobile development job skills. The results of this study can be used by educators in designing curriculum that address the current needs of industry in terms of information technology workers.

INTRODUCTION

With the explosive growth in mobile device adoption and increasing availability of wireless Internet, accessing the web through mobile devices is becoming common. Indeed, Americans today are using mobile devices more than personal computers to access the Internet [13]. Nearly two-thirds of Americans now own smartphones [16] and 7% of Americans exclusively depend on the smartphone for Internet access. The trend of mobile internet access is driving a need for websites with a responsive design — websites that can adapt to a variety of devices and mobile technologies. It is therefore not surprising that many companies are seeking to employ more workers with the knowledge, skills and abilities (KSAs) in areas such as website design and development, and mobile technologies.

Although web and mobile technologies (WMT) are increasingly important, with the majority of software development jobs expected to be within the web context [6], academic research and curriculum development may lag behind the needs of industry. A recent review of conference papers presented at two education-focused ACM Special Interest Groups meetings (SIGCSE and ITiCSE) found that only 1.5 percent of papers presented in the prior decade pertained to teaching web development, with only 17 papers since 2005 [6]. In contrast, 65 papers had a focus on game-related topics, during the same timeframe. Connolly [6] came to the conclusion that it appears that the significant rise in web and mobile technologies within the workplace has not necessarily correlated with an increase in attention to this field by researchers and educators. Connolly [6] also had the foresight to predict that the web development environment was at the start of a new cycle of change, making the case that educators will be hard-pressed to update their curricula to include the breadth of additional, essential technologies and skills that will be in demand going forward.

The growing importance of WMT within the information technology (IT) workplace raises a number of issues in terms of educating students who can fulfill such roles: 1. What are the expected core KSAs of employees within the WMT field?; 2. What is the state of education in meeting the demands for WMT-related KSAs? These issues have motivated the authors to investigate WMT-related KSAs, based on a content analysis of job advertisements for positions within the WMT field. Specifically, to analyze the corpus of jobs advertisements, we make use of both automated and non-automated methods, with the non-automated method being the application of a consensus-based pile sort methodology.

The research extends previous studies on WMT-related KSAs. It also narrows the focus on IT skills gap research to the web and mobile areas. First, we present a brief overview of these research streams, as well as job advertisement content analysis. Next, the methodology section discusses the consensus-based pile sort method as an extension of traditional pile-sort. A description of the initial data collection is then presented, followed by a description of future analysis. Finally, the paper closes with a brief discussion of anticipated results and contribution.

LITERATURE REVIEW

Evolution of IT KSAs

There is a long history of researchers investigating IT-related workplace skills valued by employers and their alignment to IT program curricula. Trauth, Farwell, and Lee [21] recommended that industry and academia work together to address the "expectation gap" identified between industry needs and academic preparation. IT researchers have revisited this issue many times since finding that, as one might expect, the specifics of desirable technical IT skills have changed over the years. For example, COBOL was identified as one of the ten most valuable skills to learn in the 1990s [14], but is hardly mentioned today. In contrast, a more recent study found growing importance in skills relating to web applications, security, data management, mobile commerce and wireless technologies [11]. New technologies, such as HTML5, CSS3, jQuery, responsive design, CSS frameworks, Android and iOS development that were nowhere in our vocabulary just a few years ago [18] are now among the fastest growing job trends. Five of the top ten keyword trends are directly related to mobile web development with HTML5 reported as "the fastest growing keyword found in all online job postings" by *Indeed.com* in mid-2014. Moreover, Smith and Ali [17] determined newer programming languages, Python and Ruby, were identified as trending upwards, as were newer web development technologies of HTML5, CSS3, JQuery and PHP [18]. Smith and Ali [18] pointed out that the skills needed for web development are vastly different from those needed for standard computer programming.

While technical skills desired by employers have changed over the years, a consistent finding in IT workforce KSA research has been an emphasis on the need for strong business and interpersonal skills as well as desirable personal traits [10] [12] [24]. These findings have been reported in studies seeking opinions from many stakeholders including: IT managers [12], system users and consultants [10], and IT professionals [24]. For example, a recent longitudinal study asked IT managers to identify important KSAs of IT workers. Employers that were surveyed consistently valued the interpersonal skills and personal traits above technical skills with honesty and integrity ranked most highly [1] [2]. Given that the need for soft skills and desirable personal traits are well known, we have chosen to focus the proposed research study on the rapidly changing technically-oriented WMT skills.

Job Advertisement Research

One research approach that has been used often to gain insight into industry needs is content analysis of IT professional job advertisements. However, both the source of job advertisements to be analyzed and the methods used have changed over time. Seminal work in this area examined print newspaper advertisements for mention of specified skills [20]. Other researchers have drawn job advertisements from trade journals

and online job-posting sites [22], whereas others have investigated skill requirements by performing a content analysis of data collected from job ads posted on the websites of large Fortune 500 corporations [9]. Unlike studies assessing stakeholders' opinions of IT skill importance, studies of job ads have, in general, found they focus more on technical skills over business and interpersonal skills [20]. As such, job advertisements represent a valuable data resource for the proposed study of WMT KSAs.

While the KSA studies previously mentioned drew job advertisements from a variety of sources, they have generally conducted their analyses by tabulating the number of times specified skills (typically from a priori lists based on previous literature) are mentioned in job ads. As technology has progressed, some researchers have introduced more sophisticated methods for investigating job advertisements. Smith and Ali [17] used an automated data mining process based on predefined keyword indexing for classification of searches to extract data from over 80,000 job ads posted on the online job agency *www.dice.com*. Data was gathered for comparison to identify trends and scarcity of talent to guide curricula. Sodhi and Son [19] developed a computer-based content analysis method to infer employers' skill requirements by analyzing over 1,000 online job ads. Although their study focused on operations research jobs, they developed a replicable empirical method to create a hierarchical taxonomy of related words and phrases to form discipline-specific categories of skills. Sodhi and Son [19] noted that tracking the changing needs of employers is useful for HR consultants who want to know which skills employers desire as well as for university program directors concerned with updating curricula. In this paper, we contribute to this stream of literature by employing a methodology that is designed for examining a content domain where key terminology is emerging or undergoing rapid change.

METHODOLOGY

Pile Sort Method

The pile-sort method [5] has been applied in anthropology as a method for cultural domain analysis [3]. Examples of domains that have been studied include color terms, kinship terms, diseases, plant terms, animal terms, airplane piloting errors, kinds of pain, and characteristics of infant feeding methods [23]. In one variation of the pile-sort method, individual 'informants' are first asked to place a set of terms into piles that contain similar items. In an unconstrained sort, there is no limit on the number of piles the informant can create [23], but an informant may be asked to place each term into only a single pile. Once an informant has completed the pile-sorting, an item-by-item similarity matrix is tabulated reflecting the co-occurrence of items across piles. These matrixes can then be aggregated across informants to derive a pooled proximity matrix. From these summaries, a spatial representation of the aggregated differences may be generated (e.g., using multi-dimensional scaling). While the traditional pile-sort method has been described as a 'simple' and 'compelling' method [4, p. 233], several researchers have noted that aggregation of judgments may not be feasible when informants' proximity judgments vary widely [8] [15].

Consensus-based Pile Sort Method

Gardiner et al. [7] proposed a variation of the traditional pile-sort method in which researchers play the role of informants, and follow a specified protocol for deriving an aggregated matrix of similarity/dis-similarity judgments. In a traditional pile-sort task, informants are not allowed to interact; in contrast, following the consensus-based pile sort method, interaction between informants is not only encouraged, but considered mandatory to ensure the success of the pile-sort exercise. Gardiner et al. [7] argue that taking an interactive conciliatory approach to the pile-sort task will be a superior approach when the domain in question is ambiguous, fast changing, or potentially open to different interpretations by informants due to different knowledge sets or experience (i.e., when informants' proximity judgments may vary widely).

In the following sections, we discuss the details of data collection of WMT job ads that are subsequently used to generate a set of terms for analysis and the anticipated application of the consensus-based pile sort method to categorize those terms.

DATA COLLECTION AND PREPARATION

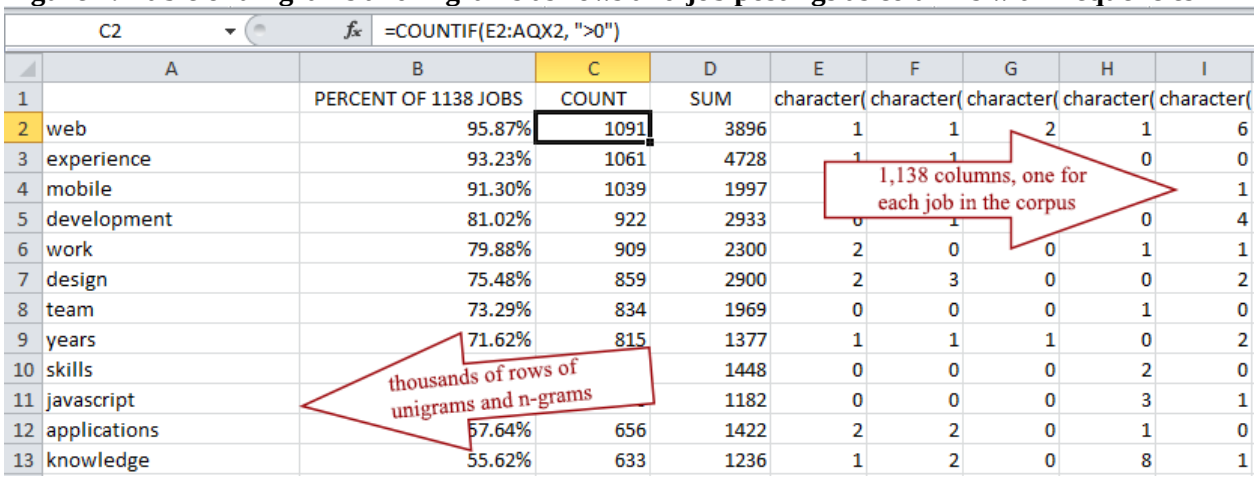
As of the writing of this paper, data collection has been completed. Job advertisements containing both the keywords *web* and *mobile* were sampled from *Indeed.com*, an online service that aggregates millions of job postings from thousands of companies. This sample was collected on June 12, 2015. The first 2,000 jobs containing the specified search terms were downloaded and analyzed.

The corpus of 2,000 jobs was examined to remove duplicate job ads and those with irrelevant job titles. Titles that included references to clerical assistance, sales, customer support, marketing, content editing or production, instruction or faculty positions, and graphic art production in which the primary job function did not involve IT skills, were removed. This resulted in 1,138 relevant job postings as the document corpus.

Using the corpus, an initial keyword dictionary was developed as follows:

1. A Python script utilizing the DOM aware Beautiful Soup library was run to cycle through the corpus of HTML files stripping the HTML markup, whitespace, and unnecessary content, and outputting them as text files with a consistent naming convention using a job number appended to the job title as the file name. For example: *Job_180 Frontend Developer*.
2. The R programming language, which is designed to explore datasets, was utilized to run a routine that removes punctuation and stop words, converts text to lowercase and performs stemming.
3. The R script generated a sparse n-gram matrix of keywords (unigrams) and phrases containing up to 8 words (n-grams) from the corpus of job descriptions. Terms are listed without using any pre-determined keywords or phrases.
4. This produced a table with rows for each n-gram token and columns for the frequency of their occurrence in each job description (see Figure 1). N-grams appearing in fewer than 2% of all job postings were removed by the R script. This resulted in 1,138 columns, one for each job, and 1,782 rows containing the terms and phrases.
5. The resulting unigram and n-gram tokens were reduced through judgment by making conceptual associations, resulting in 150 terms representing technologies and skills. This set of terms will be further analyzed using the consensus-based pile sort approach.

Figure 1: Table of unigrams and n-grams as rows and job postings as columns with frequencies



	A	B	C	D	E	F	G	H	I
1		PERCENT OF 1138 JOBS	COUNT	SUM	character(	character(	character(	character(	character(
2	web	95.87%	1091	3896	1	1	2	1	6
3	experience	93.23%	1061	4728	1	1		0	0
4	mobile	91.30%	1039	1997					1
5	development	81.02%	922	2933	0	1		0	4
6	work	79.88%	909	2300	2	0	0	1	1
7	design	75.48%	859	2900	2	3	0	0	2
8	team	73.29%	834	1969	0	0	0	1	0
9	years	71.62%	815	1377	1	1	1	0	2
10	skills			1448	0	0	0	2	0
11	javascript			1182	0	0	0	3	1
12	applications	57.64%	656	1422	2	2	0	1	0
13	knowledge	55.62%	633	1236	1	2	0	8	1

FUTURE ANALYSIS

Application of the Consensus-based Pile Sort Method to WMT Job Advertisements

Future steps in this research project will proceed using the consensus-based pile sort methodology [7]. This analysis method proceeds in multiple rounds. In the first round, multiple informants independently sort the derived terms into an initial set of suggested categories. During this stage, informants have the option of declaring a term unsuitable for any of the proposed categories, in which case, it is placed in an *Unsorted* category. At the end of this sorting round, there are likely to be some terms on whose category the informants unanimously agreed upon, and others for which researchers chose different categories. The sort results for concepts that the informants find unanimous agreement upon will then be used to refine the initial categories. Detailed definitions of the categories will be developed based on the meanings of the terms unanimously assigned to the category. This process may involve reference to the document corpus to ensure that the meaning of terms is clearly understood. If necessary, any of the proposed categories may be discarded, revised, or combined and new categories may be added.

Subsequently, a second round of sorting will be conducted using the refined categories. In the second round, only those terms for which there were previous sorting discrepancies are considered (i.e., terms that were unanimously assigned to a category in round one are not resorted). This sorting is done independently by all informants. Once completed, the sort results are tabulated and disagreements among the informants discussed and resolved (i.e. to arrive at consensus). This reconciliation process follows an established and replicable protocol including reference to the document corpus to resolve any ambiguity or misunderstanding in term usage. The end result should be a well-structured set of categories and terms representing the emerging domain captured in the document corpus. The authors anticipate that preliminary results from this analysis will be presented at the conference.

DISCUSSION AND FUTURE RESEARCH

The contribution of this research is expected to provide greater understanding of industry demand for WMT KSAs. It may help to provide university educators with an updated view of the skills and technologies most important for students to have to qualify for jobs in the web and mobile areas. Given the rapid changing nature of web and mobile technologies, the findings of this study can be used to guide curriculum development decisions IT-related disciplines.

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Forecasting the performance of hotel properties in the coastal section of Horry and Georgetown, South Carolina

Pierre Valdema, MBA, Class of 2015
E. Craig Wall Sr. College of Business Administration
Coastal Carolina University

L. Taylor Damonte, Professor/Director
Clay Brittain Jr. Center for Resort Tourism
E. Craig Wall Sr. College of Business Administration
Coastal Carolina University

Abstract

This study focuses on the performance of properties in the Coastal sections of Horry and Georgetown, South Carolina, with the objective of trying to forecast performance based on the weekly vacation rental reservations data that have been collected for the years 2011, 2012, and 2013. The reservation status data have been collected as far out as six-weeks prior the date of arrival. For this research, we compare six-week data forecasts with the actual hotel industry averages for this market. The main purpose was to determine if the weekly vacation rental reservations status data could be utilized to predict hotel industry performance results. In other words, the intent was to determine whether local vacation rental properties (VRPs) reservations data collected weekly for the past three years could be used to predict the actual average weekly occupancy rates for hotels located in Myrtle Beach, South Carolina.

Introduction

Tourism has a good impact on the local economy of Horry and Georgetown Counties. Myrtle Beach is one of the best East Coast family vacation destinations. Millions of people from all over the world visit this area every year. According to Cho (2003), “Forecasting plays a major role in tourism planning. The promotion of tourism projects involving substantial sums of money requires an estimate of future demand

and market penetration. The commitment to developing tourism would be much easier if it were possible to analyze current and past tourist traffic and predict the nature of changes in tourism demand". The accuracy of this research is important because it could help increase the hotel's revenues and profit margin.

Literature Review

For the purpose of this study, finding a good forecasting technique would play a major role in determining whether the six week forecasts could predict actual results reported in the Smith Travel Research (STR), a nationally recognized measurer of hotel industry performance. Julia (n.d.) mentioned, "Forecasting techniques can be categorized in two broad categories: quantitative and qualitative. The techniques in the quantitative category include mathematical models such as moving average, straight-line projection, exponential smoothing, regression, trend-line analysis, simulation, life-cycle analysis, decomposition, Box-Jenkins, expert systems, and neutral network". For the vacation rental properties, weekly data were collected from February 2011 to February 2013. A mathematical model was possible and appropriate for this study because VRP and STR data were collected in numerical formats.

Box-Jenkins Technique

According to Lin (2013), "Time-series models have been widely used in tourism demand forecasting literature with the dominance of the autoregressive integrated moving average (ARIMA) models". The Box-Jenkins Technique can also be named as the ARIMA modeling. This method can be used for time-series analysis and forecasting. "The term ARIMA is in short stands for the combination that comprises of Autoregressive/Integrated/Moving Average Model [12]. This model can be used when the time series data is in stationary state and there is no missing data within the time series data" (Ahmad & Ahmad, 2013). There are some data missing for certain weeks for the Vacation Rental Properties. This has happened either because

the source where the data should have been retrieved was not available or unavailability of weekly data during the last two weeks of December. In order to use this model there should be no missing data. For this reason, this method was not the best strategy for this study.

Trend-line Analysis

Gupta (2015) stated, "Trend analysis is a graphical representation of data over a period of time in order to predict the future. Trend-lines are used to extrapolate the data beyond the available data to forecast future values". The trend-line analysis could be useful for this study because it is easy to implement using excel. In excel, it is good visually, but it would not give any statistical verification on whether VRP is useful in predicting STR data. As noted by Stevenson (2012), As linear trend equation has the form y(t) = a + b(t) where

t = Specified number of time periods from t = 0

y(t) = Forecast for period t

a = Value of y(t) at t = 0

b = Slope of the line

Trend-line in excel should be able to display the equation in the form of y (x) = m (x) + b. It should also display the R Squared. If R squared is high (i.e. close to 100%), then we can assume VRP is a good predictor.

Exponential Smoothing methods

Stevenson (2012) mentioned in his book, "Exponential smoothing is a sophisticated weighted averaging method that is still relatively easy to use and understand. Each new forecast is based on the previous plus a percentage of the difference between that forecast and the actual value of the series at that point" (p. 80). This could be a good approach for prediction, but VRP data tends to have trend or seasonal pattern. The Exponential Smoothing methods would be more appropriate for forecasting data with no trend or seasonal pattern.

Regression Analysis

Regression analysis can be used to examine a relationship between two variables. According to Nau (n.d.), "Regression analysis is the art and science of fitting straight lines to patterns of data. In a linear regression model, the variable of interest (the so called "dependent" variable) is predicted from k other variables (the so-called "independent" variables) using a linear equation". This method is useful because it can be used to determine if the reservation status data have been collected, as far out as six-weeks prior the date of arrival, is useful in predicting the Smith Travel Research's hotel industry daily average occupancy. Regression analysis is easy to implement using excel. Similar to the Trend-line analysis, the regression analysis would display the R squared and the values of the equation y (x) = m (x) + b. Both methods (Regression and Trend-line analysis) could be used to verify the agreement on what has been done. For the purpose of this study, it appeared that Trend-line and regression analysis were more appropriate. They both could be implemented using Excel, which would decrease the amount of time to complete the analysis.

Analysis

The main purpose of the study was to determine whether local vacation rental property reservations data collected three times for each rental week for the past three years could be used to predict the occupancy rate for hotels located in Myrtle Beach, South Carolina. The VRP reservations data were collected weekly, whereas the STR data were gathered daily. The reservation status data were collected as far out as six-weeks prior the date of arrival. VRP reservations forecasts were divided into three observations of property status. The third sample was collected one week before the date of arrival, the second sample was collected two weeks before the date of arrival; the first sample was collected two weeks before the second sample, which was five weeks before the date of arrival. This approach allow researchers to provide nightly-lodging industry managers with a barometer of the relative demand for their services as early as six weeks in advance.

Data for Horry and Georgetown counties were retrieved from the vacation rental websites. Data collected from those websites were as follows: Maximum occupancy for either condo or house, sample units, sample bedrooms, bedrooms rented, asking price, and rental revenue. From the data collected we were able to calculate separately population units, sample units, sample units occupied, population bedrooms, sample bedrooms, sample bedrooms occupied, average weekly rate, and average percentage of occupancy for Horry and Georgetown counties. This was done for observation samples 1, 2, and 3 for both Horry and Georgetown counties each week. To prepare the data for analysis, data from Horry and Georgetown were added together. From this new table, we computed delta from the previous year for each week.

The STR data also needed to be re-formatted prior to analysis. We decided to compare VRP results against STR hotels' results for categories of properties based on the amount of meeting space. These categories included properties with no meeting space, properties with meeting space less than 2,500 sq./ft., and properties with meeting space greater than 2,500 sq./ft. The delta compared to the previous year was computed for each of these categories for each week.

Sample 1 - VRP vs. STR data (combined)

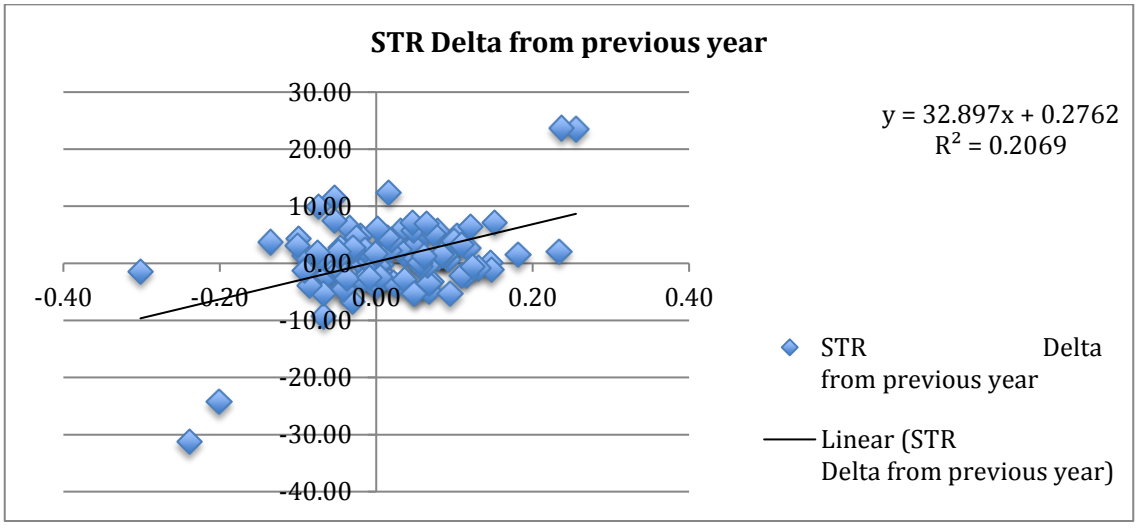

Figure 1.1 - Screen shot of VRP vs. STR data Scatterplots/trend line (1st Sample)

Linear Regression

Regression Statistics	
R	0.45
R Square	0.21
Adjusted R Square	0.20
S	5.71
Total number of observatio	105.00

3.8 = 0.2743 + 32.8721 * 0.09975483359513776

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	866.96	866.96	26.60	0.00
Residual	103.00	3,357.10	32.59		
Total	104.00	4,224.05			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	0.27	0.57	- 0.85	1.40	0.48	0.63	*No*
0.09975483359513776	32.87	6.37	20.23	45.51	5.16	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Figure 1.2 - Screen shot for linear regression analysis between VRP vs. STR data (1st Sample)

Sample 2 - VRP vs. STR data (combined)

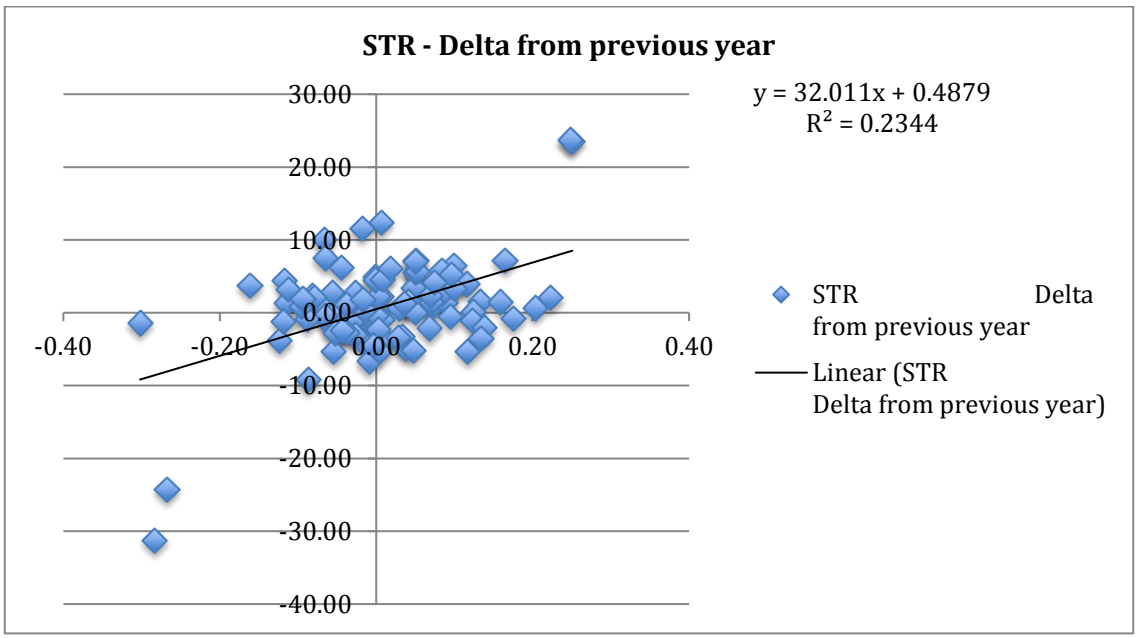

Figure 1.3 - Screen shot of VRP vs. STR data Scatterplots/trend line (2nd Sample)

Linear Regression							
Regression Statistics							
R	0.48						
R Square	0.23						
Adjusted R Square	0.23						
S	5.61						
Total number of observations	105.00						
3.8 = 0.4867 + 31.9976 * 0.09909330213512724							
ANOVA							
	d.f.	*SS*	*MS*	*F*	*p-level*		
Regression	1.00	983.36	983.36	31.25	0.00		
Residual	103.00	3,240.70	31.46				
Total	104.00	4,224.05					
	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	0.49	0.55	- 0.60	1.58	0.88	0.38	*No*
0.09909330213512724	32.00	5.72	20.65	43.35	5.59	0.00	*Yes*
T (5%)	1.98						
LCL - Lower value of a reliable interval (LCL)							
UCL - Upper value of a reliable interval (UCL)							

Figure 1.4 - Screen shot for linear regression analysis between VRP vs. STR data (2nd Sample)

Sample 3 - VRP vs. STR data (combined)

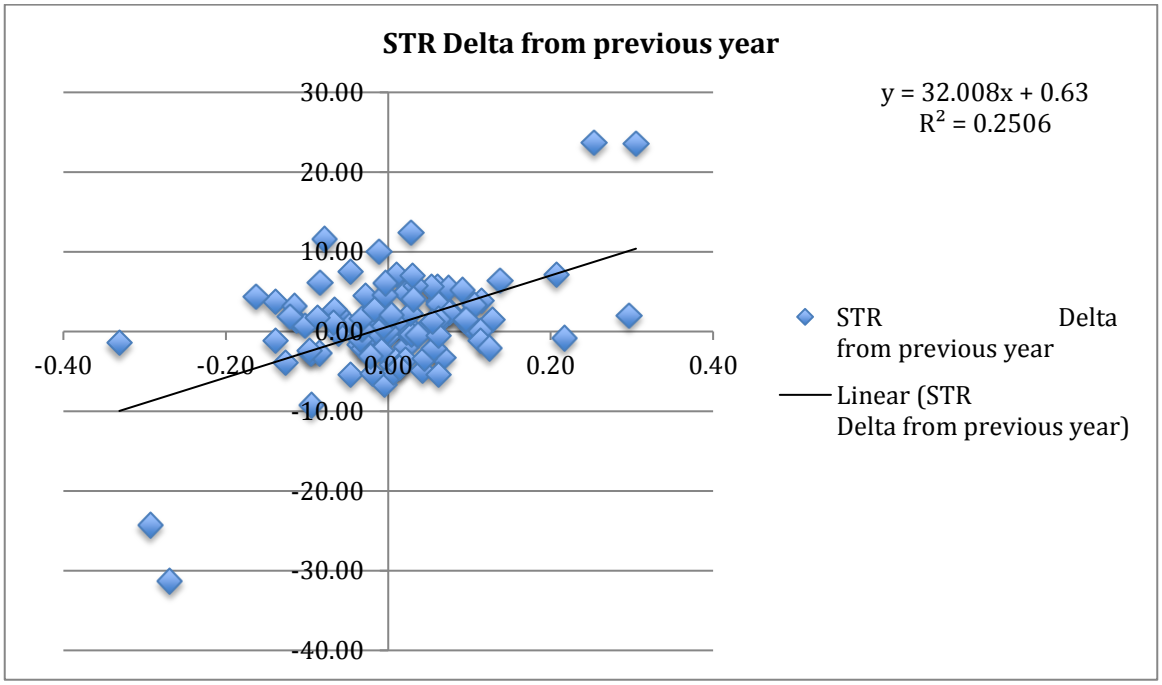

Figure 1.5 - Screen shot of VRP vs. STR data Scatterplots/trend line (3rd Sample)

Linear Regression

Regression Statistics	
R	0.50
R Square	0.25
Adjusted R Square	0.24
S	5.55
Total number of observations	105.00

3.8 = 0.6189 + 31.9425 * 0.06142146826557476

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	1,053.37	1,053.37	34.22	0.00
Residual	103.00	3,171.02	30.79		
Total	104.00	4,224.39			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	0.62	0.54	- 0.46	1.69	1.14	0.26	*No*
0.06142146826557476	31.94	5.46	21.11	42.77	5.85	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Figure 1.6 - Screen shot for linear regression analysis between VRP vs. STR data (3rd Sample)

Findings for Combined Analysis

The 3rd VRP observation sample (Figure 1.5 and 1.6) estimation appeared to provide the best a forecasting STR results. In Figure 1.1 and 1.2, the R Squared value was .20; in Figure 1.3 and 1.4, the R Squared value was .23; in Figure 1.5 and 1.6, R Squared value was .25. This was still a relatively low R Squared value, but as expected the third sample had the highest R Squared value.

Furthermore, we noticed the P-values in the regression analysis for Figure 1.2, 1.4, and 1.6 were all less than .05, indicating that the reservations status data could be utilized to predict hotel industry performance results even if the R Squared values were low in all three samples for the combined analysis.

Sample 1 - VRP vs. STR data with no Meeting Space

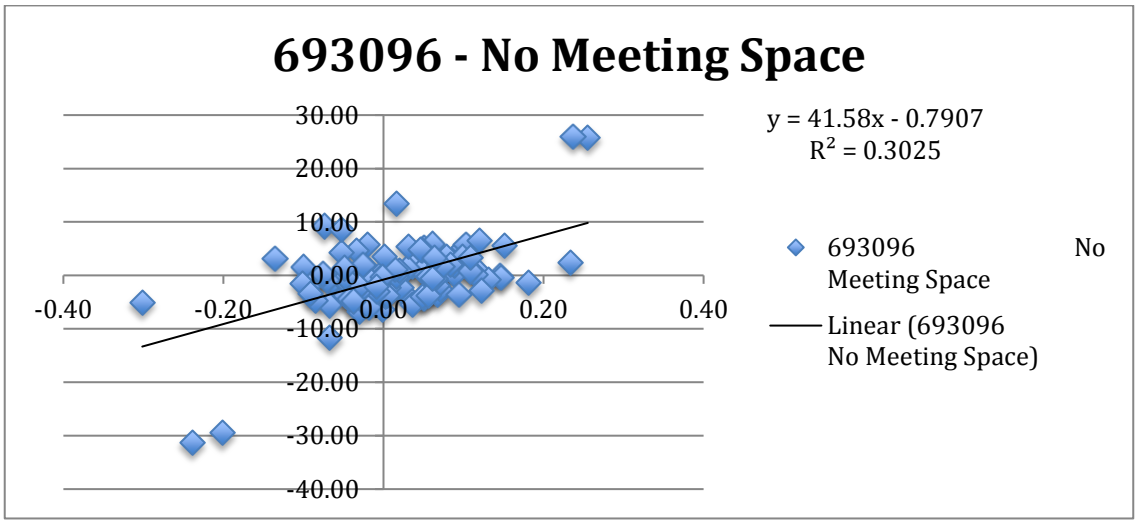

Figure 2.1 - Screen shot of VRP vs. STR data Scatterplots/trend line with no meeting Space (1st Sample)

Linear Regression

Regression Statistics	
R	0.55
R Square	0.30
Adjusted R Square	0.29
S	5.59
Total number of observatio	105.00

5.203440777736503 =- 0.8052 + 41.3866 * 0.09975483359513776

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	1,374.24	1,374.24	43.92	0.00
Residual	103.00	3,222.97	31.29		
Total	104.00	4,597.21			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	- 0.81	0.55	- 1.91	0.30	- 1.45	0.15	*No*
0.09975483359513776	41.39	6.25	29.00	53.77	6.63	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Figure 2.2 - Screen shot for linear regression analysis between VRP vs. STR data With no meeting space (1st Sample)

Sample 2 - VRP vs. STR data with no Meeting Space

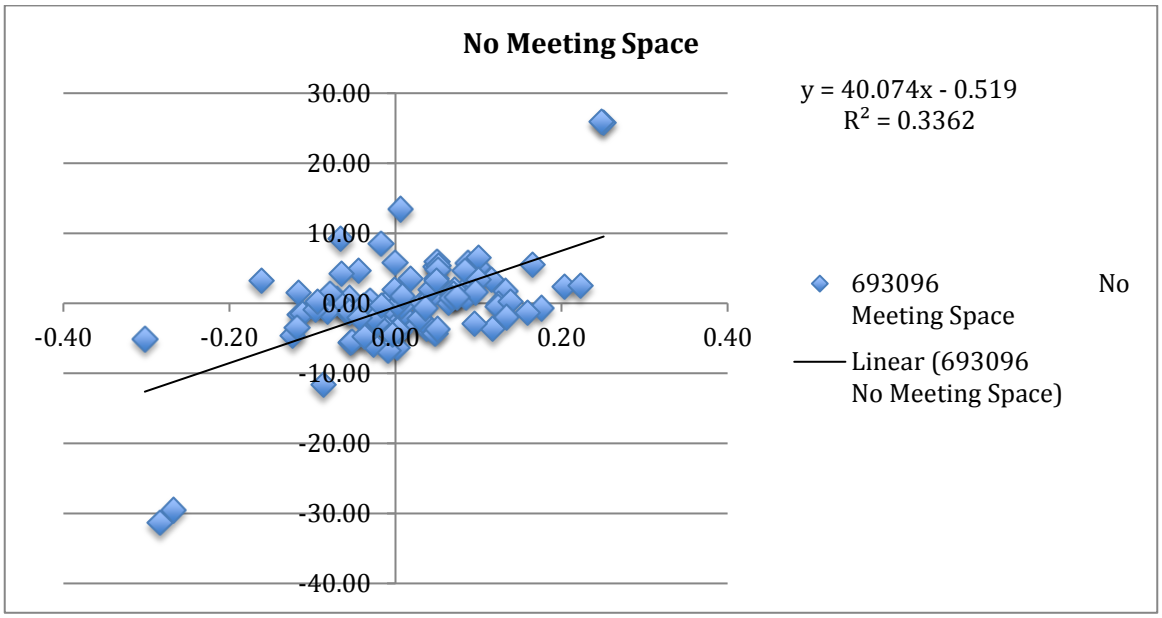

Figure 2.3 - Screen shot of VRP vs. STR data Scatterplots/trend line with no meeting Space (2nd Sample)

Linear Regression

Regression Statistics	
R	0.58
R Square	0.33
Adjusted R Square	0.33
S	5.46
Total number of observations	105.00

5.203440777736503 =- 0.5341 + 39.9112 * 0.0990933021351272 4

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	1,529.92	1,529.92	51.37	0.00
Residual	103.00	3,067.30	29.78		
Total	104.00	4,597.21			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	- 0.53	0.54	- 1.60	0.53	- 1.00	0.32	*No*
0.0990933021351272 4	39.91	5.57	28.87	50.95	7.17	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)
UCL - Upper value of a reliable interval (UCL)

Figure 2.4 - Screen shot for linear regression analysis between VRP vs. STR data With no meeting space (2nd Sample)

Sample 2 - VRP vs. STR data with no Meeting Space

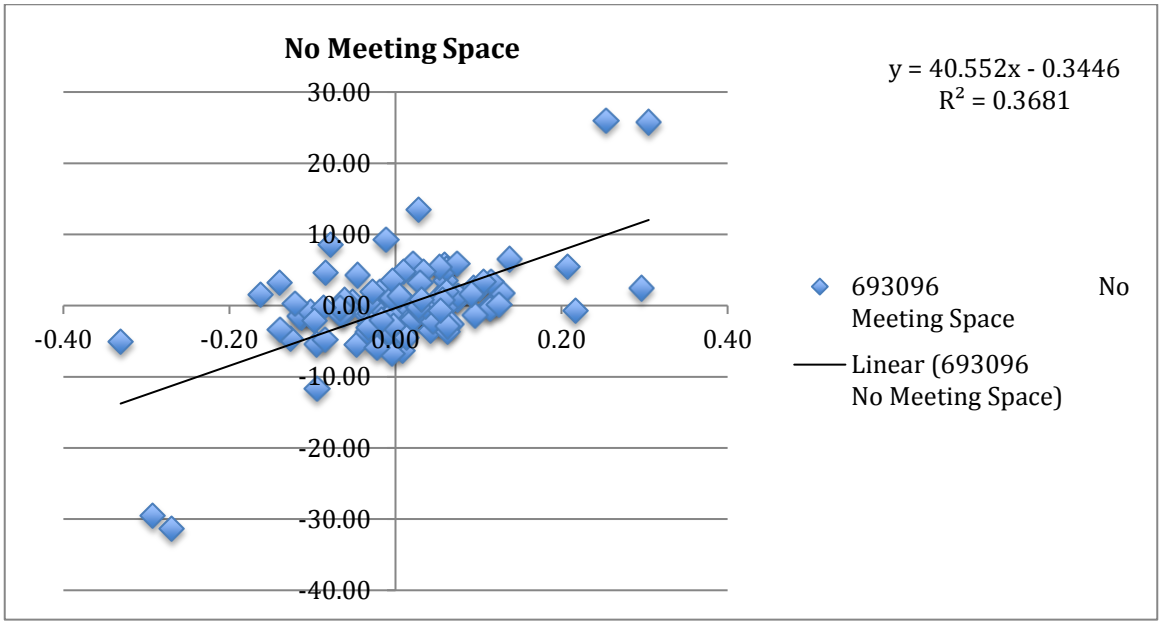

Figure 2.5 - Screen shot of VRP vs. STR data Scatterplots/trend line with no meeting Space (3rd Sample)

Linear Regression

Regression Statistics	
R	0.61
R Square	0.37
Adjusted R Square	0.36
S	5.32
Total number of observations	105.00

5.203440777736503 =- 0.3728 + 40.3862 * 0.06142146826557476

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	1,683.87	1,683.87	59.53	0.00
Residual	103.00	2,913.34	28.28		
Total	104.00	4,597.21			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	- 0.37	0.52	- 1.40	0.66	- 0.72	0.47	*No*
0.06142146826557476	40.39	5.23	30.01	50.77	7.72	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Figure 2.6 - Screen shot for linear regression analysis between VRP vs. STR data With no meeting space (3rd Sample)

Findings for Comparison of VRP vs. STR with no Meeting Space

Our expectation for this particular analysis was the same as the previous analysis. The 3rd sample (Figure 2.5 and 2.6) estimation was expected to provide a better estimate.

As can be seen, it appeared that our assumption was right. In Figure 2.1 and 2.2, the R Squared value was .30; in Figure 2.3 and 2.4, the R Squared value was .33; in Figure 2.5 and 2.6, R Squared value was .37. This also displayed low R Squared values again the third sample produced the highest R Squared value.

Furthermore, we noticed the P-values in the regression analysis for Figure 2.2, 2.4, and 2.6 were all less than .05 indicating that the reservations status data could be utilized to predict hotel industry performance results even if the R Squared values were low in all three samples for the combined analysis with no meeting space.

Sample 1 - VRP vs. STR data with Meeting Space < 2,500 sq./ft.

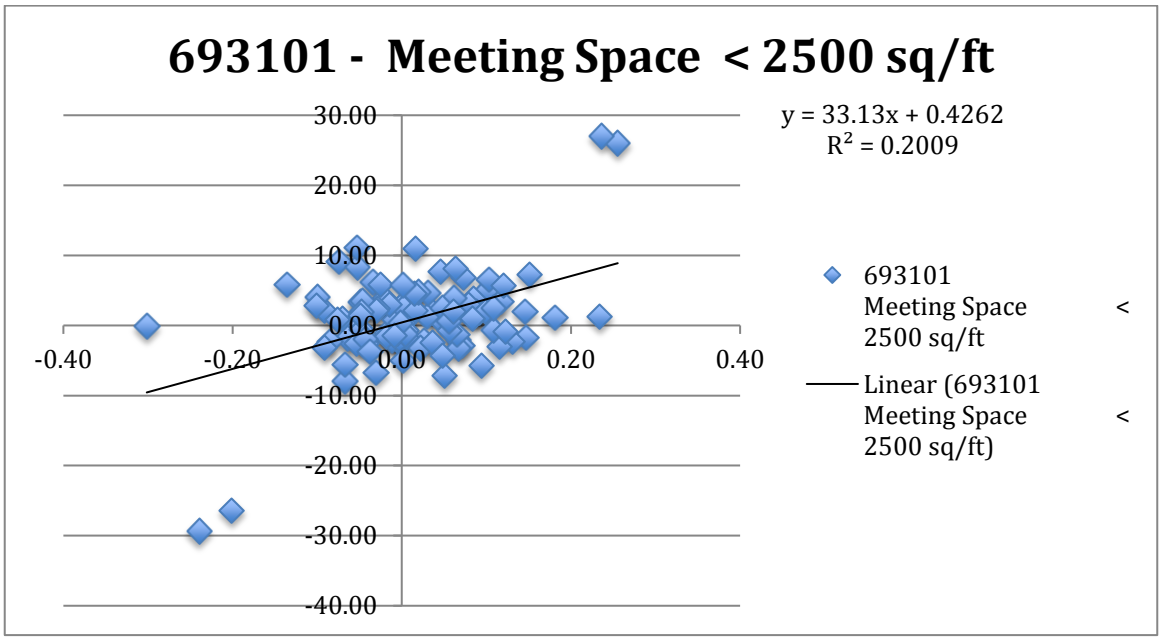

Figure 2.1 - Screen shot of VRP vs. STR data Scatterplots/trend line with meeting Space < 2,500 sq./ft. (1st Sample)

Linear Regression

Regression Statistics	
R	0.45
R Square	0.20
Adjusted R Square	0.19
S	5.86
Total number of observatio	105.00

4.920645647801987 = 0.4168 + 33.0060 * 0.09975483359513776

Plot Area

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	874.04	874.04	25.49	0.00
Residual	103.00	3,531.66	34.29		
Total	104.00	4,405.70			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	0.42	0.58	- 0.74	1.57	0.72	0.47	*No*
0.09975483359513776	33.01	6.54	20.04	45.97	5.05	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Figure 3.2 - Screen shot for linear regression analysis between VRP vs. STR data With meeting space < 2,500 sq./ft. (1st Sample)

Sample 2 - VRP vs. STR data with Meeting Space < 2,500 sq./ft.

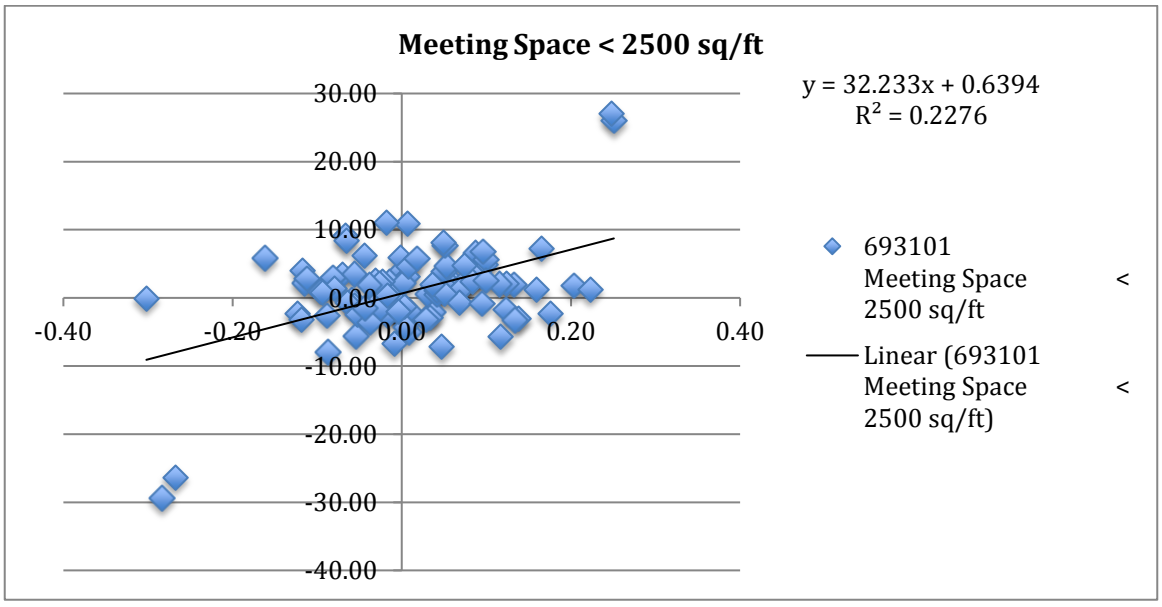

Figure 3.3 - Screen shot of VRP vs. STR data Scatterplots/trend line with meeting Space < 2,500 sq./ft. (2nd Sample)

Linear Regression

Regression Statistics	
R	0.47
R Square	0.23
Adjusted R Square	0.22
S	5.76
Total number of observations	105.00

4.920645647801987 = 0.6301 + 32.1318 * 0.09909330213512724

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	991.63	991.63	29.92	0.00
Residual	103.00	3,414.08	33.15		
Total	104.00	4,405.70			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	0.63	0.56	- 0.49	1.75	1.12	0.27	*No*
0.09909330213512724	32.13	5.87	20.48	43.78	5.47	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Figure 3.4 - Screen shot for linear regression analysis between VRP vs. STR data With meeting space < 2,500 sq./ft. (2nd Sample)

Sample 3 - VRP vs. STR data with Meeting Space < 2,500 sq./ft.

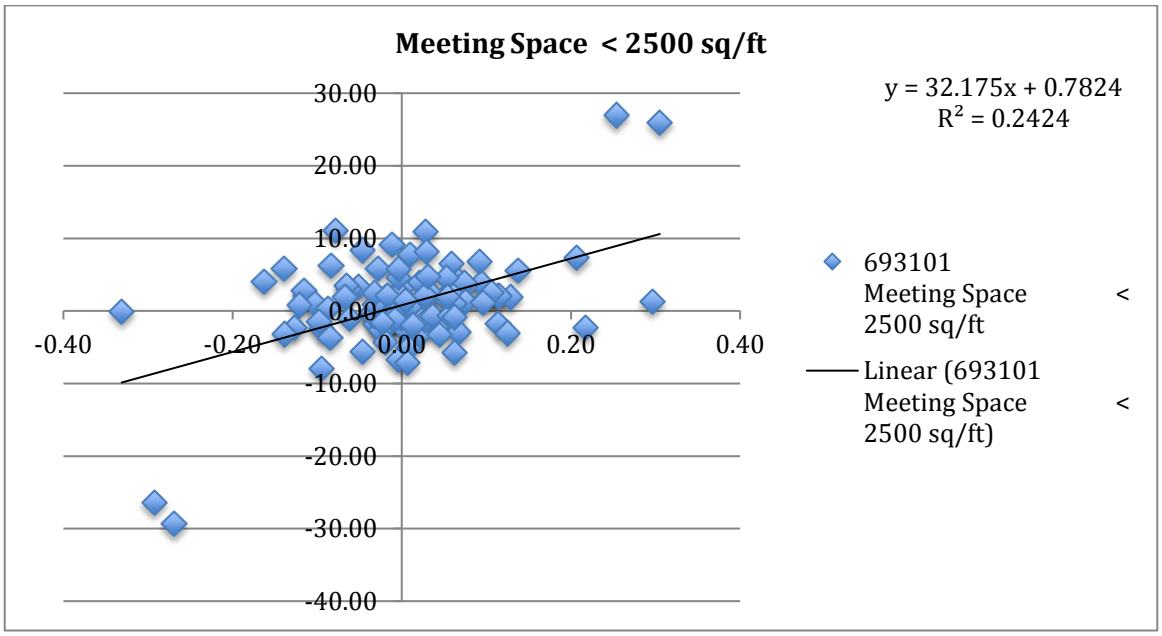

Figure 3.5 - Screen shot of VRP vs. STR data Scatterplots/trend line with meeting Space < 2,500 sq./ft. (3rd Sample)

Linear Regression							
Regression Statistics							
R	0.49						
R Square	0.24						
Adjusted R Square	0.23						
S	5.70						
Total number of observations	105.00						
4.920645647801987 = 0.7625 + 32.0579 * 0.06142146826557476							
ANOVA							
	d.f.	*SS*	*MS*	*F*	*p-level*		
Regression	1.00	1,060.99	1,060.99	32.67	0.00		
Residual	103.00	3,344.71	32.47				
Total	104.00	4,405.70					
	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	0.76	0.56	- 0.34	1.87	1.37	0.17	*No*
0.06142146826557476	32.06	5.61	20.93	43.18	5.72	0.00	*Yes*
T (5%)	1.98						
LCL - Lower value of a reliable interval (LCL)							
UCL - Upper value of a reliable interval (UCL)							

Figure 3.6 - Screen shot for linear regression analysis between VRP vs. STR data With meeting space < 2,500 sq./ft. (3rd Sample)

Findings for Comparison of VRP vs. STR With Meeting Space < 2,500 sq./ft.

Again, we noticed that our expectations were correct. In Figure 3.1 and 2.2, the R Squared value was .20; in Figure 2.3 and 2.4, the R Squared value was .23; in Figure 2.5 and 2.6, R Squared value was .24. This also displayed low R Squared values. However, It was noticeable that the third sample was more accurate because it had the highest R Squared.

In addition, we observed the P-values in the regression analysis for Figure 3.2, 3.4, and 3.6 were all less than 0.05. This implied that the reservations status data could be used to predict hotel industry performance results even if the R Squared values were low in all three samples for the analysis with meeting space less than 2,500 sq./ft.

Another thing that caught our attention was the fact that R Squared values for the analysis of VRP vs. STR with meeting space less than 2,500 seemed to be lower than the analysis of VRP vs. STR with no meeting space.

Sample 1 - VRP vs. STR data with Meeting Space > 2,500 sq./ft.

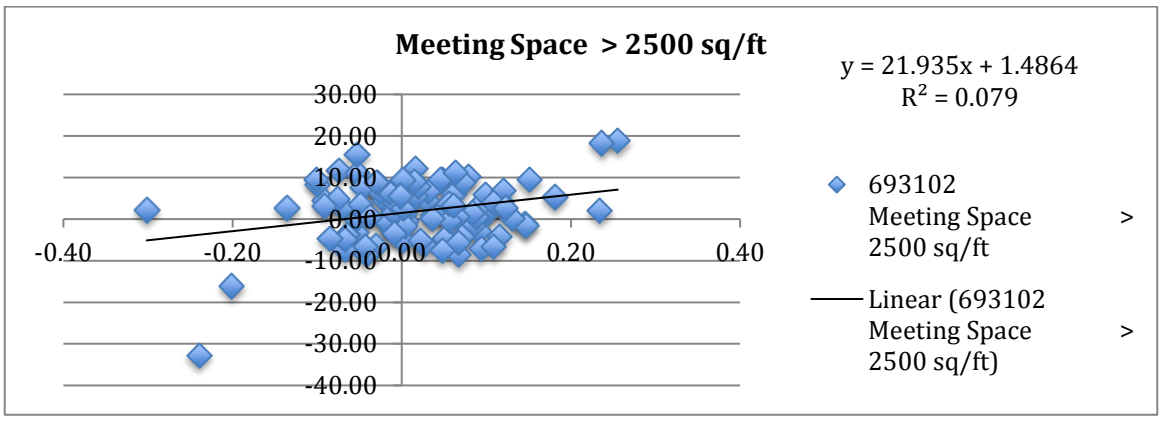

Figure 4.1 - VRP vs. STR data Scatterplots/trend line with meeting Space > 2,500 sq./ft. (1st Sample)

Linear Regression							
Regression Statistics							
R	0.28						
R Square	0.08						
Adjusted R Square	0.07						
S	6.63						
Total number of observatio	105.00						
1.24 = 1.5056 + 22.1896 * 0.09975483359513776							
ANOVA							
	d.f.	*SS*	*MS*	*F*	*p-level*		
Regression	1.00	395.04	395.04	8.98	0.00		
Residual	103.00	4,530.87	43.99				
Total	104.00	4,925.92					
	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	1.51	0.66	0.20	2.81	2.29	0.02	*Yes*
0.09975483359513776	22.19	7.40	7.50	36.87	3.00	0.00	*Yes*
T (5%)	1.98						
LCL - Lower value of a reliable interval (LCL)							
UCL - Upper value of a reliable interval (UCL)							

Figure 4.2 - Screen shot for linear regression analysis between VRP vs. STR data With meeting space > 2,500 sq./ft. (1st Sample)

Sample 2 - VRP vs. STR data with Meeting Space > 2,500 sq./ft.

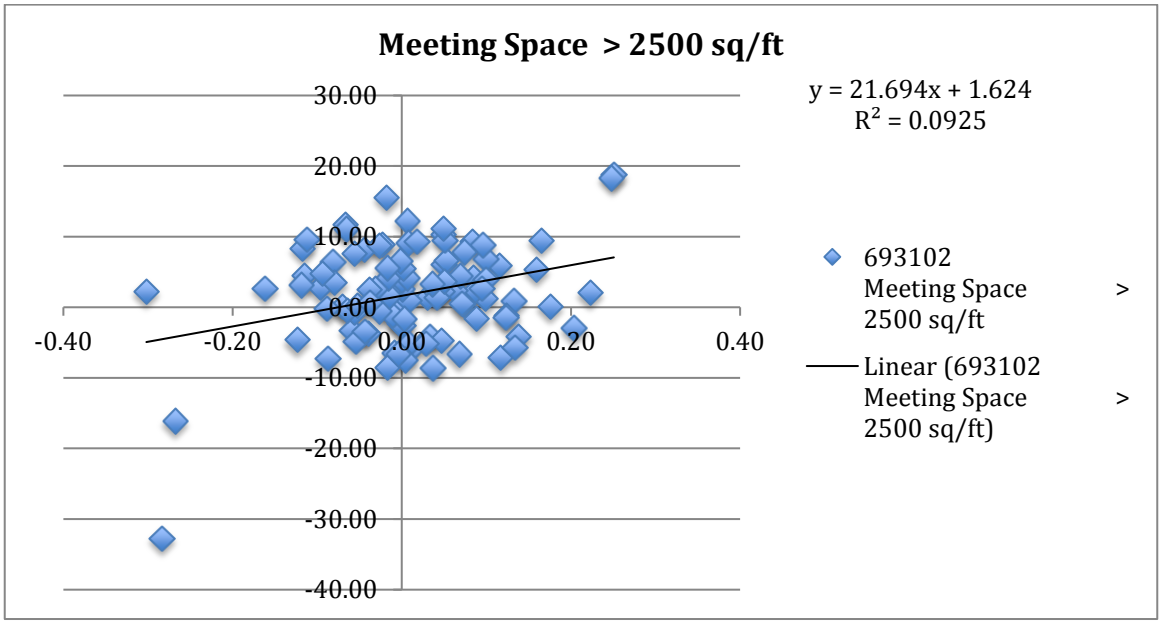

Figure 4.3 - VRP vs. STR data Scatterplots/trend line with meeting Space > 2,500 sq./ft. (2nd Sample)

Linear Regression

Regression Statistics	
R	0.31
R Square	0.09
Adjusted R Square	0.08
S	6.58
Total number of observations	105.00

1.24 = 1.6458 + 21.9302 * 0.09909330213512724

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	1.00	461.92	461.92	10.66	0.00
Residual	103.00	4,464.00	43.34		
Total	104.00	4,925.92			

	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	1.65	0.65	0.37	2.93	2.55	0.01	*Yes*
0.09909330213512724	21.93	6.72	8.61	35.25	3.26	0.00	*Yes*
T (5%)	1.98						

LCL - Lower value of a reliable interval (LCL)
UCL - Upper value of a reliable interval (UCL)

Figure 4.4 - Screen shot for linear regression analysis between VRP vs. STR data With meeting space > 2,500 sq./ft. (2nd Sample)

Sample 3 - VRP vs. STR data with Meeting Space > 2,500 sq./ft.

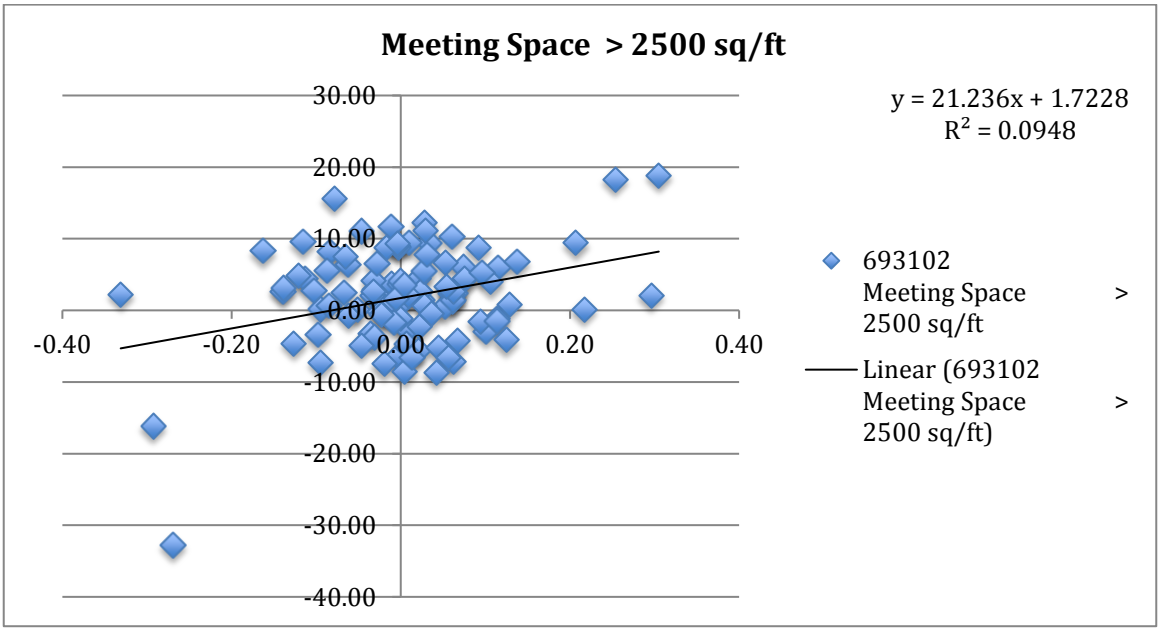

Figure 4.5 - Screen shot of VRP vs. STR data Scatterplots/trend line with meeting Space > 2,500 sq./ft. (3rd Sample)

Linear Regression							
Regression Statistics							
R	0.31						
R Square	0.10						
Adjusted R Square	0.09						
S	6.58						
Total number of observations	105.00						
1.241589958362177 = 1.7393 + 21.3325 * 0.06142146826557476							
ANOVA							
	d.f.	*SS*	*MS*	*F*	*p-level*		
Regression	1.00	469.82	469.82	10.86	0.00		
Residual	103.00	4,455.16	43.25				
Total	104.00	4,924.97					
	Coefficients	*Standard Erro*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%) rejected?*
Intercept	1.74	0.64	0.46	3.01	2.71	0.01	*Yes*
0.06142146826557476	21.33	6.47	8.50	34.17	3.30	0.00	*Yes*
T (5%)	1.98						
LCL - Lower value of a reliable interval (LCL)							
UCL - Upper value of a reliable interval (UCL)							

Figure 4.6 - Screen shot for linear regression analysis between VRP vs. STR data With meeting space > 2,500 sq./ft. (3rd Sample)

Findings for Comparison of VRP vs. STR
With Meeting Space > 2,500 sq./ft.

R Squared values regressing data in the three observations samples against the performance of STR properties having greater than 2,500 sq.ft. of meeting space produced the lowest R-square results, though still statistically significant at the .05 level. In Figure 4.1 and 4.2, the R Squared value was .08; in Figure 4.3 and 4.4, the R Squared value was .09; in Figure 2.5 and 2.6, R Squared value was .10. Consequently, results indicated that the VRP reservations status data could be used to predict hotel industry performance results of properties having greater than 2,500 sq./ft. of meeting space.

Conclusion

This study attempted to determine if local VRP property reservations data publically available on the Internet could be used to predict the occupancy rate of hotels located in the coastal sections of Horry and Georgetown counties, South Carolina. The research indicated that the percentage of VRP units booked can be a predictor of demand for the nightly-rented hotel properties, particularly when those properties have limited convention space. The level of VRP reservations seemed to account for more of the variance in occupancy for properties with less meeting space than for properties with more meeting space. So, it may be that the level of reservations for the weekly-rented vacation properties may be indicative of the demand for the destination area, whereas convention properties seem to be able to drive more of their own demand separately from the demand for the resort destination area.

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Fundamentals of Applied Cybersecurity for Business and Management

Harry Katzan, Jr.
Webster University
Director, Institute for Cybersecurity Research
U.S.A.

Abstract

It is well established that cybersecurity is a complicated and complex subject encompassing computer security, information assurance, comprehensive infrastructure protection, commercial integrity, and ubiquitous personal interactions. The concepts apply to information, computers, networks, and other elements of coordination, cooperation, and control, and they apply to government, business, education, and the ordinary lives of private individuals. The concerns normally involve the Internet as a communication facility – hence the name *Cybersecurity*. Achieving and maintaining cybersecurity is a never-ending process, much like national security, bank security, and so forth, so it is important to know the essential foundations of how to manage the risks of using technical interactions in order to obtain the inherent benefits. Some of the concerns that immediately come to mind are identity, personal privacy, intellectual property, secure maintenance of the critical infrastructure, and the continued operation of necessary organizations. There is a plethora of printed and online literature on various aspects of cybersecurity – including computer security, information assurance, infrastructure security, personal security, and associated government policy information. The purpose of this paper is to give a composite picture of what cybersecurity is all about, identify the important literature on the subject, and describe how it differs from everyday information security affecting individuals and computer activities. This paper requires knowledge of basic information systems, computer, and network security technology for an understanding of the implications of many of the topics.

KEYWORDS: Cybersecurity, information assurance, critical infrastructure protection.

Introduction

It is well established that cybersecurity is a complicated and complex subject encompassing computer security, information assurance, comprehensive infrastructure protection, commercial integrity, and ubiquitous personal interactions. Most people look at the subject from a personal perspective. Is my computer and information secure from outside interference? Is the operation of my online business vulnerable to outside threats? Will I get the item I ordered? Are my utilities safe from international intrusion? Have I done enough to protect my personal privacy? Are my bank accounts and credit cards safe? How do we protect our websites and online information systems from hackers? The list of everyday concerns that people have over the modern system of communication could go on and on. Clearly, concerned citizens and organizations look to someone or something else, such as their Internet service provider or their company or the government, to solve the problem and just tell them what to do.

So far, it hasn't been that simple and probably never will be. The digital infrastructure based on the Internet that we call cyberspace is something that we depend on every day for a prosperous economy, a strong military, and an enlightened lifestyle. Cyberspace, as a concept, is a virtual world synthesized from computer hardware and software, desktops and laptops, tablets and cell phones, and broadband and wireless signals that power our schools, businesses, hospitals, government, utilities, and personal lives

through a sophisticated set of communication systems, available worldwide. However, the power to build also provides the power to disrupt and destroy. Many persons associate cybersecurity with cyber crime, since it costs persons, commercial organizations, and governments more than a $1 trillion per year.[1] However, there is considerably more to cybersecurity than cyber crime, so it is necessary to start off with concepts and definitions.

Concepts and Definitions

Cyberspace has been defined as the interdependent network of information technology infrastructure, and includes the Internet, telecommunications networks, computer systems, and embedded processors and controllers in critical industries.[2] Alternately, cyberspace is often regarded as any process, program, or protocol relating to the use of the Internet for data processing transmission or use in telecommunication. As such, cyberspace is instrumental in sustaining the everyday activities of millions of people and thousands of organizations worldwide.

The strategic plan for the U.S. Department of Homeland Security lists five main missions for the period 2012-2016, listed as follows:[3]

Mission 1: Preventing Terrorism and Enhancing Security
Mission 2: Securing and Managing Our Borders
Mission 3: Enforcing and Administering Our Immigration Laws
Mission 4: Safeguarding and Securing Cyberspace
Mission 5: Ensuring Resilience to Disaster

Clearly, the placement of cybersecurity as one of the five major strategic missions of the Department of Homeland Security (DHS) is a sure-fire indication that an underlying problem exists with the global dependence on the Internet that is summarized in the following introductory quote from the DHS report:[4]

> Cyberspace is highly dynamic and the risks posed by malicious cyber activity often transcend sector and international boundaries. Today's threats to cybersecurity require the engagement of the entire society – from government and law enforcement to the private sector and most importantly, members of the public – to mitigate malicious activities while bolstering defensive capabilities.

Ensuing policy goals and objectives to achieve cybersecurity could therefore include:

Goal 4.1: Create a Safe, Secure, and Resilient Cyber Environment

Objective 4.1.1: Understand and prioritize cyber threats
Objective 4.1.2: Manage risks to cyberspace
Objective 4.1.3: Prevent cyber crime and other malicious uses of cyberspace
Objective 4.1.4: Develop a robust public-private cyber incident response capability

Goal 4.2: Promote Cybersecurity Knowledge and Innovation

Objective 4.2.1: Enhance public awareness

[1] Remarks by the U.S. President on Securing Our Nation's Cyber Infrastructure, East Room, May 29, 2009.
[2] National Security Presidential Directive 54/Homeland Security Presidential Directive 23 (NSPD-54/HSPD-23).
[3] http://www.dhs.gov/xlibrary/assets/dhs-strategic-plan-fy-2012-2016.pdf.
[4] Ibid. p.12.

Objective 4.2.2: Foster a dynamic workforce
Objective 4.2.3: Invest in innovative technologies, techniques, and procedures

While the line between policy and operations may be a blurred line in some instances, a necessary requirement of cybersecurity is to have security operations be part of a stated set of objectives.

Cyber Attacks

Cyber attacks can be divided into four distinct groups:[5] cyber terrorism, cyber war, cybercrime, and cyber espionage. It would seem that cybercrime and cyber espionage are the most pressing issues, but the others are just offstage. Here are some definitions:[6]

> *Cyber crime* is the use of computers or related systems to steal or compromise confidential information for criminal purposes, most often for financial gain.
>
> *Cyber espionage* is the use of computers or related systems to collect intelligence or enable certain operations, whether in cyberspace or the real world.
>
> *Cyber terrorism* is the use of computers or related systems to create fear or panic in a society and may not result in physical destruction by cyber agitation.
>
> *Cyber war* consists of military operations conducted within cyberspace to deny an adversary, whether a state or non-state actor, the effective use of information systems and weapons, or systems controlled by information technology, in order to achieve a political end.

As such, cybersecurity has been identified as one of the most serious economic and national security challenges facing the nation.[7]

The Comprehensive National Cybersecurity Initiative

In order to achieve cybersecurity, from individual, national, organizational, or global perspectives, a proposed set of major goals has been developed:[8]

> To establish a front line of defense against today's immediate threats
> To defend against the full spectrum of threats
> To strengthen the future cybersecurity environment

Starting from the top, the President has directed the release of a summary description of the Comprehensive National Cybersecurity Initiatives, summarized as follows:

> **Initiative #1.** Manage the Federal Enterprise Network as a single network enterprise with Trusted Internet Connections.
>
> **Initiative #2.** Deploy an intrusion detection system of sensors across the Federal enterprise.

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[5] Shackelford, Scott L., In Search of Cyber Peace: A Response to the Cybersecurity Act of 2012, *Stanford Law Review,* March 8, 2012, (http://www.stanfordlawreview.org).
[6] Lord, K.M. and T. Sharp (editors), *America's Cyber Future: Security and Prosperity in the Information Age* (Volume I), Center for New American Security (June 2011), (http://www.cnas.org).
[7] National Security Council, *The Comprehensive National Cybersecurity Initiative*, The White House, (http://www.whitehouse.gov/cybersecurity/comprehensive-national-cybersecurity-initiative).
[8] Ibid., p.1.

Initiative #3. Pursue deployment of intrusion prevention systems across the Federal enterprise.

Initiative #4. Coordinate and redirect research and development (R&D) efforts.

Initiative #5. Connect current cyber ops centers to enhance situational awareness.

Initiative #6. Develop and implement a government-wide cyber counterintelligence (CI) plan.

Initiative #7. Increase the security of our classified networks.

Initiative #8. Expand cyber education.

Initiative #9. Define and develop enduring "leap-ahead" technology, strategies, and programs.

Initiative #10. Define and develop enduring deterrence strategies and programs.

Initiative #11. Develop a multi-pronged approach for global supply chain risk management.

Initiative #12. Define the Federal role for extending cybersecurity into critical infrastructure domains.

The basic idea of the twelve initiatives is to address current and future cybersecurity issues by combining the resources of the Federal government, local and state governments, and the private sector to provide a strong response to future cyber incidents and by strengthening public/private relationships.

Critical Infrastructure and Key Resources

The present concern over cybersecurity is the result of a variety of cyber attacks, intrusions, and countermeasures that have occurred globally in recent years. The threat scenarios are multidimensional and attribution is cumbersome to ascertain. Moreover, exposure to cyber threats can be direct or indirect, resulting from a dependence on one or more elements of critical infrastructure. The scope of inherent infrastructure has grown from ten in the year 2003[9] to eighteen in the year 2012.[10] The underlying philosophy is that once the critical areas are identified, a public/private dialog can be established to achieve a measurable amount of cybersecurity. Each of the six critical areas are classed as major and are assigned a Sector Specific Agency (SSA) by the Department of Homeland Security as part of the National Infrastructure Protection Plan (NIPP), intended to set national priorities, goals, and requirements for effective allocation of resources.[11] The major areas are:

Chemical
Commercial Facilities
Critical Manufacturing
Dams
Emergency Services
Nuclear Reactors, Materials, and Waste

The manner in which the public/private coordination and collaboration is executed is a matter of public debate. The key point is that a cyber intrusion in a major area can indirectly endanger a large number of people, governmental organizations, and commercial facilities.

[9] The White House, *The National Strategy to Secure Cyberspace,* February, 2003, p. xiii.
[10] Homeland Security, *More About the Office of Infrastructure Protection*, p. 1, (http://www.dhs.gov/xabout/structure/gc_1189775491423.shtm).
[11] Ibid., p.1.

The remaining twelve critical areas are assigned to existing governmental offices, as reflected in the following list:

Agriculture and food – Department of Agriculture and the Food and Drug Administration
Banking and Finance – Department of the Treasury
Communications – Department of Homeland Security
Defense Industrial Base – Department of Defense
Energy – Department of Energy
Governmental Facilities – Department of Homeland Security
Information Technology – Department of Homeland Security
National Monuments and Icons – Department of the Interior
Postal and Shipping – Transportation Security Administration
Healthcare and Public Health – Department of Health and Human Services
Transportation Systems – Transportation Security Administration and the U.S. Coast Guard
Water – Environmental Protection Agency

National and global protection necessarily involves the establishment of a framework to provide the following:[12]

The exchange of ideas, approaches, and best practices
The facilitation of security planning and resource allocation
The establishment of structure for effective coordination among partners
The enhancement of coordination with the international community
The building of public awareness

The identification of the areas of critical infrastructure is significant because of the wide diversity of cyber threats, vulnerabilities, risk, and problem domains. Moreover, critical elements possess a wide variety of technological attributes that require a range of solutions.

Summary

The paper gives an overview of the emerging discipline of cybersecurity that adds a policy level to the longstanding subjects of information security, computer security, and network security. Concepts and some basic definitions are covered. Cyber attacks are divided into cyber crime, cyber espionage, cyber terrorism, and cyber war. A comprehensive overview of the subject matter is given through the National Cybersecurity Initiative, and the notion of the critical infrastructure is explored in some detail.

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Author Information

Professor Harry Katzan, Jr. is the author of books and papers on computer science, decision science, and service science. He teaches cybersecurity in the graduate program at Webster University and directs the Institute for Cybersecurity Research.

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GUIDELINES FOR EVALUATING THE VALIDITY OF A STATISTICAL STUDY IN A GENERAL EDUCATION STATISTICS COURSE

Aniekan A. Ebiefung

Department of Mathematics

University of Tennessee at Chattanooga

Chattanooga, TN 37403

aniekan-ebiefung@utc.edu

ABSTRACT

A statistical study could be biased or invalid even when conducted by a researcher with a good reputation. It is the responsibility of the reader to critically examine a study's conclusion for accuracy and to discover hidden biases or invalid conclusions. In this paper, we give some guidelines that students can use to critically evaluate the validity of the methodology and conclusion of a statistical study.

1. INTRODUCTION

The advent of the Internet has led to huge data collection by academicians and those who use data to make money. Thus, there is an easy access to data which has led to proliferation of statistical studies. In the past, all statistical studies had to go through a strict review process before they can be accepted for publication. Unfortunately, things have changed. In this new era of electronic journals, open access journals, and private websites, the quality and accuracy of statistical studies cannot be assumed. All statistical studies must be evaluated for accuracy.

In the process of teaching a general education statistics course for years, I have come to realize that many of my students believe that any information obtained from the Internet is accurate. We know that this is not true. To help my students become discerning users of statistical information, I usually give them statistical studies to evaluate based on my pre-defined criteria. In this paper, I will share with you some of the criteria that my students use to evaluate statistical studies.

2. GUIDELINES FOR EVALUATING STATISTICAL STUDIES.

The following are some useful guidelines for critically evaluating the validity of a statistical study. These criteria are not exhaustive, but I hope that they get you started in the process of helping your students become discerning users of statistical information.

2.1 Validate the Goals and Study Design

The first important step in setting up a statistical study is to have a good design. The goal, population, and sampling technique used in the study should be clear to the reader. As the reader goes through the report, the reader should ask and answer the following questions:

- What is the goal or the question to be answered in this study?
- Is the population well-defined and appropriate?
- What type of statistical study was conducted: observational, experimental or meta-analysis?
- Did the researcher take steps to control placebo and confounding effects?

In an effort to answer these questions, which are not exhaustive, the reader should have a good idea as to whether the study was properly designed or not.

2.2 Know the Source of the Study

Anybody or organization has a right to carry out a statistical study. In some of the studies, the individual or organization may be interested in results that support its viewpoint. While there is nothing wrong for an organization to use a statistical study to further its objectives, it is the responsibility of the reader to read between the lines and to avoid being misled.

2.3 Examine the Sampling Method

The popular phrase "garbage in, garbage out" also applies to statistical studies. Even though the study design may be sound and the source credible, the study result could be biased or invalid if the sample was not properly chosen. In going over the study report, the reader should pose and answer the following questions:

- What sampling technique was used in data collection?
- Was the sample large and representative of the population?
- Was the sample chosen through a **voluntary response**? A voluntary response occurs if participants volunteer to be in the study. The problem is that such participants tend to have strong feelings about the issue and hence their opinions may be biased.

2.4 Determine How Variables were Defined and Measured

In a statistical study, we attempt to measure how one variable affects another or how the variables relate. If the variables are difficult to define or measure, then we could have a statistical study that is confusing or one that means different things to different people.

Consider the following study on beer flavor: Which beer tastes better? Fifty beer drinkers are randomly selected and blind folded. Each person in the group is given two different brands of beer to drink and to

record if the first or the second beer tastes better. The study concluded that the first bear brand tastes better.

The problem with this study is the fact that many people have different concepts of what makes something taste better. For something people, taste better means it is sweeter; and for others taste better could mean neither sweet or bitter. There are many possibilities. In a study like this, the author should tell readers how to measure "taste better."

2.5 Consider Confounding Variables

Recall that a confounding variable is a variable that affects a study's outcome but was not considered in the design of the study. Obviously, the presence of a confounding variable will confuse or invalidate the result of the study. As you read any study, think of variables that could affect the study's outcome but were not controlled during the study.

Consider, as an example, a pharmaceutical company who tested its new cholesterol reducing pill in a city nicknamed the "Fat City of the World" in the summer of 1987. The study found that the cholesterol level of everybody in the study had reduced by at least 80%. After the study design, however, the average price of regular gas in the city increased from $1.99 to $10.99, an increase of over 450%. As a result, many city residents had to walk more than usual to grocery stores, banks, super markets, et cetera. Could more walking by residents, which was not considered in the study, play a part in the cholesterol reduction observed in the study? A reader of a statistical study should be able to pose and answer questions that could reveal the presence of confounding variables.

2.6 Look for Misleading Graphs

Graphs are great tools for data visualization and exploration. Unfortunately, graphs can be drawn in such a way that they are deceptive or misleading. When reading a statistical study, our students should look for misleading graphs as they could be used to suppress or exaggerate relationship between variables in a study.

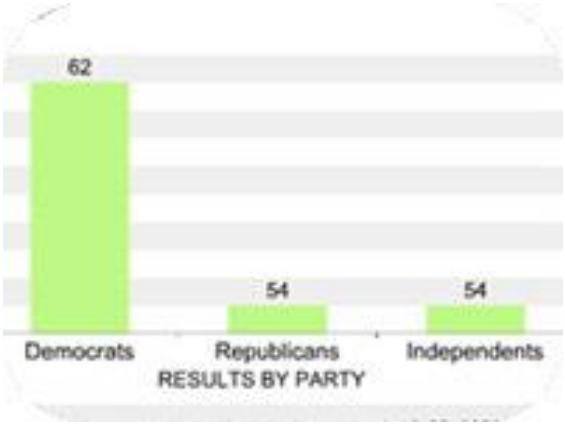
As an example, consider the Terri Schiavo's Life Support Case. Theresa Marie Schiavo, aka Terri, was comatose for about 15 years, 1990—2005. This case became a national issue when the husband wanted her taken off life-support but the parents said no. Eventually, the case was decided in favor of the husband by the Courts.

Figure 1: Picture of Terri Schiavo

Source: https://en.wikipedia.org/wiki/Terri_Schiavo_case

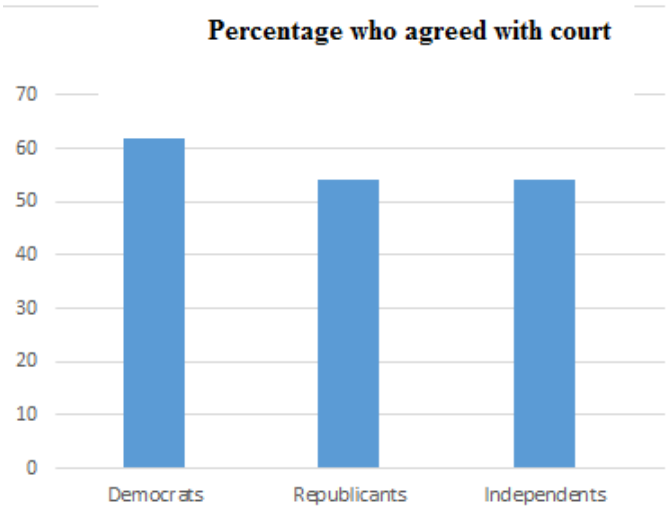
The media giant CNN conducted a survey to determine how adult Americans agreed with the Courts on taking her off life support on the basis of party affiliations. According to CNN, 62 % of Democrats, 54% of Republicans, and 54% of independents agreed with the courts. Figure 2 is the bar graph that CNN drew to visually represent the results of the surveys. This graph is misleading as the vertical scale does not start at zero. Notice the exaggerated differences among the bar heights. CNN did redraw a non-leading graph after Mediamatters.org pointed out the misleading nature of the graph. The accurate and non-misleading graph for the study is given in Figure 3. Observe that in the non-misleading graph, the differences in the bar heights are not much. The over exaggerated nature of the misleading graph was certainly of concern to all who cared about fairness.

Figure 2: CNN Misleading Graph



http://www.adweek.com/tvnewser/schiavo-cnns-absurd-misleading-graph/5724; July 25, 2015

Figure 3: Non-misleading graph for the CNN survey



It is not unethical to draw a graph in which the vertical axis does not start at zero or other misleading graphs. However, it is the responsibility of the reader to give appropriate interpretations to these graphs as they read statistical studies.

2.7 Scrutinize the Study Conclusion

Suppose that a statistical study is well-defined and professionally conducted. Does it mean that the conclusion should be accepted without scrutiny? The answer is no. It is possible for a researcher to misinterpret study outcomes. Hence, the conclusion of statistical studies should be evaluated against well-defined criteria. The following are the questions I ask my students to answer as they evaluate a statistical study.

- Does the conclusion agree with the stated goal?
- Is the conclusion a partial answer to the stated goal?
- Does the conclusion make sense?
- Is the conclusion statistically significant?
- Is the conclusion of practical significance or useful?
- Are there other ways that the stated conclusion can be explained?

3. CONCLUSION

A statistical study could be biased. Students should be equipped with the skills they need to evaluate these studies for accuracy. This is important because of the availability of data and the consequent proliferation of statistical studies.

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INVENTORY PLANNING REQUIRES COLLABORATION BETWEEN OPERATIONS AND ACCOUNTING TO SATISFY MARKETING DEMANDS

Richard E. Crandall, Appalachian State University, CIS & SCM Dept., Peacock Hall, Boone, NC 28608, crandllre@appstate.edu

William "Rick" Crandall, School of Business, Post Office Box 1510, University of North Carolina at Pembroke, Pembroke, NC 28372, rick.crandall@uncp.edu

ABSTRACT

Inventory is necessary in most businesses, especially in retailing and distribution. But who decides how much inventory is necessary or desirable? This decision can lead to a conflict among marketing, production and accounting departments. Marketing wants enough inventory to satisfy demand plus a little extra in case of a windfall in sales. Production is more concerned with the rate of production although they do have to worry about where to store the inventory until it is used. Accounting has to worry about the cost of carrying inventory and the cash flow needed to support the inventory. In this paper, we will examine different situations that may confront inventory planners and how Operations and Accounting can work together to develop an inventory plan that satisfies demand at an acceptable cost, considering production capacity and financial constraints.

INTRODUCTION

Inventory is necessary in most businesses, especially in retailing and distribution. But who decides how much inventory is necessary or desirable? This decision can lead to a conflict among marketing, production and accounting departments. Marketing wants enough inventory to satisfy demand plus a little extra in case of a windfall in sales. Production is more concerned with the rate of production although they do have to worry about where to store the inventory until it is used. Accounting has to worry about the cost of carrying inventory and the cash flow necessary to support the inventory.

In this paper, we will examine different situations that may confront inventory planners and how Operations and Accounting can work together to develop an inventory plan that satisfies demand at an acceptable cost, considering production capacity and financial constraints. The first shows how Operations might distinguish among items with different total annual values. This differentiation is a derivative of Pareto's Law in which he found that the distribution of wealth was not spread evenly but tended to be concentrated among a small percentage of the population. This concept was eventually formulated into what became known as the 80-20 rule and, when applied to inventory, took on this configuration:

- 20 percent of the items in inventory represent 80 percent of the total value (cost)
- 30 percent of the items in inventory represent 15 percent of the total value (cost)
- 50 percent of the items in inventory represent 5 percent of the total value (cost)

For convenience, these item classifications were labeled A, B and C items. For inventory planning purposes, the A items were planned most carefully because of their greater value, while C items were planned more casually, and B items were in between. The section **Micro-Macro Inventory Plan** describes how this concept can be used in inventory planning.

The Micro-Macro Inventory Plan does not consider fluctuations in inventory over time. Since demand, or sales, of items usually vary over time, it is logical to expect that inventory may also fluctuate from one time period to the next. The section **Production Planning over Time** describes three different scenarios

that could result from a policy to keep production at a constant level throughout the year to minimize production costs, even when demand varies widely throughout the year. This practice often results in wide fluctuations in inventory.

Because wide fluctuations in inventory may cause problems, such as lack of storage space or concern for obsolescence, often companies look at a way to optimize the production plan to minimize total costs. This approach is described in the section **Optimized Production Plan**.

The approaches described above and illustrated in the following sections can be used by production planners and inventory managers. At some point, they must develop a plan that can be integrated into a total company plan.

MICRO-MACRO INVENTORY PLAN

Table 1 illustrates a way to plan, at least for the normal replenishment and safety stock levels of inventory. A TV set is designated as an A item, a circuit board as a B item, and a fuse as a C item. In practice, there would normally be many more items to consider but because of limited space, only one item in each classification will be used in the example.

In Table 1, the planner considers two sources of inventory – the average inventory based on the economic order quantity (EOQ) and the base inventory of safety stock. As shown, the plan for an A item envisions lower quantities of inventory than for B or C items, for both EOQ and safety stock planning. Consequently, the inventory turns for A items are greater than for B and C items. It is also important that Operations work in units at the item level and only converts to dollars at the total inventory level. The result is that Operations expects to need an average of $12,448 worth of inventory during the year.

Table 1. Inventory Plan from Operations

Inventory Analysis						
Product Type		A	B	C	Total	
Product		TV	Circuit board	Fuse	All Products	
Build-up of Inventory from Individual Items						
Sales per Year (units)		500	1,600	6,400	8,500	
Purchase price per unit		$400.00	$40.00	$1.60	$32.26	Average
Total cost of purchases/year		$200,000	$64,000	$10,240	$274,240	
Carrying cost/unit/year	25%	$100.00	$10.00	$0.40	$8.07	Average
Ordering cost per order	20.0	20.0	20.0	20.0	$20.00	
Sales per Week (units)	50	10	32	128		
Economic order quantity	EOQ	14	80	800		
Weeks of supply per order		1.4	2.5	6.3		
Safety Stock (weeks)	1	1.0	2.0	4.0		
Safety Stock (units)		10	64	512		
Average Cycle Inventory	2	7	40	400		
Total Average Inventory (units)		17	104	912		
Average Turns		29	15	7	22.0	
Total Inventory ($)		$6,828	$4,160	$1,459	$12,448	**By operations**

Table 2. Inventory Plan from Accounting

Total Target					
Mark-up on Cost	50%	100%	150%	65%	
Selling Price	$600.00	$80.00	$4.00	$53.36	Average
Total Sales per Year	$300,000	$128,000	$25,600	$453,600	
Cost of Sales	$200,000	$64,000	$10,240	$274,240	
Gross Margin	$100,000	$64,000	$15,360	$179,360	
% Gross Margin	33%	50%	60%	40%	Average
Target Inventory Turns				25.0	
Target Inventory Dollars				$10,970	**By accounting**
Calculated minus Target Inventory				$1,478	

In Table 1, there are several key variables, shown in the second column from the left – carrying cost per unit, ordering cost per order, and a safety stock index number that can be used to select a level of safety stock for each product. In the conference presentation, the Goal Seek of Excel will be used to show how these variables can be altered in the spreadsheet.

Table 2 shows a way that Accounting, or Finance, could determine the gross amount of inventory allowable under the total company cash flow plan. They could start with the sales and gross margins calculations, and then use an overall inventory turn target to calculate the total inventory desired or targeted.

Differences between the two approaches have to be reconciled, if the groups are to proceed with a meaningful plan. There are several decision variables that could be changed in order for the Operations and Accounting plans to agree. These include (1) reducing the ordering costs per order, (2) reducing the level of safety stock, (3) increasing the carrying cost per unit (for increased obsolescence or damage), and (4) changing the target inventory turns in the Accounting analysis, or some combination of the four.

This plan provides for cycle inventory and safety stock. The level of safety stock has to consider a number of variables, such as late deliveries, adverse weather, competitor's new product, and the like. Deciding on an acceptable level of safety stock requires further analysis.

A spreadsheet of this approach to illustrate how the two approaches can be reconciled will be used in the conference presentation.

PRODUCTION PLANNING OVER TIME

The process described in the Micro-Macro Inventory Plan could be used if demand were relatively stable throughout the year; however, often, demand fluctuates during the year, sometimes widely. In this situation, the inventory may also fluctuate.

In this section, three conditions are described – (1) relatively stable demand, (2) fluctuating demand peaking during the winter months, beginning in December, and (3) fluctuating demand peaking during the summer, beginning in June.

Table 3 shows the results for the relatively stable demand situation and Figure 1 shows the results in graphical form. Demand/sales vary from 45 to 55 units per month, production is steady at 50 units per month, and inventory varies from 40 to 50 units per month. This scenario results in an average ending

inventory of 44 units and an average of 27 days of inventory. This situation would not cause undue concern for either Operations or Accounting.

Table 3. Inventory Plan for Relatively Stable Demand

Relatively Stable Demand Throughout the Year														
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in Month		31	28	31	30	31	30	31	31	30	31	30	31	365
Sales (in units)		50	45	55	50	45	50	55	45	45	50	55	55	600
Beginning Inventory		40	40	45	40	40	45	45	40	45	50	50	45	
Production		50	50	50	50	50	50	50	50	50	50	50	50	600
Ending Inventory	40	40	45	40	40	45	45	40	45	50	50	45	40	44
Days of Inventory		25	28	23	24	31	27	23	31	33	31	25	23	27

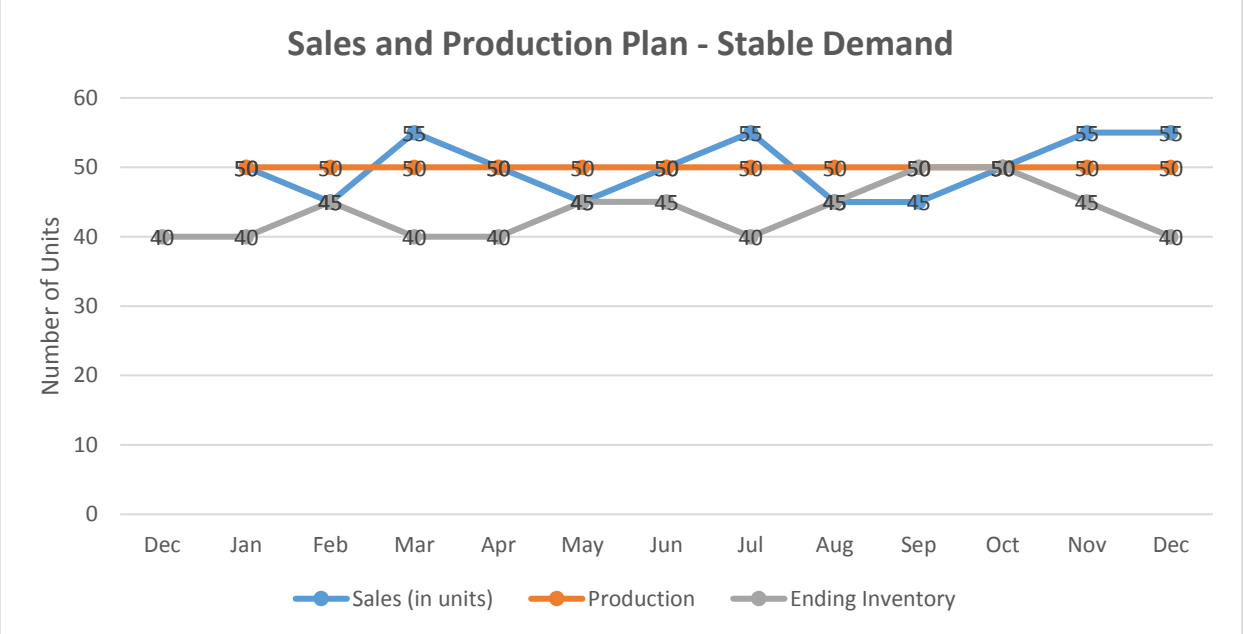

Figure 1. Sales, Production and Inventory for Stable Demand

Table 4 shows the inventory plan when production is kept constant while demand begins to peak in December and carries the high demand through the winter and early spring. In this situation, there must be a high level of inventory to start the year when demand is in excess of supply (production). To build this inventory for the next season, production during the summer months exceeds demand and inventory increases to a relatively high level. The result for the year is an average ending inventory of 57 units and an average of 89 days of inventory. This is much higher than for the stable demand situation described earlier. It should also be noted that this plan results in a zero inventory in May and June, not a

comfortable expectation for either Marketing or Operations. Figure 2 show the results graphically and highlights the wide fluctuations in inventory.

Table 4. Inventory Plan for Demand Peaking during Winter Months

Uneven Demand with Peak in December														
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in Month		31	28	31	30	31	30	31	31	30	31	30	31	365
Sales (in units)		90	80	70	70	60	50	30	30	20	10	10	80	600
Beginning Inventory		120	80	50	30	10	0	0	20	40	70	110	150	
Production		50	50	50	50	50	50	50	50	50	50	50	50	600
Ending Inventory	120	80	50	30	10	0	0	20	40	70	110	150	120	57
Days of Inventory		28	18	13	4	0	0	21	41	105	341	450	47	89

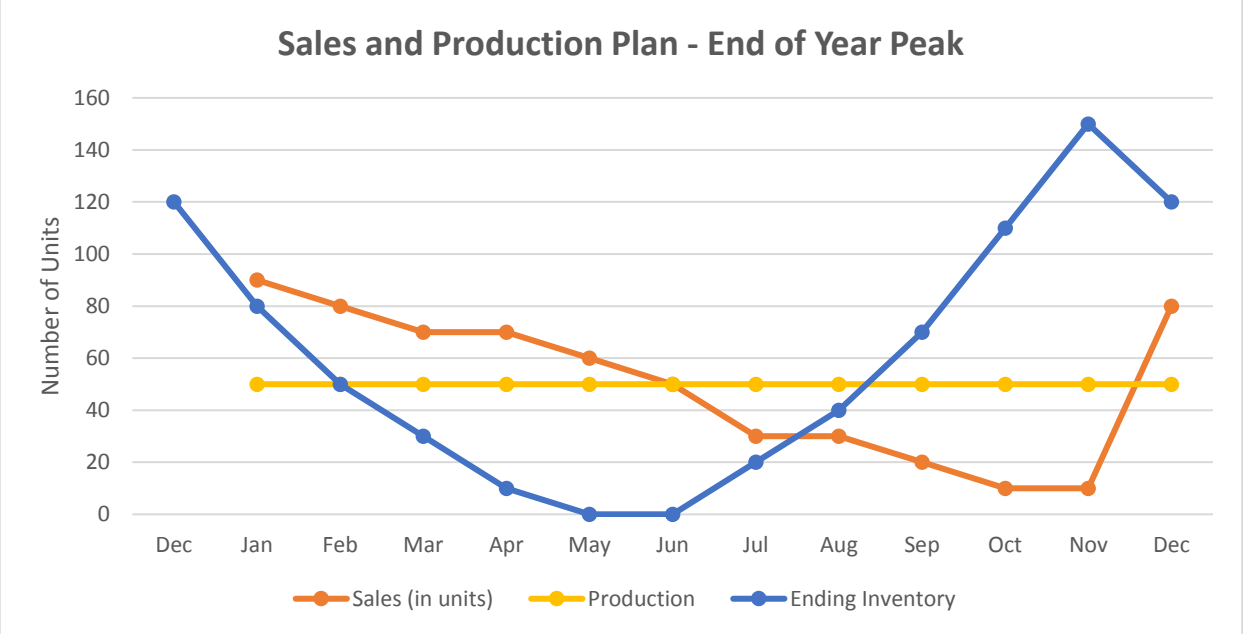

Figure 2. Inventory Plan for Demand Peaking during Winter Months

Table 5 and Figure 3 show the inventory plan when production is kept constant while demand begins to peak in June and carries the high demand through the summer months. In this situation, there need not be much inventory to start the year when demand is less than supply (production). To build this inventory for the summer, production must increase inventory quickly to satisfy the peak demand. Inventory declines to a minimum in October and builds a little by the end of the year. The result for the year is an average ending inventory of 92 units and an average of 109 days of inventory. This is much higher than

for the stable demand situation described earlier and the second situation with demand peaking during the winter.

Table 5. Inventory Plan for Demand Peaking during Summer Months

Uneven Demand with Peak during the Summer														
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in Month		31	28	31	30	31	30	31	31	30	31	30	31	365
Sales (in units)		10	10	20	30	40	80	100	90	90	60	40	30	600
Beginning Inventory		40	80	120	150	170	180	150	100	60	20	10	20	
Production		50	50	50	50	50	50	50	50	50	50	50	50	600
Ending Inventory	40	80	120	150	170	180	150	100	60	20	10	20	40	92
Days of Inventory		248	336	233	170	140	56	31	21	7	5	15	41	109

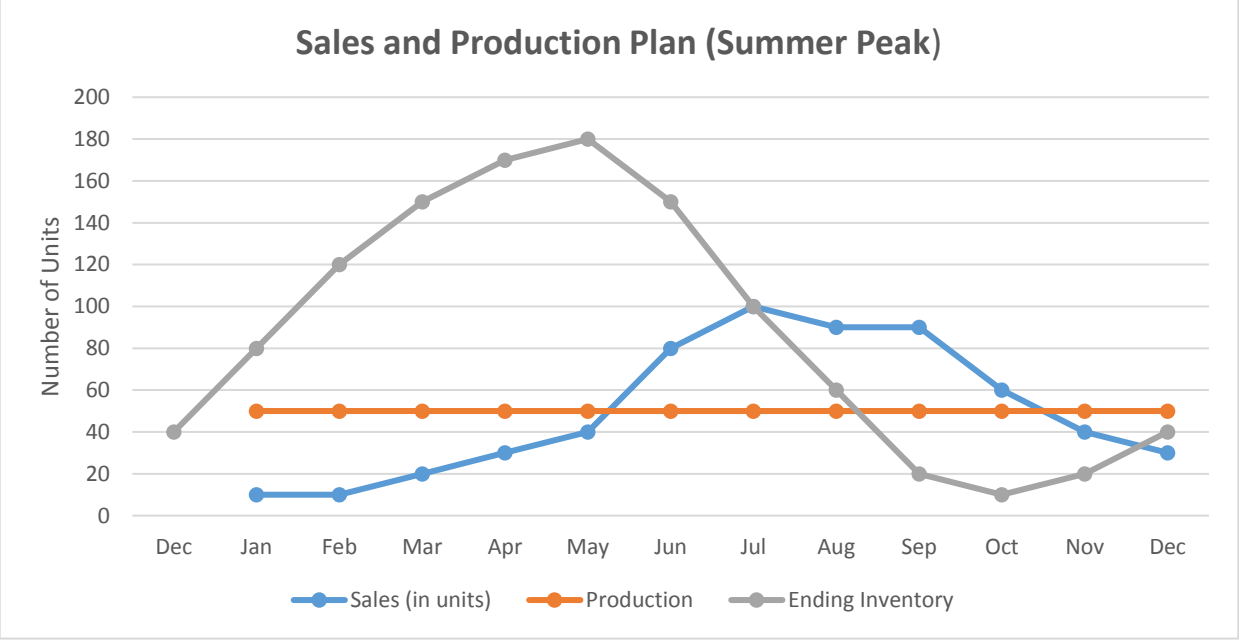

Figure 3. Inventory Plan for Demand Peaking during Summer Months

This example considers a fiscal year from January through December. Changing the fiscal year to better fit the demand year is a possibility; however, that sort of change must include considerations other than inventory.

In the preceding section, inventory plans were constructed for stable production to minimize layoffs and hiring and training costs, even with fluctuating demand. The buildup of inventory is sometimes not

feasible. As a result, often companies need a way to optimize production and inventory planning in the face of some constraints. The next section describes such an approach.

OPTIMIZED PRODUCTION PLAN

An approach that is used to determine how much to produce each period is called optimized production planning. Often this would be used for finished assemblies, such as an automobile. This is illustrated in Table 6. The upper part of the table shows a variety of variables to be considered in putting a production plan together.

Starting with a forecast, the production plan is determined and the resultant beginning and ending inventories for each period. Table 6 shows a level production plan (constant amount each period), which results in both backorders (Period 1), a buildup of inventory in Period 3 through 8, and a sell-off of inventory during the remainder of the year. The total cost for this level production plan is $136,700.

The Production Plan offers another opportunity of using a "What-If" analysis, such as Excel's Solver, by varying the production amounts each period to search for the best combination of costs, which include hiring and layoff costs when production varies, as well as inventory carrying and backorder costs. As with previous models, this has more meaning when demonstrated.

Table 6. Level Production Plan

Production Planning of a Seasonal Business													
Input Data													
Beginning inventory	0		Target ending inventory			0		Hiring costs per worker				$400	
Beginning no. of workers	5		Target ending workers			5		Layoff costs per worker				$500	
Hours/worker/month	160							Regular wages per hour				$10	
O'time hrs/worker/month	20		Machine capacity - units			200		Overtime wages per hour				$15	
Labor hours/unit	20		Storage capacity - units			200		Inventory carrying/unit/month				$20	
								Backorder cost/unit				$60	
										Total Costs			$136,700
Trial Solution													
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Ending inventory	-35	0	10	30	50	85	105	125	115	65	25	0	
Forecast demand	85	15	40	30	30	15	30	30	60	100	90	75	600
Beginning inventory	0	-35	0	10	30	50	85	105	125	115	65	25	
Production	50	50	50	50	50	50	50	50	50	50	50	50	600

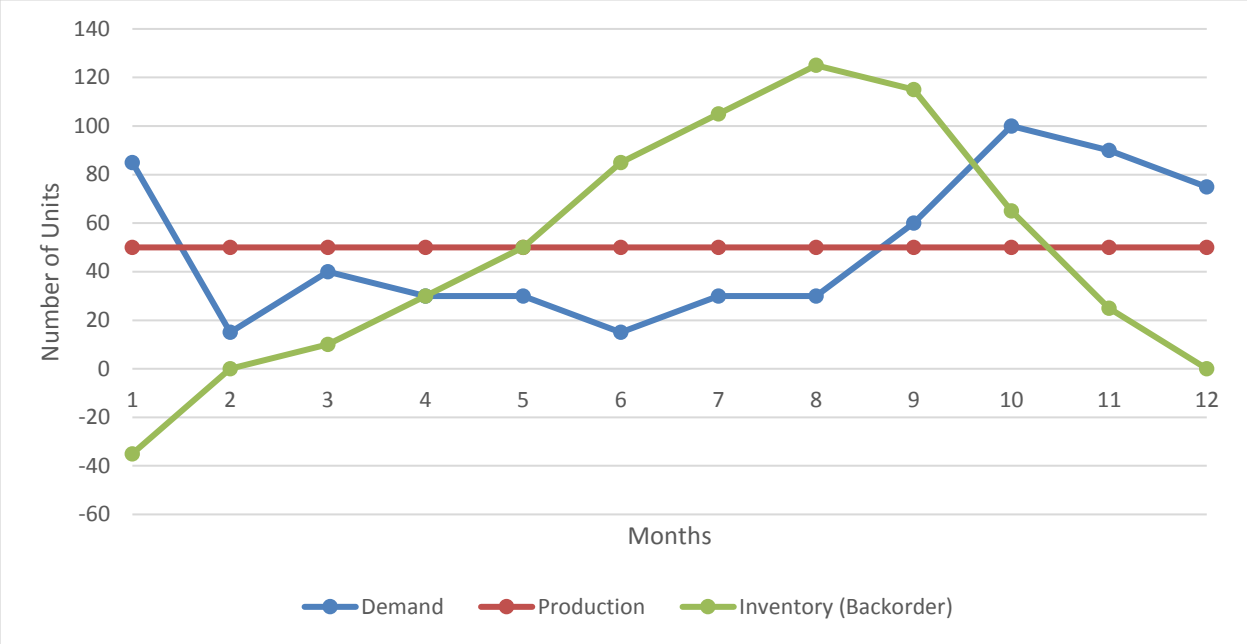

Figure 4. Level Production Plan

Table 7. Optimized Production Plan

Production Planning of a Seasonal Business													
Input Data													
Beginning inventory	0		Target ending inventory			0		Hiring costs per worker				$400	
Beginning no. of workers	5		Target ending workers			5		Layoff costs per worker				$500	
Hours/worker/month	160							Regular wages per hour				$10	
O'time hrs/worker/month	20		Machine capacity - units			200		Overtime wages per hour				$15	
Labor hours/unit	20		Storage capacity - units			200		Inventory carrying/unit/month				$20	
								Backorder cost/unit				$60	
										Total Costs			$133,560
Trial Solution													
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Ending inventory	-33	0	0	2	4	21	23	41	61	41	31	0	
Forecast demand	85	15	40	30	30	15	30	30	60	100	90	75	600
Beginning inventory	0	-33	0	0	2	4	21	23	41	61	41	31	
Production	52	48	40	32	32	32	32	48	80	80	80	44	600

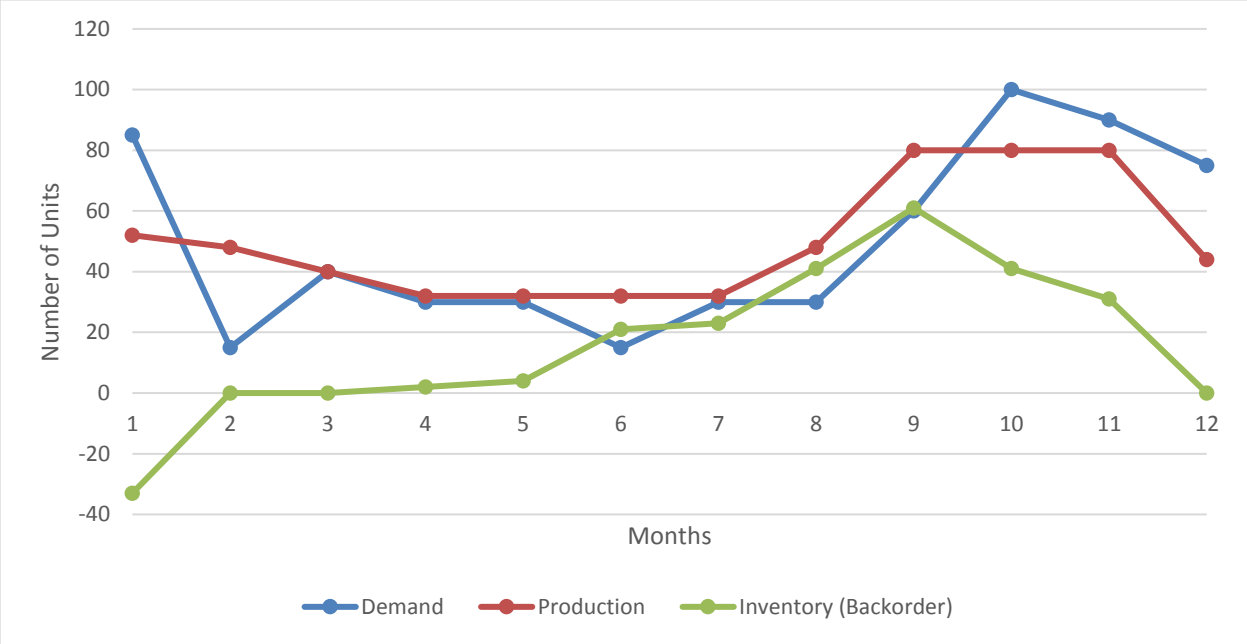

Figure 5. Optimized Production Plan

Production plans, of the type shown in Table 7, can be designed to search for the optimum solution. This makes it possible to quickly evaluate the negative effects of imposing constraints on the plan, such as no stock outs, maximum inventory level because of storage capacity, tolerable variation in production to avoid layoffs and rehiring, and the like. This type of plan requires the convergence of marketing, finance/accounting and operations if it is to truly reflect the corporate plan.

For example, Table 8 shows a slightly revised production plan to eliminate backorders. This is done by increasing the cost of backorders from $60 (Table 6) to $600 in Table 7. The result is a plan that costs more ($135,301, as compared with $133,175), but it eliminates backorders. This is the kind of decisions that production and inventory planners make frequently.

Table 8. Optimized Production Plan (Revision 1)

Production Planning of a Seasonal Business													
Input Data													
Beginning inventory	0		Target ending inventory	0			Hiring costs per worker	$400					
Beginning no. of workers	5		Target ending workers	5			Layoff costs per worker	$500					
Hours/worker/month	160						Regular wages per hour	$10					
O'time hrs/worker/month	20		Machine capacity - units	200			Overtime wages per hour	$15					
Labor hours/unit	20		Storage capacity - units	200			Inventory carrying/unit/month	$20					
							Backorder cost/unit	$600					
								Total Costs					$135,301
Trial Solution													
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Ending inventory	0	14	3	1	0	14	13	11	43	34	35	0	
Forecast demand	85	15	40	30	30	15	30	30	60	100	90	75	600
Beginning inventory	0	0	14	3	1	0	14	13	11	43	34	35	
Production	85	29	29	29	29	29	29	29	91	91	91	40	600

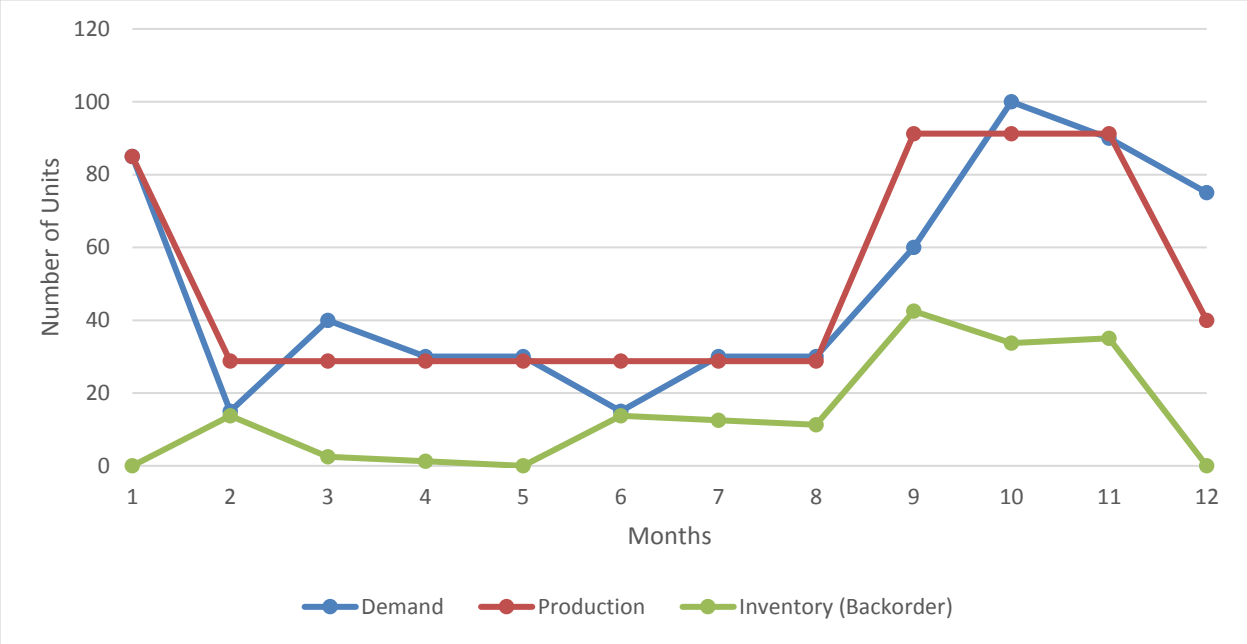

Figure 6. Optimized Production Plan (Revision 1)

Other variations could be viewed by changing the constraints imposed until a plan satisfactory to Marketing, Operations and Accounting is achieved.

CONCLUSION

Inventory planning is a process that requires the collaboration of Marketing, Operations and Accounting. The examples described above are some of the approaches that can be used to achieve a result satisfactory to all parties.

NOTE: Spreadsheets of all of the above examples will be available for discussion if this paper is accepted for the conference.

IRONY IN SUSTAINABILITY, ACCOUNTABILITY, AND REPORTING: THE CASE OF BRITISH PETROLEUM

Elizabeth D. Capener, CPA, CGMA, San Jose State University, elizabeth.capener@sjsu.edu
Maria L. Bullen, Ph.D., CPA, San Jose State University, maria.bullen@sjsu.edu
Gregory S. Kordecki, CPA, CGMA, Clayton State University, gregkordecki@clayton.edu

ABSTRACT

Many companies invest significant resources in environmental reporting. Is this reporting closely aligned with a company's actions, or is it a form of "window dressing"? How does management's response in an environmental crisis align with environmental reporting? A case study examining British Petroleum (BP) was undertaken because of the magnitude and timing of the Gulf of Mexico oil spill, the demand for quick responses from management during the disaster, and the many Sustainability awards bestowed upon the company.

BP Oil Spill is Major Non-Sustainable Event

BP is responsible for the Gulf of Mexico oil spill, the largest accidental ocean oil spill in the history of the world (Robertson, 2010). The spill occurred during three months in 2010, therefore the event is relatively recent and of interest. The event is "non-sustainable" in both a micro and macro sense. The spill results in BP setting up a $20 billion fund to settle issues relating to the spill (Robertson, 2010). BP cannot incur such losses every year, as the company would not be able to continue due to bankruptcy. In the big picture, the tremendous damage as a result of the spill has had a devastating impact on the ability of the area to sustain itself environmentally.

Prior to April 2010, BP Recognized for Quality Sustainability Reporting

There are a number of groups that recognize quality sustainability reporting, and BP had been an award-winning sustainability company for a number of years. The Global Reporting Initiative (GRI) is an international, independent standards organization that develops and communicates sustainability reporting and guidelines for voluntary use by businesses, government, and other organizations with the objective of assisting them in making better decisions. The winner of the GRI Readers' Choice award is selected by the votes of the readers of GRI reports as the best GRI report that year (GRI, 2011).

Corporate Register was begun in 1998 and aims to serve as the global source for corporate responsibility reports. As of March 2009 (Corporate Register), more than 20,000 companies from 116 countries had filed reports. The Corporate Register reporting awards (CRRA) were started in 2007 as the only global award to recognize excellence in CR reporting. The best reports are determined by the votes of the 35,000 members of Corporate Register. ESRA (European Sustainability Reporting Association) was formed at the request of the European Commission. ESRA bills itself as, "The European business network for CSR. It is the largest European CSR network linking 70 multi-national corporations, 31 CSR organizations and over 3,000 companies from 25 European countries" (CSR Europe, 2011). BP has received the following accolades for its sustainability reporting:

- 2010, CRRA Corporate Register Reporting Awards (Corporate Register, 2010):
    - Best report – 1st runner up
    - Relevance and materiality – 2nd runner up
    - Openness and honesty – 1st runner up
    - Credibility through assurance – 4th place (Ernst and Young, LLP (UK))

    The 2008 report was considered for the above awards
- 2010 City of Amsterdam Sustainability and Innovation Award (bp, 2010)
- 2008, GRI Readers' Choice Award (GRI, 2009)
- 2007, #1 Accountability Rating, second time, (ESRA, 2008)

As a further indication of its superior sustainability record, British Petroleum was listed in two sustainability stock indexes in 2010 prior to the spill. As a result, BP was recommended to investors interested in an ethical investment strategy. BP was included in the DJSI (Dow Jones Sustainability Index – World Index) until its removal May 31, 2010 due to the long-term environmental, social, economic impacts of the Gulf oil spill and the decline of BP's reputation (Vetri, Francois). It was also delisted from the UK based FTSE4GOOD index series after the spill (bp, 2010).

One might expect a company with poor or no environmental policies and reporting to be involved in non-sustainable events. How does a company that has been recognized for years for its superior sustainability indicators and reporting respond when it is responsible for a large non-sustainable incident?

Legitimacy Theory in the Literature: An Introduction

"Strategic legitimacy theory contends that organizations are able to make strategic choices to alter their legitimacy status . . . by adapting their activities and changing perceptions. . . Organizations might take various actions to ensure that their behavior is perceived to be legitimate." (Aerts & Cormier, 2009) Legitimacy theory indicates companies would report information to persuade others that its behavior is responsible and good, while its actions are different. Cho & Roberts (2010) confirmed legitimacy theory in a study of the US Toxic 100, finding that worse environmental performers disclose more information in a more sophisticated manner. Their examination of website environmental reporting found the reporting to be disconnected from company policy, with companies presenting a more favorable picture to stakeholders. Future suggested research was for a longitudinal study and studies of non-US firms. Mobus (2005) finds "legitimacy theory is underdeveloped and cannot be used to predict behavior. How does the legitimization process work and what are the effects?" A deeper understanding of the origins of legitimacy theory will help to understand where legitimacy comes from and why companies would behave according to this theory.

Corporation Now Seen as Part of System of Society

Ackoff 1981 (as cited by Zakhem, 2008) writes about the evolution of the corporation from a machine, to an organism, to an organization. At first, during the Industrial Revolution, the owners of the company also managed the company like a machine with the purpose of making a profit. Post World War I, the owners no longer ran the company and the employees were not family. Companies evolved into organisms that needed to survive and grow. Technology grew and investment in the training of employees was made, which made the corporation dependent on the employees. Managing people well became very important. As businesses grew, their impact on society and the environment grew. Environmental and consumer interests called for government intervention with business. More recently, the corporation is being seen as an organization that is part of a system. The organization, the people working there, and the larger society the organization is part of all have their own goals, which often are different. Demand for information the

organization's activities in the environmental and social arenas grew to be sure the goals of the company are aligned with the larger society. Legitimacy theory is one theory we can use to explain when the goals are not aligned.

Immediate Managerial Response to Gulf of Mexico Oil Spill

Comments by CEO Tony Hayward during the months of the spill (April, May, and June, 2010) that appear to be to improve the image of BP and support legitimacy theory are as follows:

First, his statements downplaying the impact of the non-sustainable incident:

- "The Gulf of Mexico is a very big ocean. The amount of volume of oil and dispersant we are putting into it is tiny in relation to the total water volume" (CNN Money Link, 2010).
- "I think the environmental impact of this disaster is likely to be very, very modest," (CNN Money Link, 2010).

Second, he appeared to try to distance BP from responsibility for the non-sustainable incident, while agreeing they must clean it up. The incongruous quotes follow:

- "This was not our accident … This was not our drilling rig. This was not our equipment. It was not our people, our systems or our processes. This was Transocean's rig. Their systems. Their people. Their equipment" (Wray, 2010).
- "In terms of responsibility, I want to be very clear about this, this was not our accident." But it is our responsibility to deal with the leak and to clear up the oil (Politicol News, 2010).

Third, Mr. Hayward claimed to be victimized:

- "What the hell did we do to deserve this?" (CNN Money Link, 2010).

Legitimacy Theory Appears to Explain Response

BP was not responding to pressure from particular stakeholders when public outcry occurred over the largest oil spill in the world. Many of BP's immediate responses had more to do with managing and improving its image in the wake of the Gulf of Mexico spill than stopping the spill and remediating damages.

An expanded paper further analyzes the defects in corporate response and the irony created through the lack of social responsibility.

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KNOWLEDGE SHARING, AN *IMPERATIVE* FOR SUCCESSFUL SUPPLY CHAIN COLLABORATION: AN EMPIRICAL ANALYSIS

Anu Mathews, MBA Student, College of Business, Anderson University, SC

ABSTRACT

Supply chain collaboration is an emerging concept in a dyadic and extended network for generating the competitive advantage by participants; however, knowledge sharing among participants in the collaborative network is a significant parameter to achieve this strategic benefit. This paper is a systematic literature review on the significance of knowledge sharing in supply chain collaboration for B2B and B2C among dyadic and extended supply chain participants, published over a 10-year period from 2005 to 2016, and empirical analysis is performed to hypothesize the method for successful knowledge sharing in SCC based on nature of collaboration.

1. INTRODUCTION

The evolution of globalised dynamic markets with rapidly changing customer preferences is driving firms participating in the supply chain to become more collaborative, agile and flexible for the successful implementation of supply chain processes in the business to business (B2B) and business to consumer (B2C) chain (Soosay and Hyland, 2015; Ince and Ozkan, 2015; Cao and Zhang, 2011; Simatupang and Sridharan, 2005). This is required in order to meet or exceed customer expectations. Supply Chain is defined in various literature as systemic, strategic coordination of traditional business functions (Almeida, Marins, Salgado, Santos and Silva, 2015; Mentzer, DeWitt and Keebler, 2001) fostered through strategic and management of material, information, and capital flows (Ince and Ozkan, 2015). With the advancement of supply chain practices, academicians and researchers have developed supply chain collaboration (SCC) as a key measure for generating the competitive advantage (Soosay and Hyland, 2015; Cao and Zhang, 2011; He, Ghobadian and Gallear, 2013; Singh and Power, 2009; Myers and Cheung, 2008; Kembro, Selviaridis and Näslund, 2014). Further studies have identified knowledge sharing as an imperative and keystone for successful supply chain collaboration among the supply chain participants in a buyer-customer dyadic relationship and to the extended supply chain network participants (Cao and Zhang, 2011; Myers and Cheung,2008; Kembro et al., 2014; Soosay and Hyland, 2015).

Supply chain collaboration is defined as two or more chain members working together to create a competitive advantage through sharing information, making joint decisions and sharing benefits which result from the greater profitability of satisfying end customer needs than acting alone (Soosay and Hyland, 2015). For purposes of this paper, SCC is defined as the integration of B2B and B2C processes within and between firms and organizations collaborating to achieve common desired results in the

dimensions of inventory, forecasts, transportation and freight, demand planning, people, processes, finances and technology. The collaborative supply chain participants can reap the benefits of integrated B2B and B2C processes in the supply chain only by constant information sharing and periodic syncing of data, as knowledge is recognized as an important source of competitive advantage (He et al., 2013).

Over the last decade, there has been increasing academic and practitioner interest in understanding and identifying the factors that contribute to effective knowledge transfer between supply chain actors (He et al., 2013). While technological suggestions such as electronic data interchange (EDI) (Ahmad and Ullah, 2013) and enterprise resource planning (ERP) (Ahmad and Ullah, 2013) to leverage knowledge sharing in SCC has been recommended by various literature reviews (Soosay and Hyland, 2015; Almeida et al, 2015; Simatupang and Sridharan, 2005; Cao et al., 2011; Kembro et al., 2014), there is no clear case study done on any firm's ERP implemented system shared across all the B2B and B2C processes among supply chain participants. This raises further anticipation on the existence of any firm which has successfully implemented information sharing through ERP implementation for information sharing, across all participants in supply chain network. This research identified the elements of B2B and B2C process systems where information sharing is vital to maximize the competitive advantage of the supply chain participants, these include processes such as procurement, transportation, distribution, inventory management, product design, development and commercialization, manufacturing planning and flow management, order processing and fulfillment, customer relationship management, supplier relationship management, returns management and demand management (Ahmad and Ullah, 2013; Soosay and Hyland, 2015). Although the studies agree unanimously on the benefits of knowledge sharing across these business processes elements, various relationship barriers such as trust (Ahmad and Ullah, 2013; Cai et al., 2013; Almeida et al,2015; He et al.,2013; Gold, Seuring and Beske, 2010) , mutual respect (Ahmad and Ullah, 2013), power asymmetry (Cai et al., 2013; Almeida et al, 2015; He et al., 2013) and other factors which will be detailed in this literature review, needs to be overcome by the supply chain participants in order to benefit from knowledge sharing in SCC.

The paper aims to review the literature and perform an empirical analysis on the factors that contribute to knowledge sharing among supply chain participants and deduce knowledge sharing as an imperative for successful SCC. The review is guided by following three research questions:

RQ1. What is the nature and extent of knowledge sharing in SCC?

RQ2. Does knowledge sharing in SCC benefit the supply chain participants?

RQ3. What are the key themes that need to be addressed for future research and implementation of successful knowledge sharing in supply chain collaboration?

The paper is organized as follows. Section 2 describes the research methodology and statistics and discusses the sample. Section 3 is the discussion on the main topic and addresses the research questions by discussing the dimensions of supply chain collaboration, empirical analysis of knowledge sharing in supply chain collaboration and barriers of knowledge sharing among supply chain participants. Section 4 describes the benefits of effective knowledge sharing across various supply chain processes identified in the study. Section 5 describes the future research opportunities and practical implementation of knowledge sharing in supply chain collaboration. Section 6 provides the conclusion on the literature review including the limitations of this study.

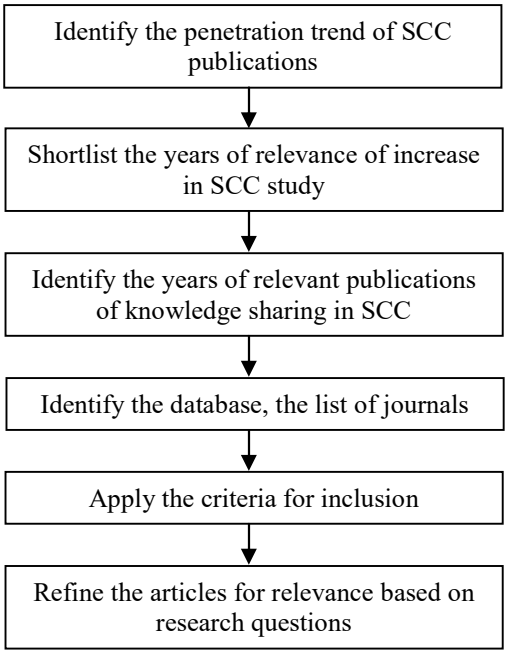
2. RESEARCH METHODOLOGY AND STATISTICS

Since knowledge or information sharing in SCC was the key focus area, it was significant for the review to understand the level of academician interest in SCC over the last decade. First, for the initial keyword search of *supply chain collaboration,* we could see there was an increasing trend on publications for the same topic since 2009 in various international journals. Second, to shortlist the time period of publications to be considered for the review, keyword search of *supply chain knowledge transfer* was done. It was found that majority of publications relevant in knowledge sharing in SCC were published within the last six years, subsequently, the articles for review inclusion were chosen from years 2005 – 2016. These years also ensure that this review includes academician recommendations for patterns of knowledge sharing, during the maturing years of supply chain collaboration, as well. Third, after identifying and establishing on the key concepts to be researched and relevant years to include in the study, keywords were shortlisted and articles were reviewed and researched for the relevant data to conclude the findings based on empirical analysis. The articles were also looked into to identify the impact of technology on knowledge sharing among supply chain partners and the utilization of technology such as information technology systems for information sharing among supply chain participants. Fourth, to achieve the highest level of relevance, only articles published in English in leading supply chain international journals were considered which includes literature reviews, relevant case study, and research papers, where textbooks and book chapters were excluded.

Empirical research was done by performing a systematic literature review of publications, which overlapped in two criteria, first, the list in the initial search for relevant articles for this research and second, the list of publications that was repeatedly mentioned in other works of literature taken for this study. Accordingly, the publications included in research are *as listed here: Decision Sciences, The International Journal of Logistics Management, International Journal of Physical Distribution and Logistics Management, Journal of Business Logistics, Journal of Operations Management, and Journal of Supply Chain Management,* with the following keywords: *supply chain collaboration, supply chain literature review, supply chain knowledge transfer, supply chain collaboration antecedents, absorptive capacity, distributive capability, collaborative engagement, supply chain knowledge management collaboration* for the scholarly and practitioner articles in the years 2005-2016.

The scholarly papers and research studies were found using Google Scholar as a search engine, for its ease of use and providing the count of 'Cited by'. The articles were further granulated with the focus of current state of supply chain collaboration, the role of knowledge sharing in supply chain collaboration to achieve the desired results of supply chain collaboration, the qualitative and quantitative factors affecting knowledge sharing among participants in supply chain collaboration, the benefits and hindrances of effective knowledge sharing in supply chain collaboration, techniques of how to execute effective SCC including knowledge sharing among the participants and the future scope of implementation and research.

TABLE 1: METHODOLOGY OF RESEARCH



2.1 Search Results

A total of 11 literature reviews, 4 research papers and 1 case study was included in the scope of this review, after extensive search and refine on the relevance of published articles in the dimension of our research focus, nature and extent of knowledge sharing in SCC, benefits of knowledge sharing in SCC and the key themes for future research for implementation of knowledge sharing. Out of the many articles found in search results, only the articles 'cited by' at least 240 are taken into consideration and were further refined on the focus areas of qualitative parameters of knowledge sharing such as trust, power, collaborative symmetry etc., which is detailed in the paper and on the quantitative parameters of collaboration interdependency theories detailed in the review.

2.2 Data statistics

After considering a number of journals for relevant articles – literature reviews, case studies and research papers, on supply chain collaboration and knowledge sharing, we identified the most relevant articles from the below journals with the number of articles included in our review mapped in below table:

TABLE 2: NUMBER OF ARTICLES DISTRIBUTION IN JOURNALS INCLUDED IN THE STUDY:

3. DISCUSSION AND EMPIRICAL ANALYSIS OF KNOWLEDGE SHARING IN SCC

Soosay and Hyland, 2015 differentiates coordination with collaboration in supply chain as 'collaboration can be conceptualized as a strategy, a unique dynamic capability and the highest form of long-term, trust-based relationship. It is characterized by joint planning and decision-making regarding strategic and operational matters; resource, process, information and risk sharing and mutual understanding, working towards shared goals and achieving optimal solutions'. Knowledge sharing in supply chain helps the participants to share the risks, costs and generate competitive advantage for market share as the prevailing competition is largely characterized by time-based competition. The knowledge sharing related to supply chain often results in a speedier delivery of quality products or services, which increases market share, as well as lower overhead and inventory costs (Cao and Zhang, 2011). Furthermore, Cao and Zhang, 2011, identifies seven interconnecting elements in supply chain collaboration as information sharing, goal congruence, decision synchronization, incentive alignment, resource sharing, collaborative communication and joint knowledge creation. Knowledge sharing among supply-chain partners, as a key aspect of such partnerships, has been deduced to be critical to the performance of a collaborative supply-chain network (Ralston, 2014; He et al, 2013).The key decision criteria of a successful knowledge sharing between SCC participants is dependent on the knowledge transfer characteristics such as absorptive capacity, dispatching capacity and distributive capability (Whitehead, Zacharia and Prater, 2016) along with other qualitative factors. Knowledge acquisition is the process of accessing and absorbing knowledge through direct or indirect contact or interaction with knowledge sources (He et al., 2013). Successful collaboration is dependent upon the abilities of each firm to the collaboration and, more specifically, each firm's specific knowledge absorptive and transfer capabilities (Whitehead et al., 2016). An empirical analysis of the factors in knowledge sharing in SCC is discussed in the next section.

3.1 Impact of qualitative factors in knowledge sharing in SCC

Although supply chain participants in dyadic and extended frameworks appreciate having access to the relevant, quality, reliable information for effective performance and reduce wastage, the qualitative factors required for the successful knowledge collaboration and sharing are highly significant. Trust (Ahmad and Ullah, 2013; Cai et al., 2013; Almeida et al, 2015; He et al., 2013; Gold et al., 2010), mutual respect, information sharing (Almeida et al, 2015), reduced privacy barriers, reliance on supply chain partners in providing accurate detailed and timely demand information (Ahmad and Ullah, 2013), synchronized communication (Almeida et al, 2015), idiosyncratic resources (Cao and Zhang, 2011), dysfunctional silos in organizations (Soosay and Hyland, 2015), power (Cai et al., 2013; Almeida et al, 2015; He et al., 2013), commitment, shared values and a common vision of the future (Gold et al., 2010; Cai et al., 2013; Soosay and Hyland, 2015) comprise the qualitative factors that measure the nature and extent of effective knowledge sharing in supply chain collaboration.

Power is defined as the ability of one party (A) to get another party (B) to undertake an activity that B would not otherwise undertake (He et al., 2013). He et al., 2013 distinguishes between 'possessed power' and 'realized power' as 'realized power' is the outcome of exercising 'possessed power' to bring about intended changes in the behavior of the counterpart and balanced power exists where partnership actors possess broadly similar levels of power in influencing each other's decisions, while unbalanced power exists when one or more actors are able to manipulate decisions of the other actors. The power allocation among the supply chain participants is a key attribute to measure the nature of knowledge sharing, as some participants deem to be more powerful with access to key information and resources and less interdependency.

Trust among the participating members can overcome the disadvantages related to power disparity for knowledge sharing. Knowledge sharing between the buyer and the supplier requires that business practices, information, and technology know-how be shared (Cai et al., 2013), which requires substantial amount of trust and power distribution between the participants and defines the nature of the interdependent relationship. Trust in inter-organizational relationships is that it constitutes the essential element of organizational culture which is necessary for the individual to interact and share knowledge (Ahmad and Ullah, 2013). Trust may help to overcome obstacles in technical knowledge sharing and would increase a firm's willingness to share more technical knowledge as any potential risk of opportunism is reduced, and would make technical exchanges more efficient by reducing the time, effort, and financial cost in knowledge sharing (Cai et al., 2013). Trust grows over time and is embedded in the relationship itself. Trust cannot be traded on the marketplace and is very difficult to imitate by competitors (Gold et al., 2010). Two-way communication, facilitated by various forms of information technology and even extended to sensitive design information and crucial project and planning processes (Gold et al., 2010) may be assumed prerequisites of transferring and combining knowledge and hence initiating inter-organizational learning processes that may lead to the inter-firm competitive advantage.

Training improves the individual's knowledge on the SC system, while information sharing among participants in supply chain network in data level such as inventory levels, stock levels, etc. improves the performance of the SC system. As partners share and communicate with transparency and credibility, behavioral response due to improved trust, honesty, respect and commitment promote strategic collaboration, reducing the impact in SC network due to the volatility of supply and order disruptions (Almeida et al, 2015). Collaboration through Information sharing and joint decision making among participants in a SC network improves the trust and behavioral responses to make the supply chain more stable (Almeida et al, 2015). From the literature reviews, it is observed that the qualitative factors that measure the nature and extent of effective knowledge sharing in supply chain collaboration are interdependent to leverage the SCC. SCC is a "… business agreement between two or more companies at the same level in the supply chain or network in order to allow greater ease of work and cooperation

towards achieving a common objective" (Ahmad and Ullah, 2013). Successful SCC is when it is considered as a chain of B2B processes integrated with B2C processes. The sequential qualitative methodologies that can be used for knowledge sharing in SCC are (Kampstra, Ashayeri and Gattorna, 2006):

1. "Communication"- sharing of information through simple IT applications,
2. "Co- ordination"- intra and inter entity co-ordination of processes,
3. "Intensive Collaboration"- for improving the strategic decision making and enhancement of innovation in the supply chain,
4. "Partnerships"- sharing of investments and also profits.

In order to perform knowledge sharing in SCC, the participants need to identify the collaborative network defined as 'constituted by a variety of entities (e.g. organizations and people) that are largely autonomous, geographically distributed, and heterogeneous in terms of their: operating environment, culture, social capital, and goals' (Camarinha-Matos and Afsarmanesh, 2005) of SCC if in a dyadic/extended participant's relationship between buyer-supplier in the B2B and buyer-supplier-customer in a B2B+B2C framework.

Hence it is posited that the nature of knowledge sharing in SCC is defined by the quality of these identified qualitative factors and extent of knowledge sharing in SCC extends from the dyadic buyer-supplier relationship to an extended network of all participants including the customer.

3.2 The measurable impact analysis of knowledge sharing in SCC for participants

The dominant competitive advantage of any business firm is having access to predictive/un-predictive information and data first handed and vital data/information being immediately accessible to all participants in the collaborative network in order to perform a quick responsive strategy. In order to maximize the benefit of information sharing in the supply chain network, it is critical to understand the concept of 'sender'/ 'source' and 'receiver'/ 'recipients' participating in the information sharing in a dyadic/ extended network of supply chain participants. *Sources* are defined as the organizations that have substantial specialized (rare, inimitable) commercial knowledge, based on expert knowledge and/or experience (Whitehead et al., 2016). *Recipients* are those organizations that are intentionally looking for specialized knowledge for commercial application and they have an identified need that must be filled by the knowledge that is not available within their firm (Whitehead et al., 2016). Once the sources and recipients (Whitehead et al., 2016) acknowledges their mutual collaborative role in supply chain, as the information sharing process progresses, closeness increases between the receivers and the senders and finally the members become able to act on new information in a timely manner, helps in improving relationships through the integration of partners information system, decision systems and business processes leading to improved performance , increase in visibility and reduction in uncertainty (Ahmad and Ullah, 2013) which paves the way to achieve inter-organizational competitive advantage to be a key player in the industry.

The bull-whip effect (BWE) in supply chain network was studied by two of the authors covered in literature reviews, Almieda et al., 2015 and Kembro et al., 2015, who identify BWE as the amplification in demand order variability as it moves up the spectrum of supply chain network and 'Information distortion also leads to a behavioral cause of BWE which is related to stock suspicion, when companies request a surplus amount of orders due to being afraid of reaching an empty stock and lose customers' (Almieda et al., 2015). The review notes that 'information sharing through information integration and synchronized communication improves the demand forecasts performance, sharing information is essential to reduce the fluctuations in inventories replenishment to improve the performance of the SC' (Almieda et al., 2015).

The percentage of contribution to firm performance index, due to the act of knowledge sharing among collaborative partners would be impacted by distributive capability (DC) - The ability of a knowledge source to transfer commercially relevant knowledge to a known recipient in order to effectuate positive performance outcomes (Whitehead et al., 2016), absorptive capacity (AC)- the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends (Whitehead et al., 2016) and dispatching capacity - The ability of the firm to identify essential knowledge, prepare it for transfer and ensure that it is transferred in its entirety (Whitehead et al., 2016). DC and AC are complementary requirements for knowledge transfer and their asymmetry leads to necessary behavioral changes by either the source or the recipient or both suffer reductions in knowledge transfer success and the recipient's level of AC is positively related to the level of engagement in collaborative initiatives and to the operational outcomes of collaborative initiatives (Whitehead et al., 2016). The knowledge-based view (KBV) posits that the relative ability to acquire and develop knowledge is the key reason for variances in organizational performance making knowledge acquisition capability an essential contributor to the enhanced operation of supply chain partners with knowledge acquisition mechanisms in supply chains including joint problem solving, ongoing manual adjustment, supplier co-design and collocation (He et al., 2013)

Firms need to identify the breadth and scope of knowledge sharing, in the dimensions of tactical, strategic and operational, where tactical knowledge sharing include purchasing, operation scheduling and logistics (Ahmad and Ullah, 2013), quarterly forecasts, plans and trends, operational knowledge sharing include order information, demand or sales data stock levels (Kembro et al., 2014), and strategic knowledge sharing includes long- term corporate objectives, marketing and information of the customer (Ahmad and Ullah, 2013), one-year forecasts, sales promotion and marketing strategies (Mentzer et al., 2001) to enable effective planning of future purchases and growth within the alliance (Kembro et al., 2014).

Hence it is posited that knowledge sharing in SCC benefits the business and the supply chain participants.

3.3 Method for knowledge sharing among SCC participants

Once the business advantage through knowledge sharing in the collaborative network (CN) is acknowledged by supply chain participants, for effective collaboration, it is critical to identify the organizational behavior and nature of participants. We have used the list of collated theories in the literature review by Soosay and Hyland, 2015, and grouped the decision factors of each of the theories from various authors and identified the B2B and B2C process collaboration needed in terms of interdependence theory in literature review by Kembro and Selviaridis, 2015. Kembro et al., 2015, in their paper of empirical study of demand-related information sharing in dyadic and extended supply chain has identified that 'supply chain participants adapt information sharing in a pooled, serial or reciprocal type of interdependence'. "Interdependence theory suggests that groups or units within an organization are interdependent because of their technological requirements" (Kembro et al., 2015) Three main types of interdependence are:

1. Pooled interdependence signifies two activities without direct links that share a common resource and together contribute to a system output: "each part renders a discrete contribution to the whole and each is supported by the whole" (Thompson, 1967, p. 54);
2. Serial interdependence exists through direct links between activities where the input of one part is directly dependent on output from another; and
3. Reciprocal interdependencies represent the mutual exchange of inputs and outputs with "each unit posing contingency for the other" (Thompson, 1967 p. 55).

SOURCE : Kembro et al., 2015

Myers and Cheung (2008) identified the types of knowledge sharing required in the supply chain.

1. Information sharing: takes place when companies exchange important data about sales, customer needs, market structures and demands.
2. Joint sense making: occurs when supply chain participants' work together to solve operational problems, analyze and discuss strategic issues and facilitate communication about the relationship.
3. Knowledge integration: occurs when supply chain partners develop relationship-specific memories, providing everyone with a common understanding of idiosyncratic routines and procedures governing the relationship.

Once the type of interdependency for each type of collaboration was identified, we mapped the type of knowledge sharing needed for supply chain participants aligned to the corresponding collaborative theory.

TABLE 3: MAPPING OF TYPE OF KNOWLEDGE SHARING FOR THE COLLABORATION THEORY:

Organizational theory for collaboration	***Decision factors***	***B2B/B2C process collaboration needed - pooled/serial/reciprocal***	***Method for knowledge sharing***
Resource-based theory (Barney, 1991)	**:** collaborations are designed to enlarge the size of the joint benefits and give each member a share of a greater gain that could not be generated by each member alone **:** resources, including technologies could be utilized and exploited from supply chain partners or synergistically combined to derive competitive advantage **:** firms enter into resource based collaborative agreements to complement their resources **:** inter-organization collaboration facilitates the development of valuable resources	Reciprocal Interdependence	Knowledge Integration
Relational view (Dyer and Singh, 1998)	**:** idiosyncratic inter-firm linkages are an important source of competitive advantage and superior rent, as relational rents are the supernormal profits jointly created in a collaboration through the combined idiosyncratic assets, knowledge and capabilities of firms and such resources can be distributed across partners in the supply chain **:** four sources of relational rents: (a) relation-specific assets; (b) knowledge sharing routines; (c) complementary resources/capabilities; and (d) effective governance **:** The unit of analysis in the case of the relational view is networks and/or dyads of firms	Pooled Interdependence	Knowledge Integration

Organizational theory for collaboration	*Decision factors*	*B2B/B2C process collaboration needed - pooled/serial/reciprocal*	*Method for knowledge sharing*
	: Shared resources and routines are a source of competitive advantage		
Resource advantage theory (Hunt and Davis's, 2008)	**:** firms that bundle resources of greater effectiveness and/or lower cost relative to competitors due to heterogeneously distributed resources within markets achieve superior performance and to reduce uncertainty and interdependence **:** recognizes the significance of power	Pooled Interdependence	Joint sense making
Social exchange theory (Homans, 1958)	**:** incorporates social factors into relationships and explain how companies in exchange relationships in a supply network evaluate the outcomes of the collaboration against pre-conceived reward expectations **:** collaborative behaviors and information sharing comprising trust, commitment, reciprocity and power can affect the performance of supply chains as a whole.	Pooled Interdependence	Information sharing
Stakeholder theory (Freeman, 1984; Donaldson and Preston, 1995; Mitchell et al., 1997)	**:** used to identify the dynamics of interaction between an organization and its stakeholders, characterized by power, legitimacy and urgency	Pooled Interdependence	Information sharing
Signaling theory (Spence, 1973)	**:** supports the idea that potential signals (e.g. a firm's reputation, philanthropic actions or media announcements concerning strategic decisions) could positively or negatively affect buyer–supplier relationships	Pooled Interdependence	Information sharing
Force field theory (Lewin, 1951)	**:** proposes the need for managers to consider the driving forces - customer demand, aligned goals, shared customer-oriented vision, trust, supplier development and technological connectivity and resisting forces - lack of senior management support, inadequate technology, organizational culture and structure, people, policy and processes,	Serial Interdependence	Information Sharing

Organizational theory for collaboration	*Decision factors*	*B2B/B2C process collaboration needed - pooled/serial/reciprocal*	*Method for knowledge sharing*
	opportunism, information and power asymmetries which serve as barriers to effective collaboration, when pursuing a collaboration capability.		
Transaction cost theory (Williamson, 2008)	**:** explain SCC in terms of the uncertainties, risks and opportunism in partners. **:** both demand uncertainty and environmental uncertainty & dependency affect the level of information shared with key suppliers, which in turn could have impacts on collaboration across the supply chain. **:** firms enter into collaborative agreements in order to reduce the cost of participating in the market and explains the governing mechanisms used by firms to prevent opportunistic behavior or uncertainty	Pooled Interdependence	Knowledge Integration
Contingency theory (Fielder, 1964)	**:** used to support collaborative planning initiatives in supply networks as there is no best way to organise, lead or make decisions, where the optimal course of action is dependent upon the internal and external situation.	Reciprocal Interdependence	Joint sense making
Agency theory (Jensen and Meckling, 1976; Eisenhardt, 1989)	**:** provides insights into how social, political, legal and behavioral dynamics affect supply chain relationships	Pooled Interdependence	Information Sharing
Technology-Organization-Environment theory (Tornatzky and Fleischer, 1990)	**:** used in electronic collaboration studies to explain customer-supplier relationships and the adoption or diffusion of technology.	Serial Interdependence	Knowledge Integration

Source references: Soosay and Hyland, 2015; Richey et al., 2012; Gold et al., 2010, Murray et al., 2005; He et al.,2013; Zacharia et al. 2011; Barney, 1991; Dyer and Singh, 1998; Hunt and Davis's, 2008; Homans, 1958; Freeman, 1984; Donaldson and Preston, 1995; Mitchell et al., 1997; Spence, 1973; Lewin, 1951; Williamson, 2008; Fielder, 1964; Jensen and Meckling, 1976; Eisenhardt, 1989; Tornatzky and Fleischer, 1990.

The resource-based theory focuses on supply chain partners, where collaboration is required for firms to complement their resources, facilitating synergistic development, to enlarge the join benefit and generate competitive advantage. Participants in such collaborative network pose reciprocal interdependency with mutual exchange of data through knowledge integration such as EDI to improve information processing and sharing information on automated technology implementations for mutual benefit to improve joint efficiency. (Kembro et al., 2015).

The relational view is relevant on a buyer-supplier network where, trust rather than opportunistic behavior, creates collaboration through combined idiosyncratic assets, knowledge of the firms, and resources are distributed across the partners as relational rents, jointly creating supernormal profits (Kembro et al., 2014; Soosay and Hyland, 2015). Pooled interdependence process collaboration among such partners in a relational view, with the knowledge integration method, for knowledge sharing of idiosyncratic routine and procedures governing the relationship can complement the advantages generated by partners in relational view.

Resource advantage theory recognizes the importance of power among supply chain partners, and "highlights how firms that bundle resources of greater effectiveness and/or lower cost relative to competitors due to heterogeneously distributed resources within markets can achieve superior performance" (Soosay and Hyland, 2015). The collaboration interdependence among partners in such network is pooled interdependence, as activities may/may not have direct links that share a common resource, however each will be supported by the whole. Joint sense making type of knowledge sharing compliments the benefits generated by partners in similar network, where they analyze and discuss strategic issues and facilitate communication.

Social exchange theory is relevant on supply chain partners in CN, who incorporates social factors into relationships, leveraging positive collaborative behaviors such as trust, commitment, reciprocity and power to affect the performance of supply chain as a whole (Soosay and Hyland, 2015). The participants share a pooled interdependence in such a network with the knowledge sharing method of information sharing, where participants exchange information data about sales, customer needs, market structures and demands

Stakeholder theory focuses on the qualitative behavior of stakeholders, and signaling theory focuses on the idea that potential external participant-market signals/behavior could affect buyer-supplier relationship (Soosay and Hyland, 2015) and pooled interdependence with information sharing may be used in both collaborative network theory participants.

Force field theory focuses on "driving forces such as customer demand, aligned goals, shared customer-oriented vision, trust, supplier development and technological connectivity" (Soosay and Hyland, 2015), creating a serial interdependency among participants, where information sharing through electronic data exchange can be the knowledge sharing method.

In the collaborative network where market situations and economic transactions are driving factors, transaction cost theory can be relevant, as "it explains supply chain collaboration in terms of the uncertainties, risks and opportunism in partners" (Soosay and Hyland, 2015). The participants share a pooled interdependence in the network, where knowledge integration through electronic data integration could compliment the collaborative advantages.

Contingency theory "supports that there is no best way to organize, lead or make decisions, where the optimal course of action is dependent upon the internal and external situation" (Soosay and Hyland, 2015). The partners share reciprocal interdependency where joint decision making could support the collaborative network.

Supply chain participants exhibiting agency theory attributes, could benefit from information sharing as they share a pooled interdependence. Participants in technology-organization-environment theory share serial interdependence, where partners share direct links on input provided from each other to generate output, and knowledge integration would add significant value for supply chain players.

Although we could conclude theoretically the type of knowledge sharing needed for the identified collaboration theories, a challenge exists on the quality of implementation of the same due to asymptotic idiosyncratic behavior of supply chain participants or opportunistic behavior among any participants in dyadic or extended collaborative network (CN). The barriers for knowledge sharing in pooled interdependence are demand information disaggregation; risk of demand information misinterpretation; and risk of making production and distribution decisions based on incomplete information. (Kembro et al., 2015). Similarly, the quality of information shared which is determined by accuracy, timeliness, credibility and proper formatting of data plays a significant role in the information sharing process (Ahmad and Ullah, 2013). In a knowledge integration form of information sharing, if a central ERP system or information technology systems are practiced by supply chain participants, it is imperative to ensure that all participants are connected to the system and synced with common data, albeit the business buy-in for the cost sharing by participants could be challenging as the benefit-cost ratio might increase only at the later stage of implementation of the same.

Kembro et al., 2014 also captures a final barrier, related to power-dependence theory as 'power asymmetry…resistance to sharing information. A company may fear that they could become overly dependent or the dominant player does not wish to lose the current favorable position and bargaining power in a supplier–buyer relationship. Indeed, the relative power of buyers/suppliers to one another can influence the degree of (inter)dependencies in supply chains, considering whether market shares as percentage of total expenditure/sales are high or low, and also how buyers and suppliers are connected to each other and to the broader supply networks'

Further research is needed in the classified theories and mapping we have concluded from various literature reviews on how implementation of successful knowledge sharing can be performed in collaborative network (CN).

Hence it is posited that the above discussed structural and organizational barriers, identification of collaboration method needed for the supply chain participants and the knowledge sharing method required for the participants are the key themes that need to be addressed for future research and implementation of successful knowledge sharing in SCC.

4. BENEFITS OF KNOWLEDGE SHARING IN SCC

From the literature review, it is found that most of the studies found the performance of firm improves by knowledge sharing among partners in SCC and benefits include lower operating costs, higher productivity and improved planning of production for all supply chain partners (Kembro et al., 2015). The level of knowledge acquisition from its supply chain partners is positively related to the supply chain performance of a focal firm (He et al., 2013). Knowledge sharing in collaborative supply chain network would result in improving the performance of supply chain, increase in visibility and reduction in uncertainty, improved forecast, reduced inventory levels to more long term benefits like enhanced planning in SC (Kembro et al., 2015, Ahmad and Ullah, 2013).

The reasons for the amplification of demand variation across the supply chain participants in supply chain is observed as distortions, lack of transparency, and information sharing such as historical level of end-user demand, schedule requests from businesses downstream in the SC and inventory information, also downstream in the SC (Almeida et al., 2015). The efficiency of the supply chain is related to the streamlined flow of information across the upstream and downstream participants in the CN could result in well-informed strategic decisions for the supply chain participants (Kembro et al., 2015). From the reviews it is observed that information sharing by information integration, data exchange, and synchronized communication will improve the operational, tactical and strategic decision making among the supply chain network participants, further paving the way for the network participants to be key players in a dynamic market environment.

5. FUTURE RESEARCH AND PRACTICAL IMPLEMENTATION OF KNOWLEDGE SHARING IN THE SCC

Simatupang and Sridharan (2005) in their study of 76 retail companies in New Zealand have found that sharing of information significantly affected on-time delivery, accuracy, fill rate and inventory performance, while it had a moderate impact on lead time and flexibility. Another example of utilizing knowledge transfer for business profits is Toyota's production network; it comprised not only numerous procurement relationships but also a vast array of bilateral and multilateral knowledge-transfer routines (Cai et al., 2013). In IKEA, knowledge sharing is a culture, and the company trains its supplier network on new innovative methods for cost cutting in suppliers' processes and methodologies, in order to achieve the market driving strategy.

Knowledge management in upstream and downstream in SCC, is identified as an important mechanism to maintain competitive advantage during periods of rapid change due to innovation, technology, and disruption (Almeida et al., 2015).With the revolution of robotics, artificial intelligence and drones as disruptive driving force for the future market, where robots and humans are predicted to work alongside or replace human workforce by 2020, as per the projection by the World Economic Forum (The Global Risks Report 2016, WEF), and the current trend of customer preference of switching from retail stores to online purchasing with growing e-commerce, supply chain participants in the dyadic and extended network should not overlook the benefits that can be achieved by knowledge sharing among them through the interdependencies and theories discussed in this paper in order to achieve market growth advantage and to become indispensable players in a rapid technology intervened growth industry. Further research in the dimension of surveys, case studies of practicing firms, mapped to each of the dependence theory in supply chain management is needed to establish the theories concluded based on literature review.

6. CONCLUSION

The literature review sought to explore the nature and extent of knowledge sharing in SCC, the benefit of knowledge sharing in SCC for participants and key theme that needs to be addressed for future research for implementation of knowledge sharing in SCC. The review has explored the subsequent steps required by the B2B and B2C collaborative supply chain participants, based on the organizational theory decision factors and hypothesized the method by which participants can share knowledge in order to leverage the competitive advantages generated by successful collaboration. Profit sharing among supply chain participants, implementation of ERP IT for information sharing and information integration, representation of leaders of participating supply chain actors in mutual leadership board for sharing the risks and benefits, improving the trust and power disparity etc. are the methods to implement and leverage the knowledge sharing among supply chain network firms.

Although the literature implies the significance of knowledge in leveraging the SCC benefits, the source of knowledge and sharing of the same within B2B and B2C and extended participants is not thoroughly studied through current research. Future research on the concepts observed in this literature review can be performed in the dimension of the case study in practicing firms. This would help to measure and deduce the qualitative and quantitative factors, and proposed hypothesis implementation in a buyer-supplier dyadic relationship or cross-pollinated network of buyer-supplier and buyer-supplier-customer, in a more holistic approach to explore this growing research area.

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MAXIMIZING ASSET RECOVERY: ESTABLISHING A DISPOSITION DECISION TOOL

Kimberly Whitehead, PhD, Anderson University, 316 Boulevard, Anderson, SC 29621
Edmund Prater, PhD, University of Texas at Arlington, 701 S. West Street, Arlington, TX 76019

ABSTRACT

Driven by both internal and external pressures, organizations are becoming skilled in the art of reverse logistics. Some of these have adopted reverse logistics voluntarily while others are participating due to governmental pressures and financial risk. This paper contributes to the literature by focusing on the asset disposition decision step in reverse logistics. Efficient and effective disposition decisions are key both to recovering the maximum economic value from returned assets and insuring social responsibility. Addressing the need for management tools, this paper proposes asset recovery selection criteria and performance measures that can be used to evaluate and compare disposition options.

INTRODUCTION

Despite their aggressive efforts to produce and sell products into their respective market channels, most organizations eventually become relegated to be passive recipients of those same products as they are returned through the reverse supply chain (Guide Jr. et al., 2003). This phenomenon is increasingly worrisome as the volume of products flowing through the reverse supply chain now exceeds $100 billion worth of products per annum in the USA alone (Stock et al., 2002) and continues to grow. By not proactively addressing the business issues and opportunities related to reverse logistics (RL) and the value of the products flowing through that system, many companies are not realizing the magnitude of potential economic gain associated with recovered assets (their returns) (Abdulrahman, Gunasekaran and Subramanian, 2014; Daugherty et al., 2001).

Recovered assets, products and packaging, lose their value quickly. If not actively managed by the organization, the majority of value can be eroded away during the RL process. (Blackburn et al., 2004; Souza et al., 2004). Yet organizations fail to realize that the returns environment has changed and that their returns process and RL systems should change accordingly to maximize the value of recovered assets (Blackburn et al., 2004; Mollenkopf et al., 2011; Souza et al., 2004). Organizations can learn to actively manage their reverse supply chains by breaking the RL system down into its component parts and addressing each in a systematic manner, much like is done with the forward supply chain (Guide Jr. and Van Wassenhove, 2003; Shaik and Abdul-Kader, 2014).

This paper is written as an effort to increase the transparency of the reverse supply chain and aid in the diffusion of management tools and performance measures. The focus of this paper is on one step in the RL process, the disposition decision. The RL disposition decision is defined as a decision that leads to the "establishment of an organizational policy regarding which recovery option to pursue for a specific product or line of products" (Hazen et al., 2011). Disposition decisions are key to maximizing the value recovered from returned assets and are therefore pivotal to the RL system. Many papers have explored the types of disposition options that are available to firms (Caplice and Sheffi, 1995; De Brito and Dekker, 2002; Krikke et al., 2004; Rogers and Tibben-Lembke, 2001; Stock et al., 1997; Thierry et al., 1995; Young, 2000), however, to date the only study that has investigated the disposition decision-making process is Hazen et al. (2011). In their paper, Hazen et al. (2011) perform a content analysis of the RL literature from 2000 to 2010 and create a list of high level decision parameters for disposition decisions.

This paper expands upon the work of Hazen et al. (2011) insomuch as it proposes a qualitative and quantitative selection criteria and performance measures that can be used to evaluate and compare disposition options. The approach taken to develop these measures is based on grounded theory, as it is both inductive and exploratory and takes a holistic view of RL as a business process. Current literature suggests that a holistic approach to the study of reverse logistics is warranted in order to advance this stream of research (Carter and Ellram, 1998; Dowlatshahi, 2005; Jayaraman and Luo, 2007; Shaik and Abdul-Kader, 2014). The intent of the paper is to contribute to the literature as an initial validation piece establishing parameters and providing qualitative support for certain performance measures to support strategic disposition decisions.

The outline of this paper is as follows. The paper begins with an overview of RL research, specifically laying a foundation to support the need for performance measures in the reverse supply chain. Next, RL frameworks are addressed in order to introduce the importance of the disposition decision within those models. Synthesizing the available literature, disposition options are then explored in detail including a discussion of related classification schemes. At this point the selection criteria and performance measures are proposed. The next section of the paper explains the process that was undertaken to interview managers and invite them to comment on the proposed asset recovery metrics. Their responses are analyzed and discussed along with the notable managerial implications of their response. Finally, the paper concludes with limitations and recommendations for future research.

LITERATURE REVIEW

Reverse Logistics

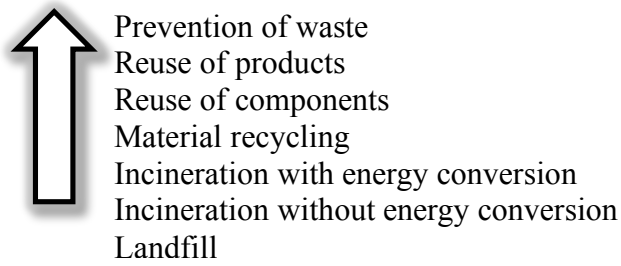
According to Rogers and Tibben-Lembke (1998), RL includes all business activities associated with the "process of planning, implementing, controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information point of consumption to the point of origin for the purpose of recapturing value or for proper disposal." Holistically, RL can be conceived as a process that recovers value from otherwise impaired assets in a cost effective and ecologically friendly manner (Sabharwal and Garg, 2013). This may include extending the products usage beyond its traditionally designed life span (Dowlatshahi, 2000; Dowlatshahi, 2005). In this manner and in order to be inclusive, for the purposes of this paper the (Rogers and Tibben-Lembke, 1998) definition for RL is expanded to exclude the points of consumption and origin. Additionally, as applied in De Brito and Dekker (2003), this paper intends to use RL as an all-inclusive construct that not only includes returns from customers, but also includes internally created impaired assets such as excess or obsolete items and/or spare parts.

There are numerous drivers for organizations to participate in asset recovery via a RL system (Rajagpal, Sundram and Naidu, 2015). These reasons are described in the literature as both voluntary and mandated and can be summarized in three categories: economic (direct and indirect), legislation, and extended responsibility (corporate citizenship) (De Brito and Dekker, 2002; Gungor and Gupta, 1999; Jayaraman and Luo, 2007; Nuss, Sahamie and Stindt, 2015). More specifically, Toffel (2004) describes typical voluntary motives as (i) reducing production costs; (ii) promoting an image of environmentally responsibility; (iii) meeting customer demands; (iv) protecting aftermarkets and (v) pre-empting regulation. Carter and Ellram (1998) further emphasized that the principal driver of RL as a valid business process is the existence of an internal "policy entrepreneur personally committed and willing to undertake responsibility for RL activities."

The drivers mentioned above are primarily associated with the cost effective goal of asset recovery and are concentrated on those product streams where there is some value to be recaptured and the disposition of the asset is into a new market channel (De Brito and Dekker, 2003; Sabharwal and Garg, 2013). There is also a growing trend toward utilizing RL to advance the ecological goals of the organization, customer and larger community (Santos, Andrade, Ferreira and Leme, 2013; Sarkis et al., 2010; Thierry et al.,

1995), these are referred to as end-of-life (EOL) strategies wherein the EOL recovery/disposal is planned at the time of creation, production and/or distribution of a product. An early model of EOL strategies for returns is Lansink's ladder developed in 1979 (Willems et al., 2006). As shown in Figure 1 Lansink's ladder is an ecological hierarchy of EOL options. Despite much research and advancement since 1979, the steps in the ladder resemble the options that are still employed today by organizations making disposition decisions. Disposition decisions, however, are being driven primarily by cost efficiency in lieu of ecological goals (Willems et al., 2006) and are hindered by the lack of deployed resources for RL planning and execution (Daugherty et al., 2001; Tibben-Lembke, 2002).

FIGURE 1
LANSINK'S LADDER ECOLOGICAL HEIRARCHY
(Lansink, 1979)



Disposition decisions, no matter their basis, ecological or economical (these are not mutually exclusive), begin with an understanding of the items returned. There are four types of returns that are generally included in a closed-loop supply chain. These include EOL, end-of-use (EOU), commercial and reusable returns. Figure 2 illustrates an integrated supply chain and shows graphically the differences between these four types of returns. More specifically, they are defined by Krikke et al. (2004) as follows:

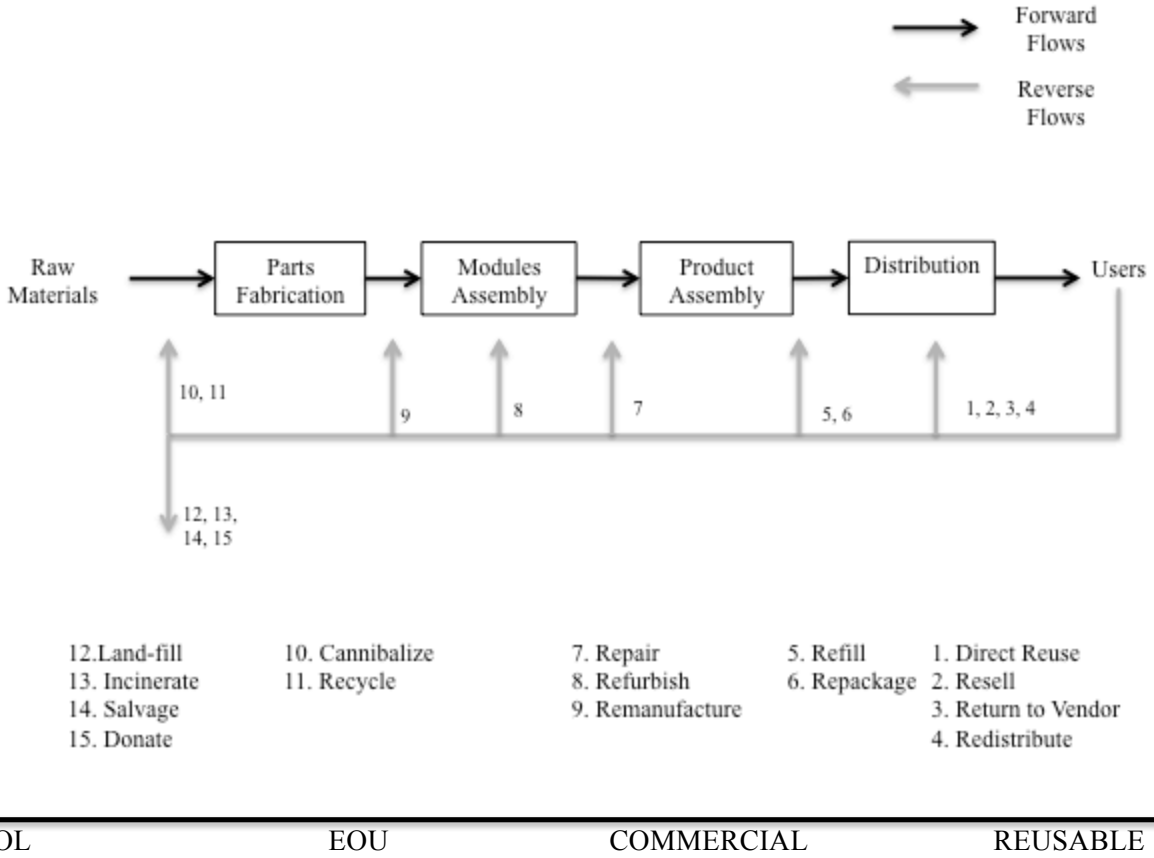
- *End-of-Life* – these are taken back from the market in order to meet environmental standards or legislation. These are generally managed according for formal rules or regulations. Typical items that are collected in this category include tires, batteries, packaging and vehicles.

- *End-of-Use* – these items are typically returned after usage at the end of a lease, as a trade-in or for product replacement. Many cases these have a high economic value and can be repaired or remanufactured.

- *Commercial Returns* – these are generally returns from the business to consumer sales process. They are returned shortly after the original sale and are associated with either product defects or a poor out of box experience.

- *Reusable Items* – these returns are associated with the consumption of the main product or consumable. These returns include such things as pallets, refillable cartridges and bottles.

FIGURE 2
REVERSE SUPPLY CHAIN & DISPOSITION OPTIONS
(*Adapted from Thierry et al., 1995*)



A detailed description of each step within a RL system or closed-loop supply chain is beyond the scope of this paper. The reader is, however, directed to a substantial and exhaustive literature review completed by Ilgin and Gupta (2010).

RL Disposition Options

Returns management and asset recovery require that products be acquired from the user and transported to a centralized location. As items arrive they are inspected and sorted, at this point the company must decide what to do with the goods (Tibben-Lembke, 2002). This critical point in the process is referred to for the purposes of this paper as the disposition decision point. This is the point in the process upon which this research is focused.

Asset recovery includes the classification and disposition of returned goods, surplus, obsolete, scrap, waste and excess material products, and other assets, in a way that maximizes value recapture to the owner, while minimizing costs and liabilities associated with holding or disposing of the impaired assets (Mollenkopf et al., 2011; Rogers and Tibben-Lembke, 1998; Sabharwal and Garg, 2013). Many times there are trade-offs that must occur at this point in the process (Young, 2000). For example, in order to meet the desired ecological goals of the organizations stakeholders or the community at large managers may need to choose an option that does maximize economic gain to the organization. However, there is little written about this important decision making process and no decision models or performance metrics

have been published that specifically support asset recovery management disposition decisions (Bernon et al., 2011; Hazen et al., 2011).

Based on a synthesis of current literature a comprehensive list of disposition options has been adopted for this research (Bernon et al., 2011; Blackburn et al., 2004; Carter and Ellram, 1998; De Brito and Dekker, 2002, 2003; Guide Jr. et al., 2003; Ilgin and Gupta, 2010; Krikke et al., 2004; Kumar et al., 2007; Meade and Sarkis, 2002; Rogers and Tibben-Lembke, 2001; Rubio et al., 2008; Young, 2000). (See Table 1 Disposal Options and Descriptions) These options are divided into three disposition categories direct recovery, indirect recovery and disposal (De Brito and Dekker, 2002).

There is a distinct gap when it comes to providing direction on choosing between competing disposition options (Hazen et al., 2011). Likewise, the literature has not matured to the point of providing guidance regarding performance measures that can be used to make disposition decisions and then by which to track their actual performance to expectations. The next section of this paper sets out to begin filling this gap in the literature by proposing asset recovery metrics that can be used to choose between options and to subsequently track their performance. The research utilizes a foundation of definitions set out by Rogers and Tibben-Lembke (1998) and pursues a holistic approach by establishing selection criteria and performance metrics that can be integrated into overall business strategy.

Performance Metrics

Current literature does not include decision metrics or performance measures for disposition options. This is partly due to the complexity and individuality of each firm's strategy regarding their reverse supply chain (Caplice and Sheffi, 1995). Because most reverse supply chain strategies are still in their infancy (Dowlatshahi, 2005) few best practices, metrics or measures are in place and industry standards are not established. Formal modeling based on analytical and objective tools is lacking (Bai et al., 2012). Notably, authors have begun to call for the integration of tangible and intangible measures to assist in managing the every changing requirements of the supply chain both in forward and reverse flows (Bai et al., 2012).

Bernon et al. (2011) notes that they found several performance criteria in the literature, however, they were not integrated into performance systems so as to become a measurement or decision tool. Utilizing a total of 9 group discussions with supply chain managers (average 18 present in each session) Bernon et al. (2011) found that the participants advocated an integrated approach to performance management for reverse logistics. The authors specifically addressed scorecarding with the supply chain manager groups. A development from this discussion was a consensus that scorecarding may be a viable method to assist in avoiding dysfunctional behavior between functions within the organization (Bernon et al., 2011).

The cross-functional nature of reverse logistics has been cited in the literature as a stumbling block or barrier to implementation of effective and efficient reverse supply chain programs (Carter and Ellram, 1998; Kaynak, Kocoglu and Akgun, 2014). This is seen again in the interview sessions executed by (Bernon et al., 2011). This is strong support for a holistic approach to researching and managing reverse logistics (Carter and Ellram, 1998; Dowlatshahi, 2005). As suggested by Toffel (2004), with proper coordination between functions, cross functional management and continuous improvement capabilities can allow organizations to establish feedback loops from the RL core functions to other department to enable better EOL planning and design improvements. This coordination is also supported by research by Gungor and Gupta (1999) and Akcalı and Cetinkaya (2011).

TABLE 1
RETURN DISPOSITION TYPES AND DESCRIPTIONS

	Disposition Option	Description	Citation
Direct Recovery	Return to Orginal Vendor	Defective finished goods, parts or raw materials returned to source vendor.	Rogers and Tibben-Lembke 1998
	Reuse	Finished products that can be checked for quality and resold to primary markets.	Krikke et al., 2004
	Resell	Sell product in its current state with special discounts into primary market.	Rogers and Tibben-Lembke 2001
	Redistribute	Sell product in its current state through secondary markets.	Rogers and Tibben-Lembke 2001
	Refill	Units are refilled i.e. fill with ink and returned to inventory	Krikke et al., 2004
	Repackage	Damaged packaging is replaced or item is rekitted and replaced in inventory.	de Brito and Dekker 2003
Indirect Recovery	Repair	Restore product to working order, some component repaired or replaced.	Krikke et al., 2004
	Refurbish	Inspect and upgrade critial modules, some modules replaced by upgrades.	Krikke et al., 2004
	Remanufacture	Manufacture new products partly from old components.	Krikke et al., 2004
	Recycle	Materials are reclaimed.	Rogers and Tibben-Lembke 1998
	Cannibalize	Selective retrival of components from returned products.	Krikke et al., 2004
Dispose	Landfill	Destroying product and discarding in public or private landfills.	Rogers and Tibben-Lembke 2001
	Incinerate	Destroying product through incineration.	de Brito and Dekker 2003
	Salvage	Destroyed with component parts sold as scrap.	Stock and Mulki 2009
	Donate	If product is still servicable it can be donated to charity.	Rogers and Tibben-Lembke 1998

SELECTION CRITERIA AND PERFORMANCE MEASUREMENT DEVELOPMENT

The purpose of the paper is to establish qualitative and quantitative selection and performance measures to support an organization's reverse supply chain disposition decisions. To serve this purpose, both a quantitative model and a qualitative analysis tool are created. These proposed tools were then taken to 12 managers across diverse industries to get their feedback on the viability and usefulness of the RL tools. This methodology is built upon grounded theory as described by Strauss and Corbin (1998) as it is based upon qualitative research including interviews with concurrent and subsequent analysis. Concepts are the unit of measure in this type of analysis (Strauss and Corbin, 1998). Categories are developed and the analysis makes use of constant comparisons and patterns (Strauss and Corbin, 1998).

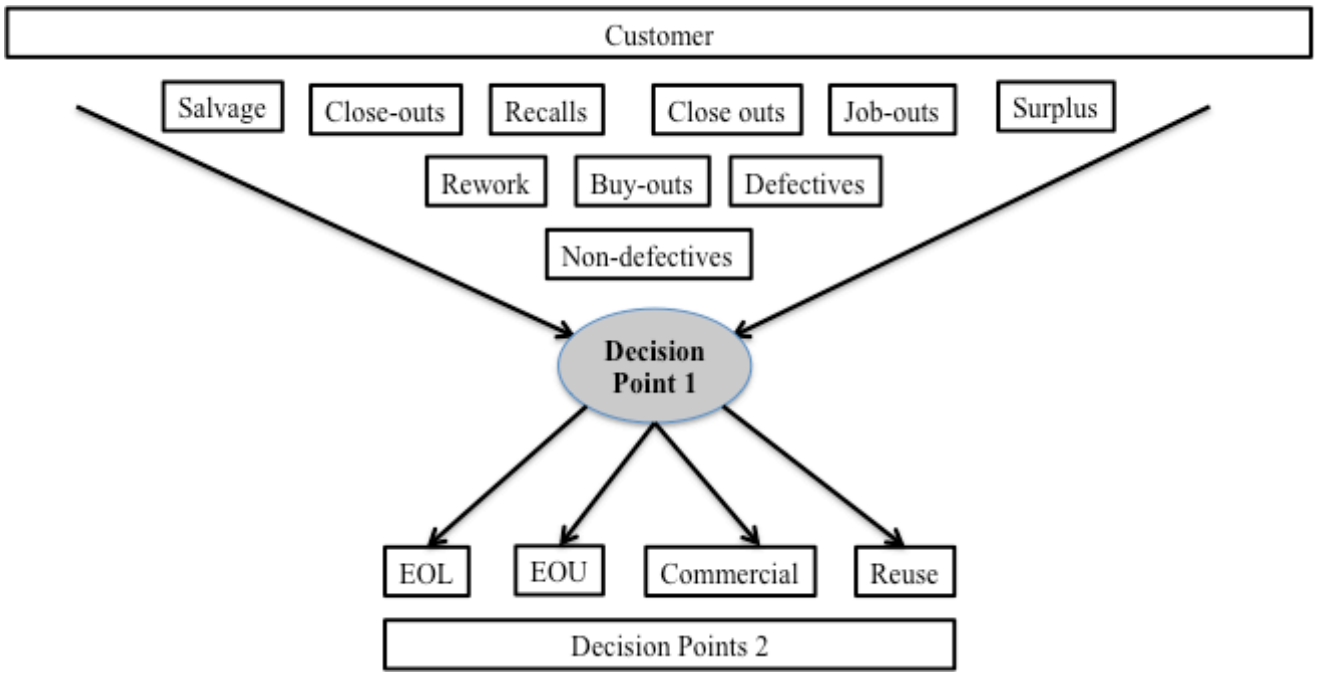
Disposition Scoring Model

The first step in this process was to build a disposition scoring model to differentiate between types of returns and evaluate potential disposition options. The disposition scoring model is built upon three fundamental keystones: classification scheme for returns, classification scheme for disposition options and a scoring system to evaluate and compare options. These keystones are developed in this section of the paper.

Return Classifications

This paper adopts the four categories of return as described by (Krikke et al., 2004): end-of-life, end-of-use, commercial and reuse. Each of these is fed by the sub-categories based on the reason for the return as shown in the diagram below (see Figure 3).

FIGURE 3
RETURN CATEGORIES



In order to categorize the returns into the four categories end-of-life, end-of-use, commercial and reuse, they must be inspected at the node shown above and entitled (decision point 1). It is proposed that at this point the returns be categorized with a coding scheme and in the form of a returns tracking unit (RTU), to be created and used similarly to the commonly known and used stock keeping unit (SKU), that would identify the item and its condition and classification and could readily be stored, tracked and shared between departments in formal or informal information systems or within information sharing processes. Realizing that the classification scheme needs to be flexible so that it can be tailored to an organization the following scheme is set forth as merely an example (see Table 2). This coding schema allows an RTU to be tracked systematically, planned for receipt in other departments and creates historical documentation that can be utilized by other functions such as quality or engineering. Institution of such a classification scheme can also assist a firm in early product differentiation in order to help maximize the value of the product whose value is dropping rapidly (Souza et al., 2004).

TABLE 2
TYPE OF COMMERCIAL RETURNS
(Adapted from Rogers and Tibben-Lembke, 1998)

Type	Attributes
Close-outs	First quality products that the retailer has decided to no longer sell.
Buy-outs (Buy-backs)	One manufacturer buys out a retailer's supply of a competitor's product.
Job-outs	First quality seasonal, holiday merchandise.
Surplus (Excess)	First quality overstock, overrun, marketing returns and slow moving items.
Recalls	Products that are suspected to be defective and can present safety concerns are returned to vendor.
Defectives	Products discovered to be defective (non-systemic defects).
Non-Defective Defectives	Products thought incorrectly to be defective.
Salvage	Damaged items.
Rework	Product with packaging that has been damaged in shipment or was packaged incorrectly.

The return reasons utilized in Figure 3 and the returns coding shown in Table 2 have been extended from those described by Rogers and Tibben-Lembke (1998) to include recall and rework. Although recalled items are similar to close-outs insomuch as they are discontinued item, they are distinctly different in the manner in which they need to be disposed (De Brito and Dekker, 2003). Additionally, recalled products may need to be tracked separately from other inventory assets to satisfy accounting, risk management and/or legal requirements. Rework is added to the return reasons to identify those items that are returned such that the product itself is non-defective, but the packaging must be replaced or the pack-out needs to be changed (De Brito and Dekker, 2003). For example, a pallet of products may be shipped to a customer with the wrong pack-out, which means that the items were not kitted properly. When this happens a

customer may return pallets of product back to the vendor to be properly kitted. The suggested return reason codes are defined in Table 3.

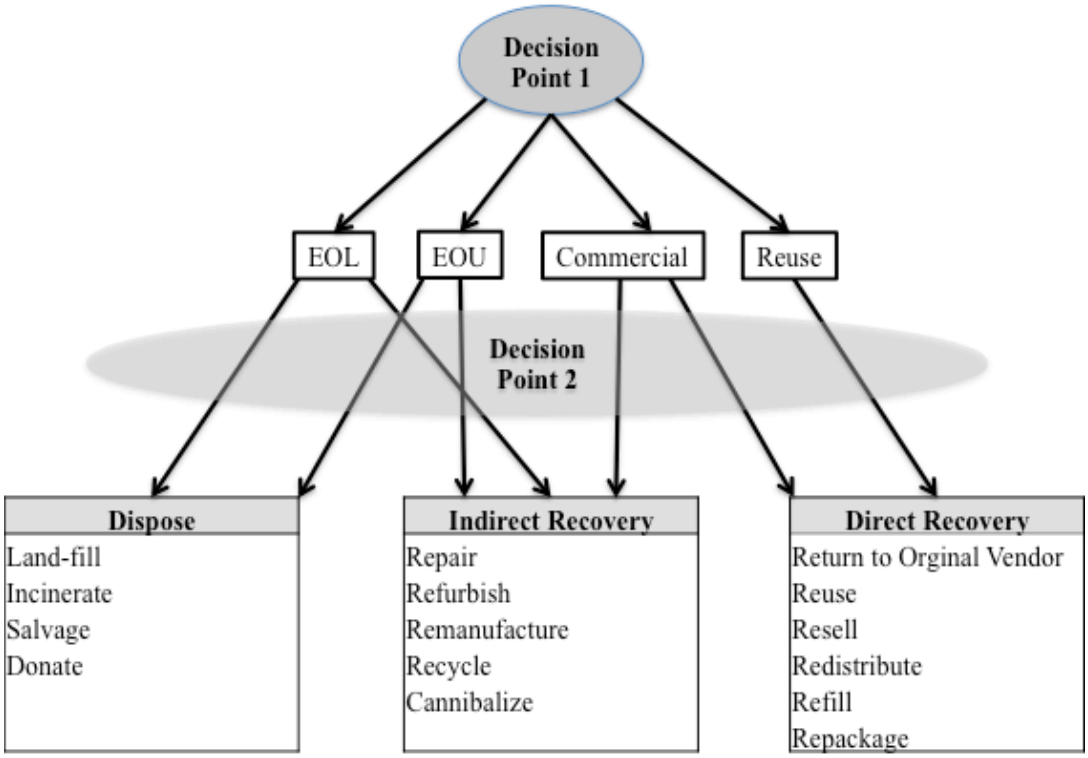
TABLE 3
CODING SCHEME FOR RETURN TRACKING UNITS (RTUS)

#	Based On	Levels	Codes
1	Proportion of the value of the item	Product, Packaging	PR, PA
2	Condition of the product	EOL, EOU, Commercial, Reuse	L, U, C, R
3	Reason for return	Recall, Close-outs, Buy-outs, Job-outs, surplus, Defectives, Non-Defective Defectives, Salvage, Rework, Other	RC, C, B, J, SU, D, N, SL, RW, O
4	Physical characteristics	Metals, Non-metals, Alloys, Other	M, NM, A, O
5	Source of return	Manufacturing returns, distribution returns, consumer/end user returns, other	M, D, E, O
6	Industry	Electronic, Automobile, Textile, Retail, Other	E, A, T, R, O
7	Type of product	Finished goods, sub-assembly, loose components, machines, tools, other	FG, SA, LC, M, T, O

Disposition Classifications

As shown in Figure 3 in the previous section return classifications and the assignment of RTUs allows a firm to sort, track and route the returns accordingly. In order for returns to be processed effectively and efficiently, they should be separated from the forward channel because of the different strategies and priorities associated with the different flows of materials and products (Rogers and Tibben-Lembke, 2001). Timely classification and coding (RTU assignment) will assist in this separation both physically and within a firm's information. Additionally, this type of classification scheme will facilitate Decision Point 1 as shown in Figure 3. This is the first step in the disposition decision process. The product must be identified as EOL, EOU, commercial or reuse as earlier defined. These narrowing of classifications reduces the options available to the decision maker in order to facilitate and speed the decision making process. See Figure 4 below that illustrates this portion of the decision making process (for ease of reference Figure 3 and Figure 4 are combined in Appendix A).

FIGURE 4
DISPOSITION OPTIONS



Based on this formal decision making process, a matrix could be built and used as a decision making tool. See the template created as an example and shown in Appendix B. Such a tool can be customized to meet a specific company and/or products needs or requirements. There are situations when the option for disposition is limited by legal or other restrictions and this should be communicated clearly to the manager responsible for making the disposition decision (Stock and Mulki, 2009). The proposed matrix can assist in communication such restrictions.

Quantitative Scoring System

In this section a scoring system is developed to assist the decision maker in quantitatively differentiating between competing disposition options. As can be see in Figure 4, in each disposition category (EOL, EOU, commercial and reuse) there is more than one disposition option. In order to choose between those options, this section develops a quantitative analysis to aid in choosing the most economical option. The quantitative analysis should be considered in conjunction with certain qualitative performance measures. Qualitative performance measures are discussed in the next section.

The magnitude of the score for a given disposition option i (DO_i) is given in equation 1. The score reflects the expected net value of implementing a strategy for a given return.

Score for Disposition Option$_i$ $DO_i = S_i =$

(Expected Recovery Value of DO_i) - (Value of RTU(s) under consideration) -

(Total expected cost of implementing DO_i)……Eq.1 (1)

It is important to note that the score calculation assumes an accrual-based value for the RTU. However, this calculation can be adapted to consider a cash flow basis depending on the priorities of the organization.

Value of RTU:

The motivation behind this parameter is to clearly state the book value of the RTU. This should be the original manufacturing cost or purchase price less any excess inventory or obsolescence accruals that apply to the subject RTU or group of RTUs.

Total expected cost of implementing DO_i:

This parameter is intended to include both the expected product recovery costs and environmental costs. Product recovery costs represent the fixed and variable costs of such things as required facilities, staffing, supplies, transportation, etc. associated with the disposition option. Total environmental cost is the summation of all the costs that are expected by the organization for environmental conformance with respect to a given disposition option. See Eq. 2 below.

Total expected cost of implementing DO_i =

(Total Expected Product Recovery Costs DO_i) +

(Total Expected Product Recovery Costs DO_i)……..Eq.2 *(2)*

Expected Recovery Value of DO_i:

The expected recovery value of a given disposition is the amount that is expected to be recovered in the disposition of the RTU. It is suggested that recovery values be tracked so that the historical values can be used to assist in this estimation for scoring purposes.

S_i:

After evaluating the three components of Eq.1, they are used in the equation to develop scores for each available disposition option. The maximum score is the most favorable to the organization.

By utilizing such a scoring model organizations can better understand the true costs (both cash and non-cash) that are associated with returns. Many organizations do not realize the critical nature of returns and their impacts to the profitability of the firm and are likely to only see returns as an operating expense associated with doing business (Stock and Mulki, 2009). This type of tool allows the organization to set aside prior conceptions of returns and look at dispositions in an objective manner.

Qualitative Analysis and Scoring

Qualitative analysis should occur simultaneously with the quantitative scoring in the preceding section. Realizing that qualitative metrics are highly subjective and vary depending on the needs of the specific organization and/or industry, the qualitative selection criteria presented here are intended to be directional and may be adopted or used as a road map to an organization implementing such a tool. Table 4 includes operational factors in RL systems as adapted from Dowlatshahi (2002).

TABLE 4
QUALITATIVE PERFORMANCE MEASURES
(Adapted from Dowlatshahi, 2002)

Measure	Yes	No
Use of computer network technology capable of tracking the returned products		
Reliability tests for determining the degree an extent of reusability of products		
Establishment of provisions for secondary markets for unwanted items		
Use of existing transportation routes and schedules		
Use of inter-modal transportation on a timely basis		
Availability of detailed shipping and receiving data for the proper handling and management of returned items		
Presence of economic benchmarks for acceptance / rejection of returned items		
Use of shipping in bulk and cube utilization		
Presence of separators (bins, place) for FSC and RSC items		
Use of existing warehousing functions and facilities		
Use of current warehousing methods and equipment		
Compliance with EPA, OSHA, ISO 14000		
Special storage requirements for storing returns (e.g., refrigerated warehouses)		
Do the supply chain partners comply with environmental and federal regulations		
Presence of educational and training programs		
Promotion of industry wide cooperative efforts		
Conformance of regulatory packaging		

Used in conjunction with each other, the decision framework shown in Figures 3 and 4 along with the quantitative and qualitative analysis and scoring models will allow an organization to taken into consideration the multiple dimensions of an asset recovery as described by (Akcalı and Cetinkaya, 2011):

- Motivation behind product recovery
- Form of product recovery
- Activities needed by the form of recovery
- Agents of the recovery process
- Location of the recovery activities

Additionally, by utilizing this information and capturing it for historical purposes the organization can create performance metrics by which to monitor the results of their disposition decisions and gauge them against the goals and strategies of the organization. The next section presents high-level performance metrics that can be implemented by an organization that adopts decision tools such as those proposed in the preceding sections.

Performance Measures

The selection of RL performance measures will vary from company to company. The metrics that are used in each depend on the end user (Caplice and Sheffi, 1995). Based on a review of the literature Caplice and Sheffi (1995) developed a list of eight criteria that represent the general characteristics of "good" performance metrics (see Table 5). Those eight criteria were used in the development of the suggested performance measurements proposed by this paper. Additionally, these measures span three dimensions of effectives used in logistics practice: utilization, productivity and effectiveness (Caplice and Sheffi, 1995).

The suggested performance measures for a RL system are shown in Table 6. These have been subdivided into types (strategic, tactical and operational) (De Brito and Dekker, 2002) for ease of reference and application. While most of these measures are self-explanatory, explanation has been provided for Gate-keeping Efficiencies and Total Average Collection Deviation (TACD).

1. *Gate-keeping Efficiencies* – the role of a gate-keeper is to decide which products to allow into the RL system (Rogers and Tibben-Lembke, 1998). For example, this could take place when a customer requests authorization for a return. In many instances a return authorization (RMA) is required in order for a customer's return to be accepted into the system. The gate-keeper is responsible for denying returns that are not qualify for return such as items that are out of warranty. This step is a key function within an efficient RL system (Rogers and Tibben-Lembke, 1998).

2. *Total Average Collection Deviation (TACD)* – in this context "collection" refers to the goods that enter into the RL system at the gate-keeping site and are transported to the asset recovery facility. TACD is a measure intended to check the deviation of goods shipped and received.

TABLE 5
DEFINITIONS OF THE EIGHT METRIC EVALUATION CRITERIA
(Caplice & Sheffi, 1994)

Criterion	Description
Validity	The metric accurately captures the events and activities being measured and controls for any exogenous factors.
Robustness	The metric is interpreted similarly by the users, is comparable across time, location, and organizations, and is repeatable.
Usefulness	The metric is readily understandable by the decision maker and provides a guide for action to be taken.
Integration	The metric includes all relevant aspects of the process and promotes coordination across functions and divisions.
Economy	The benefits of using the metric outweigh the costs of data collection, analysis and reporting.
Compatibility	The metric is compatible with the existing information, material, and cash flows and systems in the organization.
Level of Detail	The metric provides a sufficient degree of granularity or aggregation for the user.
Behavioral Soundness	The metric minimizes incentives for counter-productive acts or game-playing and is presented in a useful form.

TABLE 6
RL PERFORMANCE MEASURES

Strategic	Tactical
Acquisition costs of additional equipment to remanufacture products ($)	Return shipment cost ($)
Acquisition costs of additional warehouses, transportation fleets, etc.	ECAR % Environmental Conformance of Asset Recovery (AR) = 100 * (# of environmentally conformed products / # of products recovered by AR)
Long-term labor costs to employ additional skilled workers ($)	# of production shifts per unit of time
Average distance of suppliers	% of transportation fleet owned
	Service level of customers of remanufactured products.

Operational	
Obsolescence ratio = total value of obsolete products / total value of inventory per unit of time.	% of employees devoted to return products per unit of time
Gate-Keeping Percentage (GKP) = % of products returned at the gate keeping site.	Cost per mile for transportation before AR
IDT = Total idle time of trucks at gate-keeping site per unit of time	Cost per mile for transportation after AR
Gate-Keeping Efficiencies	Reduction in processing time
Total Average Collection Deviation (TACD)	Reduction in packaging cost
FA rsc	Recycling Fraction = (fraction of products returned for recycling) * (fraction of materials in the product recoverable) * (fraction of materials actually recovered) (Scott et al., 1997)

In additional to the strategic, operational and tactical performance metrics in Table 6, a scorecard of financial metrics is also proposed. The components included on the scorecard are Cost, Value Recovery, Required Space, Processing Time and Quantity of Products. Each of these components is monitored from forecast to actual results. In addition to providing high-level performance metrics, these items can also be used to compare disposition options to one another. Key disposition options have been included on the scorecard for illustrative purposes as shown in Table 7.

TABLE 7
ASSET RECOVERY SCORECARD

Measure	Remfg.	Recycle	Reuse	Refurbish	Landfill	Stockpile
Cost $_{actual}$ (C_a)						
Cost $_{forecasted}$ (C_f)						
Cost accuracy = $1–(\|C_a - C_f\| / C_a)*100$						
Value recovered $_{actual}$ (V_a)						
Value recovered $_{forecasted}$ (V_f)						
Value accuracy = $1–(\|V_a – V_f\| / V_a)*100$						
Required. Space $_{actual}$ (S_a)			N/A		N/A	
Required. Space $_{forecasted}$ (S_f)			N/A		N/A	
Required. Space accuracy = $1–(\|S_a – S_f\| / S_a)100$						
Processing time $_{actual}$ (T_a)						
Processing time $_{forecasted}$ (T_f)						
Processing time accuracy = $1–(\|T_a – T_f\| / T_a)*100$						
# of Products $_{actual}$ (P_a)						
# of Products $_{forecasted}$ (P_f)						
# of Products accuracy = $1–(\|P_a – P_f\| / P_a)*100$						

EMPIRICAL VALIDATION

Research Methodology

The purpose of this research is to develop selection criteria and performance measures to support RL disposition decisions. A qualitative approach was used to provisionally verify the criteria, measures and scorecard presented in the earlier sections of this paper. This was done by interviewing managers regarding the RL activities in their firm and by soliciting their feedback on the proposed criteria, measure and scorecard. This type of qualitative research plays an important role in accessing and generating discussions with key decision makers in organizations and with industry experts (Wright, 1996).

The interviews were designed to be part of a site visitation and followed a 6 step method adapted from McQuarrie (1991):

1. Set research objectives
2. Identify, select and recruit participant organizations
3. Select and train teams
4. Develop the survey interview instrument
5. Conduct interviews
6. Analyze, report and discuss results

Additionally, the interviews followed a prepared script. This was in the form of a questionnaire that included quantitative and qualitative responses regarding their own company's RL systems and strategies and regarding the proposed disposition criteria, performance measures and scorecard. The interviews were designed to address the following research questions:

a) What level of reverse supply chain integration is achieved in the organization?
b) How does the model perform in evaluating the disposition options and adoption of the right disposition strategies?
c) How resourceful are the qualitative selection criteria and are they applicable to disposition decisions?
d) How well does the proposed scoring model capture needs of the organization?

The participants represent both firms whose major focus is reverse logistics and firms whose primary business is impacted by reverse logistics issues. The interview process averaged two to three hours in order to facilitate in-depth responses. A profile of management respondents and organizations is shown in Table 8.

Results and discussion

The following discussion is thematically grouped by research question and represents the data that was collected during each of the 12 interviews.

What level of reverse supply chain integration is achieved in the organization?

The analysis revealed distinct differences in RL system management with the subject organizations. The lines of delineation were based on two key criteria *continuous vs. discrete product units* and *industrial vs. consumer goods*. For example, company 2 is in the oil and gas industry. Their reverse supply chain is focused on the recovery of CO_2 from their production process (continuous product units).

> *"The CO_2 is stripped out in the plan and the CO_2 is reinjected back into the nature gas/oil reservoir."*

TABLE 8
PROFILE OF RESPONDENTS AND ORGANIZATIONS

Control #	Organizational Focus	Position	Employees		Revenues (in $)	
			Location	Company	Location	Company
1	Automotive Financial Services	Director of Auction Teams	1,000	13,000	.	.
2	Petroleum Engineering	Operations Engineer	200	500	1.5M	1.5M
3	Ceramic Tile Manufacturing	Inventory Control and Systems Manager	180	.	.	.
4	Consumer Products Retailer	Director of Logistics Systems	275	4,000	.	.
5	Polymer Manufacturing	President	15	15	.	.
6	Wireless Devices Distribution	General Manager	21	.	10M	.
7	Automobile Manufacturing	Graduate Development Program	500	000's	.	17B
8	Aeronautics and Space Systems	Multi-Function Engineer and Science Sr. Manager	2,600	130,000	3.4B	35.5B
9	Wireless Telecom	Returns Management Center Project Manager	5,000	600,000	.	.
10	Returns Logistics	Vice President / General Manager	50	128	4.5M	14.5M
11	Medical Devices	Sr. Supply Chain Manager	250	35,000	120M	10.5B
12	Cable Manufacturing	President	70	70	8M	8M

Eighty percent of their supply chain budget is focused on the reverse supply chain and the traverse time of the product in the RL system is less than 1 minute. 1% of the oil and gas companies employees are involved in the RL system.

This is in stark contrast to the next highest budget appropriation for the reverse supply chain which is 25% in an automobile financing organization. In this case the returned unit (discrete product unit) resides in the RL system 23-25 days. 85% of this company's employees are involved in the RL system.

> *"After vehicles come to maturity in the lease portfolio or repossessed due to non-payment they are picked up from either the dealership lot or repossession yard to be reconditioned for sale at either open or closed markets, internet based or live auction."*

The majority of differences between industrial and consumer product companies RL systems and disposition activities are based on the contractual agreements between vendors and customers. The interviews revealed that many times the disposition options of the firm are limited by the customer contracts for specialized or patented products.

In an attempt to understand the integration of RL within the firm, data was collected to determine the number of departments within the organizations that were involved in RL activities and the level of communication complexity between those departments. Table 9 shows the number of departments that are involved in the RL system by company. The table also indicates the level and complexity of the communication between those departments.

The levels and complexity of data were rated from very rarely (1) to often (5). The only company each type of communication as "very often" was a service organization. This company also has the most departments (10) participating in the RL system and rated the information exchanged as "complex." The type of information exchanged within their RL system of the remaining companies is rated as "medium" to "complex," the frequency of exchange is less than expected for companies that are moving complex information through their organizations and or information systems.

How does the model perform in evaluating the disposition options and adoption of the right disposition strategies?

The return categorizations and asset recovery methods (disposition options) outlined in this paper were presented to the interviewees. They were asked if these return categories and disposition options applied to their organization. The intention of the question was to determine the validity and the generalizability of the proposed return categories and disposition options.

The responses were positive, each of the return types presented used in at least two of the interviewed companies. The recovery methods, in contrast, are less universal. Specifically, "stockpile" and "landfill" were only mentioned by one company each. This section of the interview received the least complete responses from the interviewees. It is likely that this is due to confidentiality concerns, although no one expressed that concern directly.

How resourceful are the qualitative selection criteria and are they applicable to disposition decisions?

The qualitative selection criteria outlined in this paper were presented to the interviewees. They were asked if these criteria were resourceful and if they applied to their organization. The intention of the question was to determine the validity, applicability and generalizability of the proposed criteria.

TABLE 9
DEPARTMENTAL REVERSE LOGISTICS PARTICIPATION AND INFORMATION EXCHANGE

Control #	Organizational Focus	Information Exchange Methodology				Communication Complexity	# of Departments Involved in RL
		Informal Personal	Formal Manual	Formal Databases	Formal Data Exchange		
1	Automotive Financial Services	5	5	5	5	Very Complex	10
2	Petroleum Engineering	4	2	2	4	Very Complex	2
3	Ceramic Tile Manufacturing	5	3	1	1	Very Simple	4
4	Consumer Products Retailer	5	3	1	1	Very Simple	.
5	Polymer Manufacturing	5	5	3	1	Neutral	3
6	Wireless Devices Distribution	1	1	1	1	Complex	5
7	Automobile Manufacturing	3	3	5	5	Complex	3
8	Aeronautics and Space Systems	3	4	5	5	Simple	6
9	Wireless Telecom	5	3	5	5	Simple	1
10	Returns Logistics	5	3	5	4	Neutral	.
11	Medical Devices	3	4	1	1	Complex	2
12	Cable Manufacturing	5	5	4	5	Simple	1

A score of 1 indicates "very rarely" and 5 indicates "very often."
RL = Reverse Logistics processes within the organization.

Two of the criteria were used by 11 of 12 companies. These included: "Use of computer network technology capable of tracking returned products" and "Do the supply chain partners comply with environmental and federal regulations?"

The least applicable criteria included: "Use of inter-modal transportation routes and schedules" (4 companies); "Use of shipping in bulk and cube utilization" (5 companies); and, "Special storage requirements for storing returns" (3 companies).

Although the participants acknowledged using the proposed or similar criteria in their reverse supply chain decisions, none of the companies admitted to having performance monitoring systems in place. Each of the interviewees agreed that performance monitoring is important and should be built from best practices. Even further after the interviews each company indicated that they now intend to pursue performance measures for the RL systems in their company.

How well does the proposed scoring model capture the needs of the organization?

The scoring model in this paper was presented to the interviewees. They were asked if the model would capture the needs of their organization. The intention of the question was to determine the validity, applicability and generalizability of the proposed scoring model.

The majority (7) of companies interviewed said that the scoring model would be effective for their company and that the framework presented with the scorecard would be useful in the management of their RL systems. One of the companies produced a copy of a document to show that they were already using a similar model to manage their reverse supply chain. Another commented that it would be useful not only for monitoring the system, but also for data capture that could be used in future forecasts. Finally, the last two comments were similar, they both suggested that that the model would be helpful in their organizations to help build the business case in quantifiable terms to support disposition options. This type of quantifiable analysis was not currently being undertaken in their organization.

The remaining companies (5) interviewed provided comments suggesting that the model would not be useful. The comments covered a continuum from this is "just a cost of doing business" to "we are constrained by our customer contracts." The majority of negative responses simply indicated that these types of costs are not captured by their organization, despite materiality.

MANAGERIAL IMPLICATIONS

Similar to earlier findings, this research indicates that many companies are not placing importance on returns nor their reverse supply chain and for the most part are not using metrics or benchmarks (Stock and Mulki, 2009). This fact cut across all industries and company sizes for the companies interviewed for this research.

Despite the seeming lack of importance applied to the reverse supply chain and the negative response to the scoring model by 5 of 12 respondents, all of the managers interviewed agreed that they should have some sort of RL best practices in place in their organization. Perhaps this dichotomy of responses is due to the perceived complexity of implementing and actively managing the RL system. Or, perhaps it is due to the cross-functional nature of the reverse supply chain (Jayaraman and Luo, 2007) and the resulting added complexity. The companies interviewed revealed that their RL responsibilities spanned from 1 to 10 departments within their organizations. Situations of interdepartmental complexity cause departmentalization and increased difficulties in implementing and monitoring change (DiMaggio and Powell, 1983; Meyer and Rowan, 1977).

The interviews revealed a clear need for additional guidance in the form of best practices, scorecards, performance measures, etc. Each manager expressed interest in improving their RL systems and learning more about how to exploit disposition options for the benefit of the firm. Another need that surfaced during the interviews was the need for increased communication and data sharing/visibility among departments responsible for RL functions. This communication may also include the automation of some processes within the system.

The design of a RL system has three vital parameters: value, time and volume. The methodology developed here strives to serve the value parameter. This can be viewed as the initial step in a series of continuous improvement initiatives, which can be followed by methodologies to improve time and volume. It is likely that in many instances a scoring model such as presented in this paper will provide valuable input that may lead to improvement in the other two parameters.

FUTURE RESEARCH OPPORTUNITIES AND LIMITATIONS

Several limitations to this research should be noted. Interviews are subject interviewer bias and a small number of interviews cannot claim to representative of a broader population (Strauss and Corbin, 1998). Additionally, our interviews focused on one actor within the organization namely the supply chain manager limiting the responses to the knowledge of the supply chain management. This is exacerbated as a weakness because, as we learned in the interviews, the RL system spans multiple functions within each organization and there seemed to be no standardization as to which departments were involved in the process from company to company.
Another limitation is due to the lack of previous literature on returns disposition decisions. The majority of research in RL is anecdotally or case study based and only a few researchers address the disposition decision (Stock and Mulki, 2009). None of those address these decisions through an empirical lens (Hazen et al., 2011). This lack of prior research provides a weak foundation for the development of a disposition scoring model that can be tested empirically. However, this paper attempts to bridge that gap through an inductive analysis and initial validation of parameters for RL disposition decisions.

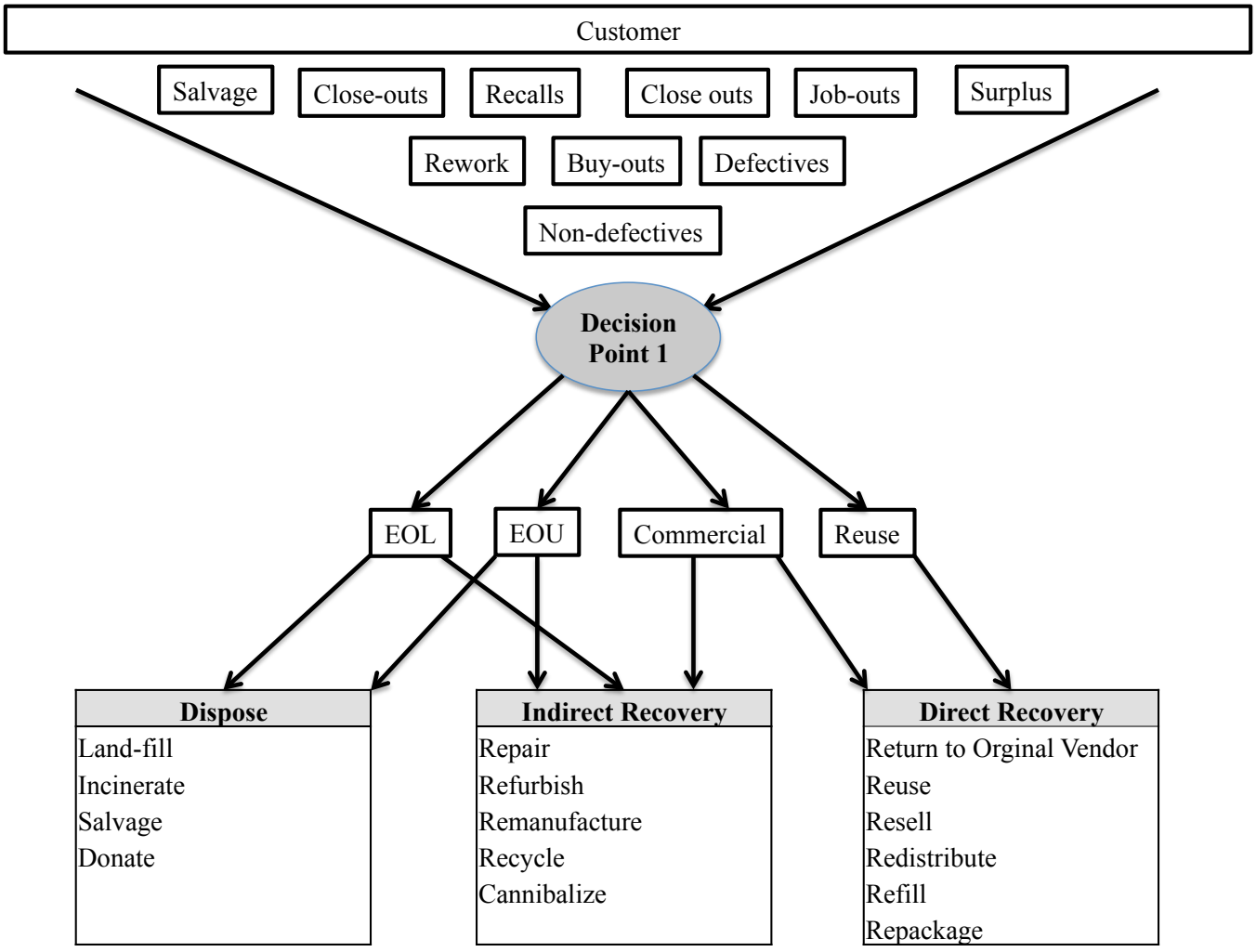
There is much room for future research in this arena. Aiming at improving the flow of materials through the reverse supply chain and improving the economic impact to the firm, while being socially responsible, takes a holistic view of manufacturing and distribution and entails understanding simultaneous activities across multiple departments within the firm. A cross functional view of the RL system can be modeled to give better understanding to the overall function of the revere supply chain. This cross-functional view could then be tested across industries for generalizability. It may be found that RL systems and functional interdependencies differ significantly by industry. If this is the case, it would be beneficial to know what the differences are so that models, best practices and scorecards could be developed to benefit practitioners in each industry (Agrawal, Singh and Murtaza, 2016). The success, measured in terms of economic and socially responsible asset recovery, of each different RL structure could also be captured and compared such that the strengths of each could be quantitatively and qualitatively captured.

Additionally, it is made clear in earlier literature and in the interviews within this paper that RL decisions are multi-dimensional. Because of the nature of these decisions a recursive model such as that derived using ANP (analytic network process) could be utilized. ANP is capable of considering the quantitative, qualitative, tangible and intangible factors within RL disposition decisions (Meade and Sarkis, 2002). ANP is capable of accounting for the multiple dimensions that have been found within the disposition decision (Meade and Sarkis, 2002).

CONCLUSION

Through a qualitative grounded theory approach, this paper has provided empirical data to enrich our understanding of organizational RL disposition decisions. This research approach, though not statistically generalizable, is appropriate in this situation as this paper seeks analytical generalization (Yin, 2003). Utilizing the insight gained from the interviews in this research the return categorization framework, the selection criteria, performance measures and scorecard developed in this paper can be improved and tested with a larger audience. This research is intended to provide a foundation for future research in the important discipline of return disposition management.

Appendix A


Customer
Salvage
Close-outs
Recalls
Close outs
Job-outs
Surplus
Rework
Buy-outs
Defectives
Non-defectives
Decision Point 1
EOL
EOU
Commercial
Reuse
Dispose
Land-fill
Incinerate
Salvage
Donate
Indirect Recovery
Repair
Refurbish
Remanufacture
Recycle
Cannibalize
Direct Recovery
Return to Orginal Vendor
Reuse
Resell
Redistribute
Refill
Repackage

APPENDIX B
FRAMEWORK FOR DISPOSITION OPTIONS

		Commercial Returns								Reusable
		EOL	EOU	Close-outs	Buy-outs	Job-outs	Surplus	Recalls	Defectives	Non-Defective Defectives	Salvage	Rework
Direct Recovery	Close-out via markdowns before return	■	■		■			■	■		■	■
	Sell as new	■	■		■			■	■		■	■
	Sell to outlet or discount store	■	■		■			■	■		■	■
	Sell to secondary market	■			■			■	■		■	■
	Sell via internet auction	■			■			■	■		■	■
	Request for bids	■			■			■	■		■	■
	Use within same unit, same organization			■	■			■	■		■	■
	Use within different unit, same organization			■	■			■	■		■	■
	Return to original vendor	■	■	■	■	■	■	■		■	■	■
Indirect Recovery	Repackage	■			■			■	■			
	Refill	■			■	■	■	■	■			
	Repair	■			■	■	■	■	■			■
	Refurbish	■			■	■	■	■	■			■
	Remanufacture				■	■	■	■				■
	Recycle											■
Dispose	Incinerate											■
	Land-fill											■
	Scrap											■
	Donate to Charity							■	■			■

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MEDICAL BATTERY: WHEN PATIENT RIGHTS CONFLICT WITH QUALITY OF CARE

Claire Reeves La Roche, Longwood University
Ripon Wilson La Roche, III, Inter American University School of Optometry

ABSTRACT

An important legal issue with potential ethical, monetary and patient care implications involves the revocation of informed consent and the potential for a lawsuit based on medical battery. In performing medical or surgical procedures, healthcare providers frequently are told to "stop" by patients. Sometimes these situations involve patients attempting to avoid something as simple as installation of eye drops or a part of a routine medical examination. For instance, a claim was brought against an ophthalmologist for failing to remove an automatic blood pressure cuff during a procedure to remove a small mass from a patient's lower lid. Medical battery is discussed. Case law involving the revocation of informed consent is reviewed. The author conducted a 2015 Healthcare Survey of healthcare providers and the results are analyzed. Ethical considerations are discussed and suggestions are made for recognizing situations in which a physician should stop a procedure and thus avoid a potential legal conflict.

Introduction

Coulter v. Thomas, 33 S.W. 3d 522 (Ky. 2000) is a case that stunned many observers in both the medical and legal communities. According to court records, Mrs. Coulter was a 53-year old, totally disabled by rheumatoid arthritis, was 5'3" tall and weighed 250 pounds. In this case, Mrs. Coulter consented to a 15-minute procedure to have a small mass removed from her lower eyelid by Dr. Kent Thomas, an ophthalmologist. To monitor her blood pressure during the procedure, an automatic blood pressure cuff (ABPC) was placed on Mrs. Coulter's arm. After the first inflation, Mrs. Coulter demanded that the ABPC be removed. The cuff was removed after the second inflation and subsequently Mrs. Coulter sued Dr. Thomas for medical battery based on revocation of consent. The lower court failed to instruct the jury on medical battery and Mrs. Coulter appealed to the Supreme Court of Kentucky where she won on appeal. The Supreme Court held that the jury should have received instructions on medical battery and sent the case back to the trial court.

When a healthcare provider is asked to stop a procedure, legal and perhaps ethical issues are raised. Cases addressing revocation of consent and medical battery are reviewed in this paper. Additionally, physicians and healthcare providers were surveyed and asked about whether patients have ever revoked consent, and if so, what were the circumstances and their responses. The results of the survey are examined. Additionally, ethical considerations are discussed and suggestions are made to avoid unwanted litigation.

Medical Battery

Battery consists of an unwanted or unauthorized touching. Battery may be a crime or an intentional tort. Although battery may be a crime, if a doctor is trying to render beneficial treatment, states are reluctant to prosecute for the crime of battery (Edwards). Thus, medical battery is usually a tort (civil cause of action for money damages). Battery may occur with an unauthorized touching or when a patient revokes consent to continue treatment. Negligence (malpractice) or harm is not a necessary element of the tort of battery.

A healthcare provider does not have the right to touch a patient without consent. This is an important principle for a clinician to remember, even if a procedure is being performed in the best interest of the

patient. In a landmark case, Justice Cardozo summarized a physician's responsibility to obtain a patient's consent as follows:

"Every human being of adult years and sound mind has a right to determine what shall be done with his own body; and a surgeon who performs an operation without his patient's consent commits an assault for which he is liable in damages. This is true except in cases of emergency, where the patient is unconscious and where it is necessary to operate before consent can be obtained." *Schoendorff v. Society of New York Hospital,* 105 NE 92, 93 (N.Y. 1914).

"The primary consideration in a medical battery case is simply whether the patient knew of and authorized a procedure." *Blanchard v. Kellum,* 975 S.W.2d 522, 524 (Tenn. 1998). Thus, if consent is absent, the intentional tort of battery may be present and the healthcare provider may be sued for damages. It is interesting to note that medical battery, unlike medical malpractice, does not require expert testimony.

Once a patient knows of and authorizes a procedure, what is required for a patient to revoke consent to proceed? In *Mims v. Boland*, 110 Ga. App 477, 138 S.E. 2d 902 (1964) the plaintiff alleged that she revoked consent for a barium enema. In spite of her objection, the enema was administered. In the Mims case, the court adopted the following two-pronged test to determine whether a patient has effectively revoked consent after a procedure is begun:

To constitute an effective withdrawal of consent after treatment or examination is in progress and potentially subject medical practitioners to liability for assault and battery if treatment or examination is continued, the following two elements are required:

> "(1) The patient must act or use language which can be subject to no other inference and which must be unquestioned responses from a clear and rational mind. These actions and utterances of the patient must be such as to leave no room for doubt in the minds of reasonable men that in view of all the circumstances consent was actually withdrawn.
>
> (2) When medical treatments or examinations occurring with the patient's consent are proceeding in a manner requiring bodily contact by the physician with the patient and consent to the contact is revoked, it must be medically feasible for the doctor to desist in the treatment or examination at that point without the cessation being detrimental to the patient's health or life from a medical viewpoint." *Mims v. Boland,* 110 Ga. App. 477, 138 S.E. 2d 902, 905 (1964)
>
> For instance, during a cataract procedure, the procedure can be safely aborted up until the point that the anterior capsule is opened. Prior to that event, there is minimal risk to the patient; however, after the capsule is opened, there would be adverse consequences associated with aborting the procedure and the patient would have to return for emergency intervention.

South Carolina is the only state that does not recognize a cause of action for medical battery based solely on revocation of informed consent. In *Linog v. Yamplosky*, 656 S.E. 2d 255 (S.C. 2008), the plaintiff was under the influence of anesthesia when she purportedly revoked consent to continue with osseous gum surgery. The plaintiff asked the court to recognize a medical battery claim based on revocation of consent and the court declined to agree. Specifically, the court held that "in order for a patient to pursue a claim stemming from a situation involving lack of or revocation of consent, a physical touching within the medical context, and a resulting injury, the patient must bring this claim under the medical malpractice framework." *Linog v. Yamplosky,* 656 S.E 2d 255 (S.C. 2008). In other words, the patient would have to prove negligence and provide expert testimony to support his or her claim.

Survey Results

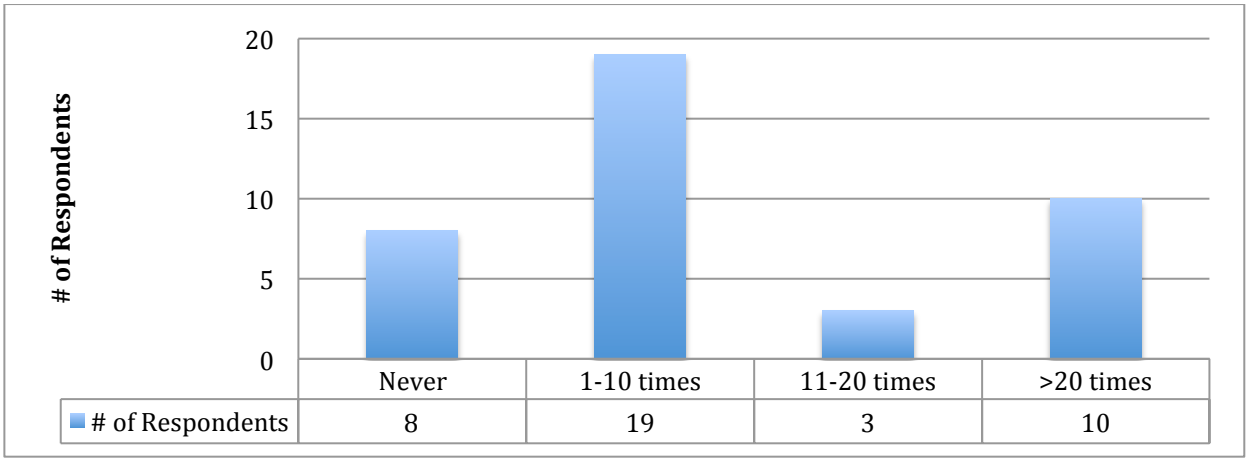
The 2015 Healthcare Survey was sent to approximately 80 healthcare professionals with an overall response of approximately 50%. Forty healthcare professionals responded, 11 females and 29 males. The responses from various medical fields represented in *Chart 1* below.

Chart 1.

SPECIALTY	
Cardiologist	**2**
Emergency Medicine	**3**
Family Doctor	**7**
General Surgeon	**2**
Gynecologist	**2**
Nephrologist	**3**
Nurse Anesthetist	**7**
Nurse Practitioner	**2**
Ophthalmologist	**3**
Optometrist	**3**
Orthopedic Surgeon	**1**
Pediatrician	**2**
Radiologist	**2**
Other (not specified)	**1**
TOTAL	**40**

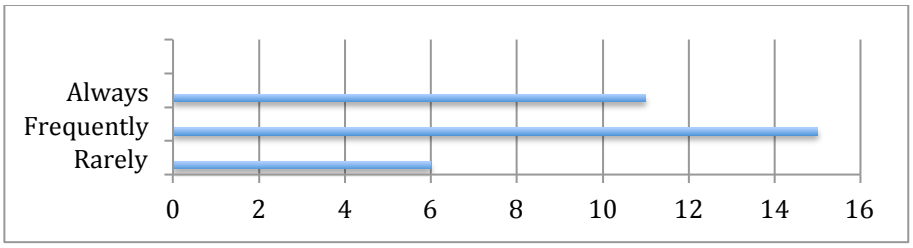
When asked, "During a medical test or surgical procedure, has the patient ever asked you to stop?" 32 (80%) of the respondents answered "Yes" and 20% said that they have never been asked to stop a treatment. *Chart 2* shows the number of times survey participants have been asked to stop a medical test or surgical procedure.

Chart 2



To avoid the possibility of a lawsuit for battery, a healthcare worker should be prepared to react appropriately when a patient revokes consent. Chart 3 illustrates the 2015 Healthcare Survey reponses to requests to stop a medical test or surgical procedure.

Chart 3



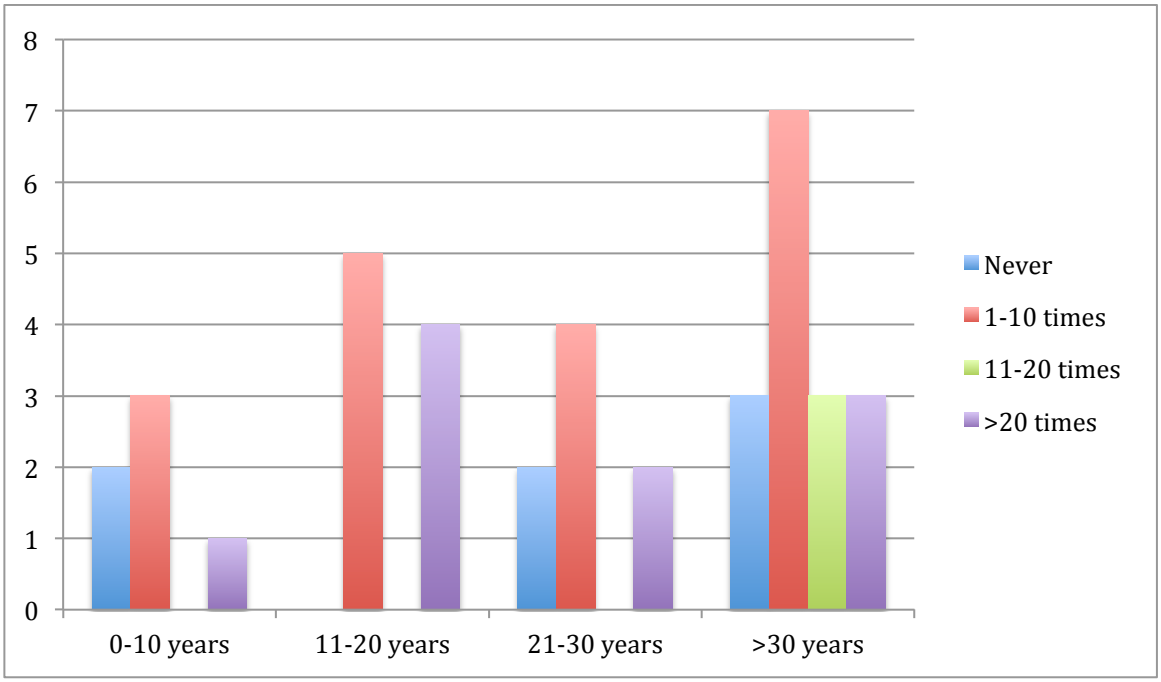
The 2015 Healthcare Survey indicated that 19 of the patient requests to stop involved what the provider considered a preferred practice, 12 patient requests involved an optional practice and 7 of the procedures were classified as "Other". "Other" procedures were self-identified by the healthcare providers as epidurals, pap smears and echocardiograms. Even though not identified as a preferred practice, these "other" procedures could arguably fall under the spectrum of standard of care. In *Chart 4*, the types of procedures that patients requested to have stopped and the number of healthcare workers identifying each type of intervention, are noted in order of frequency.

Chart 4

PROCEDURE	
Draining abscess	**12**
Starting IV	**9**
Rectal exam	**8**
Numbing for sutures	**8**
Ear exam	**7**
Debriding wound	**7**
Blood pressure	**7**
Drawing blood	**6**
Pelvic exam	**6**
Epidural	**6**
Anesthesia mask	**4**
Giving a shot	**4**
Checking eye pressure	**3**
Instilling eye drops	**3**
Throat exam	**2**
Breast exam	**2**
Setting fracture	**2**
Biopsy	**2**
Regional block	**2**
Stress test	**2**
Barium enema	**2**
Central line access	**2**
Ear irrigation	**1**
Catheter	**1**
Liquid nitrogen treatment	**1**
Naso-gastric tube	**1**
Shining a light in an eye	**1**
Finger stick	**1**

Early in a medical practice, a healthcare provider may be asked to stop a treatment. In the 2015 Healthcare Survey, all of the healthcare providers in the 1-10 year category had been in practice less than 5 years. Two-thirds of the "new providers" have been asked to stop the procedures, and, thus, it's important for nascent healthcare providers to be aware of the patient's right to stop a procedure. Of the 2 respondents that indicated that they had never been asked to stop, both were eye care providers. Chart 5 compares the number of years in practice to the number of times a physician has been asked by a patient to stop.

Chart 5



Note: One of the survey respondents did not indicate the number of years in practice; however this physician indicated that patients asked him to stop 1-10 times. This respondent is not represented on the above chart.

Ethical Considerations

The 2015 Survey may indicate either a failure to recognize revocation of consent or perhaps admit that a patient has ever told a healthcare worker to stop (among those survey respondents who denied having been asked to stop). For instance, the 2015 Survey included three Emergency Medicine physicians who had both been in practice for more than 30 years, practicing in the ER at the same hospital—one said that he had never been asked to stop a treatment or procedure while the other physicians reported that they had been asked to stop more than 20 times each.

Failure to recognize revocation of consent could subject a healthcare provider to a lawsuit based on medical battery—an unwanted touching. At the moment that consent is revoked, the physician is required to stop, if medically feasible. To do otherwise is to risk a civil lawsuit. If a healthcare worker is sued for battery, he/she must put forth a defense and this could be time consuming, expensive and stressful.

Conclusion

The 2015 Healthcare Survey raises an interesting ethical question. If, for instance, a patient is checked in to see their eye care physician and then refuses dilation and/or a pressure check, can the doctor adequately assess the health of a patient's eyes? In the event that a patient is uncooperative, should a physician continue, or is failure to perform these preferred practices a dereliction of duty? It is not unusual for a patient to ask a healthcare provider to stop a treatment or procedure. Continuing to perform a beneficial medical treatment or procedure without a patient's consent may be medical battery. It is extremely important for providers to recognize when consent has been revoked and if it is medically feasible to stop. Since there may also be a conflict between the patient's rights and the standard of medical care, it is important for the provider to determine if the intervention is medically indicated. If it is determined that the procedure is necessary, or at least beneficial, then the provider should explain the value to the patient and obtain permission to continue. Following this explanation, if consent is not obtained, then the physician should document the patient's refusal. The above suggestions should help minimize the conflict between standard of care and patient rights.

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MONITORING TECHNOLOGY IN YOUR LIFE: A WORK IN PROGRESS

Pamela S. Galluch, Roanoke College, galluch@roanoke.edu
Marta Miller-Serrano, Roanoke College, mamiller@mail.roanoke.edu

ABSTRACT

Contemporary information technologies are pervasive in the workplace. While our IT-reliant lifestyle has had a dramatic impact on business productivity, it has also caused technology-induced stress, termed technostress. We know very little about how individual differences affect technostress either objectively or perceptually. This study argues that being stressed is not always the same as feeling stressed, or an individual's physiology does not necessarily correlate to his or her psychology when working on online tasks. We believe that personality can cause individuals to over- or under-react to techno-stressful situations and thus at times cry wolf when complaining about the effect work has on his or her stress level. To do this, we examined four personality characteristics: locus of control, social desirability, fear of negative evaluation, and propensity to worry to see how they correlate with perceived stress, objective strain, and performance. Preliminary results from a pilot test are provided.

Keywords: Technostress, Strain, Salivary Alpha-Amylase, Cortisol, Individual Differences, Social Desirability, Fear of Negative Evaluation, Worry

INTRODUCTION

Contemporary information technologies are pervasive in the workplace. When working properly, information technology streamlines work and improves efficiency of an organization. However, when information technology malfunctions, workers can find themselves in complete disarray, unable to perform. While our IT-reliant lifestyle has had a dramatic impact on business productivity it has also caused technology-induced stress, termed technostress. Formally defined, technostress is the stress that directly or indirectly results from using information and communication technologies [40].

Researchers have suggested that the inconsistency of empirical findings with regards to stress is due to other researcher's failure to consider individual differences [25]. It is no surprise that individuals differ dramatically with their response to external stimuli. However, it is less clear how stress occurs in an Information Technology context, especially while considering these individual differences. We contend that regardless of actual stress incurred within the body, some individuals are born with a personality that makes them more predisposed to admit to stress, while other personalities are more likely to avoid admitting to stress.

Overall, we know very little about how individual differences handle technostress either objectively, through stress hormones such as alpha-amylase, or perceptually by suggesting that workers are stressed. This study argues that being stressed is not always feeling stressed, and that personality can cause individuals to over or underreact to techno-stressful situations. Therefore, this study examines the affects personal characteristics have on the stress process. Hence, we propose the following research question:

How does personality affect perceptual stress and objective strain?

More specifically, we seek to examine four specific personality characteristics that we feel have the most impact on the stress/strain relationship: locus of control, social desirability, fear of negative evaluation, and the propensity to worry. Therefore, we propose a more specific research question below that forms the basis of our research model.

How do Locus of Control, Social Desirability, Fear of Negative Evaluation, and the Propensity to Worry affect Perceptual Stress, Objective Strain, and Performance?

The manuscript proceeds as follows. First, we develop a model of technostress. Then, we test our hypotheses through an experiment that manipulates features of the ICT and the context to evaluate the stressor-strain relationship. Finally, we discuss our preliminary findings, methods, and implications for further study.

LITERATURE REVIEW

Rooted in Selye's [36] seminal work on stress, the transactional perspective suggests that stress is not a factor of the individual nor the environment, but rather an embedded ongoing process that involves the individual transacting with his or her environment, making judgments, and coping with the issues that arise [5].

There are many models that draw on the transactional perspective of stress. In this study, we focus on the person-environment (P-E) fit model, which suggests that stress results from high demands or insufficient supplies to meet the person's needs [1, 5, 9]. We examine the P-E fit model within the transactional perspective of stress for two reasons. First, one cannot ignore individual differences in the perception or appraisal of stress. Second, stress results from either a mismatch of one or both of two dimensions of the person with one or both of two dimensions of the environment: between abilities of a person and high demands or from the values of a person and insufficient supplies to meet the person's needs [4, 9, 11]. Basically, this model accounts for personal characteristics, coping/control characteristics, and characteristics about environmental demands.

This study specifically looks at locus of control as the individual "control" characteristic and social desirability, fear of negative evaluation, and the propensity to worry as individual "personal" characteristics that can affect how stress is processed, felt, and received. Figure 1 depicts a model of the ICT-enabled stress and Table 1 defines its components.

Table 1. Construct Definitions

Construct	Definition
Locus of Control	Measures the extent to which individuals believe they can control events affecting them [31].
Social Desirability	A bias that describes the tendency to respond in a manner that will be viewed favorably by others. It can take the form of over-reporting "good behavior" or under-reporting "bad", or undesirable behavior [6].
Fear of Negative Evaluation	Pertains to the sense of dread associated with being evaluated unfavorably while anticipating in a social situation [21].
Propensity to Worry	A self-reported measure of pathological worry [22].
Stress	The overall transactional stress process [36, 35, 34].
Perceived Stress	The psychological responses made by individuals based on an environment, such as fatigue [24].
Objective Strain	The physiological responses made by individuals, as measured by salivary alpha-amylase [12, 14].

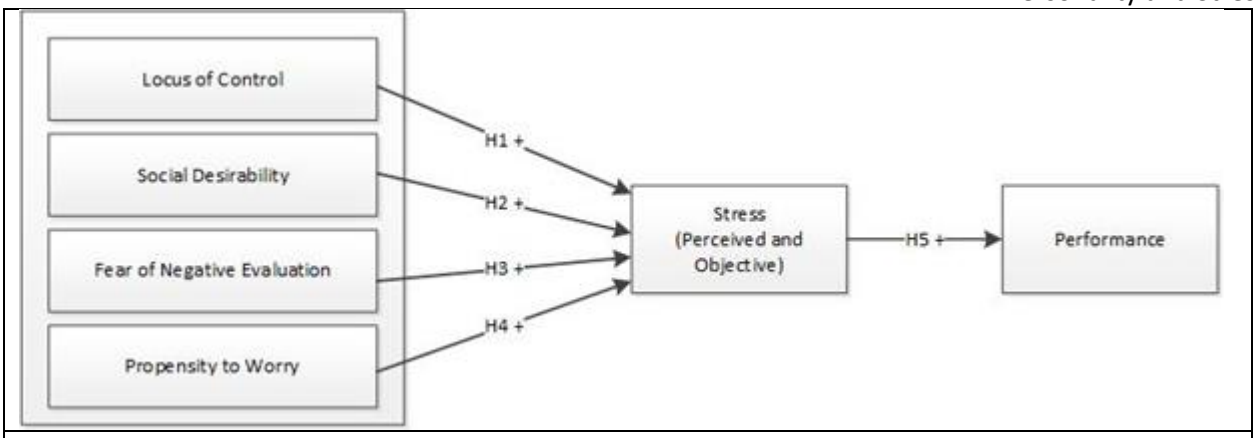

Figure 1. Research Model and Hypotheses

Internal Locus of Control

Many researchers have found that control characteristics, specifically dealing with a lack of control, can lead to stress [7, 8, 10, 19, 20, 25, 26, 33, 42]. Control has been defined in terms of personal control and locus of control, where personal control refers to an individual's' belief in his or her lack of ability to change the environment [25] and locus of control refers to people's beliefs about the extent they can control the events that influence their lives [31].

Individuals who have a strong internal locus of control believe they are in charge of their own decisions and behavior. Therefore, individuals see themselves as the prime determinant of what happens in the environment [31]. Individuals with a strong external locus of control believe that their life is generally influenced by people outside of their control [28]. An individual with a high external locus of control believes in fate, luck, and powerful others as being in control of their outcome [23]. Locus of control is a cognitive phenomenon, where regardless of the level of objective personal control, predisposed perceptions and beliefs will determine the level of felt control.

In a meta-analysis on autonomy in the workplace, high levels of control have been associated with high levels of job satisfaction, commitment, involvement, performance, and motivation and low levels of emotional distress, role stress, absenteeism, turnover, and physical symptoms [38]. Thus, the lack personal control in combination with an external locus of control can lead to strain. Therefore, the lack of control is more likely to influence stress when locus of control is external [7]. Therefore, we propose the following hypothesis:

> *Hypothesis 1. Individuals with an external locus of control will report perceptual stress and objective strain.*

Social Desirability

Social Desirability refers to a bias that describes the tendency to respond in a manner that will be viewed favorably by others. It can take the form of over-reporting "good behavior" or under-reporting "bad", or undesirable behavior [6]. Many researchers find social desirability as a major confound of psychology research, specifically dealing with varying personalities [13, 37]. Researchers suggest that social desirability could reduce data quality by causing participants to alter their responses based on how they think they should respond [39].

In this study, we examine social desirability as a tendency to lie whereas individuals may report more/less stress based on their level of social desirability. Some researchers include social desirability as a part of impression management “lie scales” as a response bias and compares it to the idea of self-deception [41,

39]. The higher an individual is on social desirability, the more likely they are to adjust their responses to try to fit in.

In psychology research, assessments of perceptual stress have been shown to be influenced by social desirability, whereas social desirability caused individuals to report higher stress [32]. However, little research has looking into technology oriented stress or how it relates to objective strain. Therefore, based on this research, we propose the following hypothesis:

Hypothesis 2. Individuals high on social desirability will report perceptual stress and objective strain.

Fear of Negative Evaluation

Fear of Negative Evaluation pertains to "the sense of dread associated with being evaluated unfavorably while anticipating in a social situation" [21]. Studies show that Fear of Negative Evaluation is closely related to measures of social-evaluative anxiety [43] and that social anxiety is generally caused by one's fear of negative evaluation [2, 15]. Fear of negative evaluation and social anxiety are often used interchangeable due to their cognitive nature; however, we focus on fear of negative evaluation because it is a more specific personality characteristic that explains how individuals adapt their answer based on how they fear others will respond.

Fear of Negative Evaluation is generally viewed as the precursor to other fears and anxiety [29]. These fears and anxiety could be linked to the admission of stress; however, little research has evaluated the impact fear of negative evaluation has specifically on stress and strain, especially in a technology oriented environment. Therefore, we propose the following hypothesis.

Hypothesis 3. Individuals high on Fear of Negative Evaluation will report perceptual stress and objective strain.

Propensity of Worry

The propensity to worry is a self-reported measure of pathological worry (Meyer et al. 1990). While there are many types of worry, we focus on the worry individuals exhibit as a personality/lifestyle trait. Some individuals are considered to be more of a *worrier* than others.

These worriers exhibit more negative emotions than others thinking about things that may or may not be important. Generally, worry is considered a negative emotion which can be caused by anxiety and lessened by self-esteem [17]. Researchers have related pathological worry to other personality types and found that worry is positively correlated to introversion and feeling Jungian typologies [27].

While worrying has been shown to cause perceived stress [16, 18], physiological researchers suggest that worrying may actually occur from cortisol reactions in the body [30]. This change in causality is partly due to the different handling as a trait or a state. Overall, researchers tend to ignore how the propensity to worry (as a trait) plays a role in motivating individuals to perform under stress. Little research has also looked into the physiological reaction to people more prone to worrying. Therefore, we propose the following hypothesis:

Hypothesis 4. Individuals who have a high propensity to worry will report perceptual stress and objective strain.

Stress, Strain, and Performance

ICTs' infusion in the workplace can lead to multiple outcomes ranging from positive outcomes (i.e., quicker task performance) to negative outcomes (i.e., higher levels of demand and stress). While researchers agree a curvilinear relationship is present between stress and performance, empirical evaluation on this

relationship is limited. Individuals who experience no stress can be inattentive, bored, and have poor performance. Individuals who experience high stress can be overexerted, which leads to clouded judgement and poorer performance.

We hypothesize that individuals who experience moderate amounts of stress will perform better and be more satisfied with their performance. Additionally, increased performance will positively affect how satisfied they are with how they did. Hence, we propose the following three hypotheses:

Hypothesis 5. Perceived stress and objective strain affects performance.

METHODS

Construct Measures

All constructs were measured using multi-item scales.

Locus of control was measured using items from Rotter [31]. We used the shortened version consisting of 13 items where they choose the answer that best fits them (i.e., *Many of the unhappy things in people's lives are partly due to bad luck.* versus *People's misfortunes result from the mistakes they make.*

Social desirability was measured using 33 items adapted from Crowne and Marlowe [6]. Participants reported whether they thought the statement in question was true or false (i.e., *Before voting I thoroughly investigate the qualifications of all the candidates.*)

Fear of Negative Evaluation was measured using 12 items from Leary [21]. Participants reported how characteristic each statement was to them on a 5 point Likert scale (i.e., *I worry about what other people will think of me even when I know it doesn't make any difference. Not at all characteristic of me(1) to Very Characteristic of me(5)).*

The propensity to worry was measured using 16 items from Meyer et al. [22]. Participants reported how typical statements were of them using a 5 point Likert scale (i.e., *If I do not have enough time to do everything, I do not worry about it. Not at all typical of me(1) to Very typical of me(5)).*

Perceived stress was measured using both Cohen's [3] PSS-10 scale and Moore's [24] scale of workplace stress. All items were answered on a 5 point Likert scale. The PSS-10 scale asked how often they felt certain ways while the workplace stress scale asked them how much they agreed with the statement. Items ranged from asking questions like how often they were "upset because of something that happened unexpectedly? To whether they were "drained mentally".

Objective strain was gathered by collecting salivary alpha-amylase, a stress induced hormone (Harmon et. al., 2008; Granger et. al., 2007).

Perceived performance was measured objectively by scoring how many math problems they got correct, and by asking how they think they did on a 3 item, 5 point Likert scale (Poor(1) to Good(5)).

EXPERIMENTAL DESIGN

We used experimental design to test our hypotheses. It took 30 minutes to complete an experiment of technology-induced stress and to gather survey items and physiological measures from participants. Each person was administered the experiment individually. Participants were required to meet two qualifications prior to signing up: experience using ICTs regularly at home or at work as well as no cardiovascular problems. See Figure 2 for details on our experiment. The readings labeled below (both baseline and post-experiment) refer to the collection of salivary alpha-amylase).

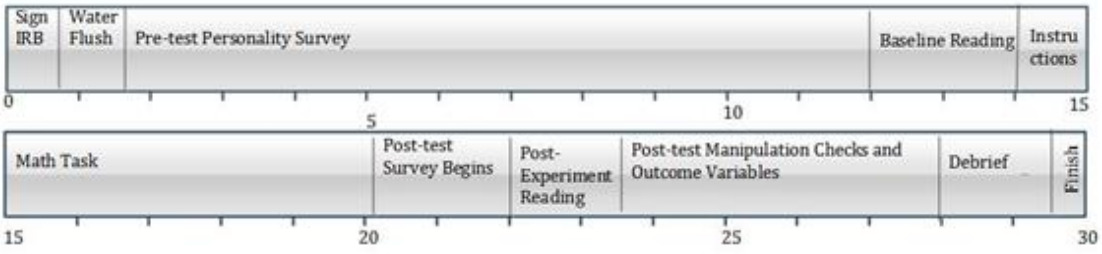

Figure 2. Experiment Protocol

Students began by being informed of their consent and accepting the IRB on SurveyMonkey.com. Students swished water for 30 seconds to prevent contaminants entering the samples, termed a water flush. The baseline measure of salivary alpha-amylase was taken 5 minutes after the water flush. After baseline measures were taken, the participant was given the instruction sheet which also outlined the incentives.

Survey questions were answered while the participants were waiting on the math portion to start. That survey collected personality measures of locus of control, social desirability, fear of negative evaluation, and propensity to worry. Upon starting the survey, the participants received a unique id from the principal investigator, termed simulation ID.

The *IT Meltdown Task* was designed to be stressful, but not more so than an individual would receive in any given workday. The researchers designed a simulation where the participant answers as many math questions as possible, while dealing with preprogrammed malfunctions and loading screens. The more questions the participant answered correctly, the more incentives he or she gets a chance to receive. The math portion only contained basic addition questions (a random 3-digit number with a second random 3-digit number i.e., 188 + 492).

After the IT simulation, participants answered post-test questions and had a second salivary reading, including perceived stress, satisfaction, performance, math aptitude, and salivary controls. Salivary controls included the intake of alcohol, caffeine, dairy, tobacco, and the recency of a major meal. Participants were administered salivettes that were purchased from Salimetrics, a salivary assay company. Salivettes are cotton-like swabs that participants keep in the side of their cheek for 2 minutes. These exact tools have been used before in IT research and are considered non-invasive by research. They will spit the cotton swab back into the test tube for processing without even touching the specimen.

Processing Samples

Assay kits were purchased from Salimetrics and processed in house. Once samples were collected, they were immediately frozen at -80◦Celsius. Each sample is identified only by a simulation number for both pretest and posttest measures. Duplicate measures were analyzed for each sample to confirm our protocol. In order to analyze the alpha-amylase inside the participant's saliva we followed a detailed protocol. That protocol is available to review at https://www.salimetrics.com/assets/documents/1-1902.pdf. This protocol included collecting duplicate readings for each sample at both the pre- and post-test collection time, giving us four readings per participant. These duplicate measures were each measured in the plate reader at two points in time, 1 minute and 3 minutes. We manually calculated the difference between those two numbers after the machine confirmed the raw readings. The duplicate scores confirmed that our protocol was correct by showing a similar reading between the measures. After analyzing the samples, we averaged the two scores and multiplied that score by 328. Generally, salivary alpha-amylase scores should fall between 3.1µ/ml and 423µ/ml, with an average of 92.4µ/ml.

Once each score was calculated for both the pretest and the posttest, an overall change in objective strain measure was calculated by subtracting the pretest measure from the posttest measure and dividing that score by the posttest measure. These numbers would generally go up from the pretest to the posttest and give us a positive final score if the participants were objectively strained by the experiment. Negative scores mean that the participant actually lowered their level of strain during the experiment. After these calculations, these final scores should fall between -1 and 1.

PRELIMINARY RESULTS

We received pilot data from 21 students at a small liberal arts institution. With this amount of data, we were able to check for the reliability and validity of our items, and run simple correlation analysis. It should be noted that with such a small sample size, type II error is less likely. Instead high Cronbach alpha scores and significant correlations are more likely to stay significant as we get more power from additional participants. Because of the low power, more data is required before regressions can yield useful insights into our hypotheses.

From our pilot data, we calculated the descriptive statistics (See Table 2). The average age of participants was 20 and 52.38% of our subjects were male. 70.43% of our participants were Caucasian/non-Hispanic, which is aligned with the general population of the college.

Table 2. Descriptive Statistics

	Mean	Standard Deviation	Cronbach's Alpha	Number of Items
Locus of Control	3.82	1.40	.711	12*
Social Desirability	2.93	1.66	.626	30**
Fear of Negative Evaluation	2.78	0.40	.903	12
Propensity to Worry	2.88	0.43	.929	15***
Perceived Stress	2.20	0.30	.934	15
Objective Strain	Time 1: 98.62 Time 2: 103.23	Time 1: 89.99 Time 2: 70.82	N/A	N/A
Performance	# Correct: 16.80 Accuracy: .47	# Correct: 5.23 Accuracy: .12	N/A	N/A

*Deleted 1 item, LOC10R, due to low reliability
**Deleted 2 items, SD12R, SD17, and SD31, due to low reliability
***Deleted 1 item, W15, due to low reliability

The correlation analysis yielded some interesting results (See Table 3 for details). Significant correlations are tagged below with an asterisk and a p-value less than .05. Women were less satisfied with how they performed (-.466; p-value <.05), perceived more stress from the experiment (.492; p-value <.05), and were more frustrated by the experiment (.533; p-value; <.05). There was no difference in performance between genders (p-value not significant).

Participants who feared negative evaluation were more likely to report stress (.475 p-value; <.05), but not necessarily objectively strained (p-value not significant). People who worried were more likely to feel stress (.616; p-value <.05) and more frustrated (.507; p-value <.05). Those who worried were also more likely to fear negative evaluation from others (.582; p-value <.05).

Internal Locus of Controls were more frustrated (-.549; p-value <.05), but not necessarily more stressed (p-value not significant).

We calculated both the number of correct answers and the accuracy. The number answered is correlated to both accuracy (.528; p-value <.05) and the amount of effort they put in (.470; p-value <.05), but it is not correlated to our stress variables. More data is needed to make more conclusions on our specific hypotheses.

Table 3. Pearson Correlations Results

		Perceived Stress	Objective Strain	Locus of Control	Social Desirability	Fear of Negative Evaluation	Propensity to Worry	Gender	Effort	Frustration
Objective Strain	Correlation	-.492								
	p-value	.087								
Locus of Control	Correlation	-.381	.014							
	p-value	.097	.963							
Social Desirability	Correlation	-.011	.023	-.394						
	p-value	.964	.939	.085						
Fear of Negative Evaluation	Correlation	.475*	.125	-.194	.157					
	p-value	.034	.671	.412	.497					
Propensity to Worry	Correlation	.616*	-.258	-.390	.302	.582*				
	p-value	.004	.374	.089	.183	.006				
Gender	Correlation	.492*	.187	-.136	-.216	.297	.425			
	p-value	.028	.523	.566	.348	.191	.055			
Effort	Correlation	.173	.042	-.358	.167	.328	.048	-.045		
	p-value	.467	.887	.122	.469	.147	.837	.845		
Frustration	Correlation	.727*	-.277	-.549	.085	.418	.507*	.533*	.387	
	p-value	.000	.338	.012	.714	.059	.019	.013	.083	
Satisfied	Correlation	-.673*	.236	.271	.166	-.258	-.217	-.466*	.093	-.575*
	p-value	.001	.416	.248	.473	.259	.345	.033	.688	.006

CONCLUSIONS AND PREPARATION FOR THE FUTURE

After the careful analysis of the pilot test, in Fall 2016, we simplified the math task and included more meltdowns to focus on the technological interruption. Instead of asking 3-digit addition questions, we asked 2-digit questions (i.e., 12+82) and have added additional questions and more loading/error screens. Many of the participants remarked that adding 3-digit numbers was very difficult, and perhaps an additional cause of stress outside the loading screens and breakdowns. As such, we have simplified our experiment and begun testing with a new group of participants.

We have also looked closely at our survey questionnaires. Some items needed clarification and needed to be altered slightly. We also took a close look at the additional personality characteristics we collected but did not present here. The Big 5 personality test will be included the next iteration, including extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience.

We are actively administering our experiment and will present this new data at South East Informs 2016.

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NO – BUSINESS INTELLIGENCE IS NOT AN OXYMORON OR A BIG DATA TECHNIQUE

MICHAEL LATTA, WALL COLLEGE, COASTAL CAROLINA UNIVERSITY

ABSTRACT

Business education current practice prepares students for analysis with tools such as Strengths, Weaknesses, Opportunity, and Threats (SWOT Analysis). Data Analytics and Predictive Modeling have become popular, and now we hear about Data Science with the advent of big data. As faculty show students how to help business organizations solve real-world problems with these advanced analysis tools, they need to understand how to integrate the softer side of Business Intelligence into business analysis practice. These softer skills include Knowledge from Education, Practical IQ, Emotional IQ and Interpersonal IQ. Taken together they define Business Intelligence which is highly useful in both academic assignments like internships and on the job after graduation.

BACKGROUND

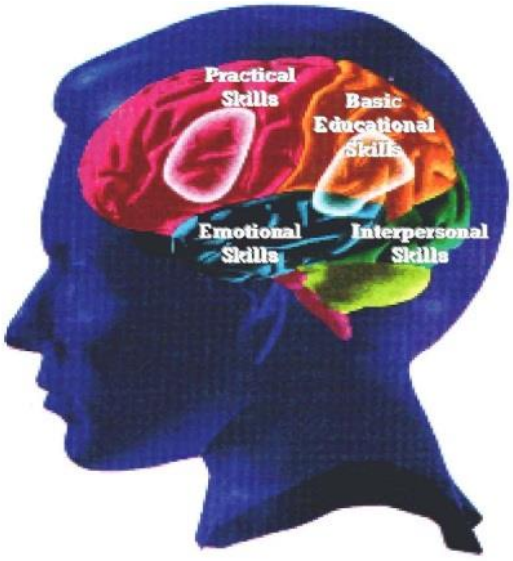
Dion, Berschid, and Walster [6] launched a line of research with their thesis that "what is beautiful is good" that has been applied to everything from reviewing resumes [14], to cooperation on tasks [16]. What can transcend physical attractiveness and personality is Business Intelligence. Without business intelligence, graduates are unlikely to be highly successful no matter how attractive they are, how much content knowledge they have, or how many technical skills they acquire in pursuing a business degree. This approach to developing business intelligence has been successfully tried in quantitatively oriented degrees such as statistics [22] which indicates its potential application in business education. In fact, the past President of the American Statistical Association, Sastry Pantula has argued that statisticians need soft skills describing Business Intelligence saying the following [12]:

> "To succeed in our careers, we need both hard skills and soft skills. There is no doubt that all our jobs require us to have a strong foundation in statistical theory and methodology and excellent computational skills to manage massive data. Soft skills are not a cover-up for the lack of hard skills; we must have and show our expertise in our field. However, hard skills by themselves are not enough. Soft skills help us work in teams, communicate with other scientists, aid management, and move up the ladder through leadership."

This paper is directed at showing how Business Intelligence is based on four kinds of IQ that are independent of physical attractiveness, personality, quantitative abilities, and technical skills:

1. Content IQ
2. Practical IQ
3. Emotional IQ
4. Social IQ

The cluster of intelligence factors appears in Figure 1 below:



Educational IQ

Fluid reasoning (FR) is the ability to solve problems in novel circumstances. Fluid reasoning is considered by its originator [3] to be independent of acquired knowledge. It is considered essential for cognitive development [11] and helps us to acquire other abilities [1] [2] [3]. Fluid reasoning, in childhood, foreshadows success in school, university, and work where cognitive skills are involved [12]. In addition to this line of research, Clouston, Kuh, Herd, Elliott, Richards, and Hofer [5] followed international birth cohorts to show that education has a direct causal and lasting benefit on cognitive development. Cognitive development was measured in a variety of ways including the change in mathematics and reading comprehension in addition to other measures from age 15 to 53. These authors found that having a university education is positively correlated with higher fluid reasoning in adulthood. Those authors concluded that differences in adult fluid reasoning are at least partially due to educational experiences after adolescence.

Gensowski, Heckman, and Savelyev [8] estimated the internal rate of return (IRR) for education for men and women included in the Terman sample, a 70-year long prospective cohort study of high-ability individuals. This analysis showed the IRR for obtaining a bachelor's degree over a high school diploma is 11.1%, and for a doctoral degree over a bachelor's degree it is 6.7%. These results are unique because they highlight the returns to high-ability and high-education individuals, who are not well-represented in typical data sets. The results also show IQ is rewarded in the labor market.

Practical IQ

Analytical and creative business knowledge and skills define Practical IQ [19]. Those with Practical IQ know how to collect, prepare, process, and interpret the output of business analysis tools such as SWOT and TOWS. Business consultants convert results of these analytical techniques into information that can be used to improve the operations and strategic position of a business. One author [23] has even offered 54 different tools and techniques business consultants can use as a resource list to call on.

Emotional IQ

The ability to identify, assess, and control their own emotions when others have trouble understanding business problems and solutions is a very important skill [9]. Emotional IQ has components as simple as good listening skills and as complex as managing an irate client. Emotional self-control defines Emotional IQ, a second element to Business Intelligence. This capability means a good business consultant is confident but not arrogant. Listens actively by reflecting what a client says to gain complete understanding. Having a PhD from a top Business School like Wharton or Harvard Business School is nice, but those with Emotional IQ will rely more on the ability to get others to understand business problems and potential solutions than what they learned in business school. Emotional IQ also means being confident is better than simply appearing confident. Being truly confident makes it a lot easier for other people to trust a business consultant with help in solving business problems and running their organization. Being truly confident and having Emotional IQ also means being 'objective.' Neuroscience has shown that in the area of analysis versus emotions, many decisions can be improved by having negative emotions recognized and kept in control [21] before crucial decisions are made. Those who have command and control over their emotions have high Emotional IQ.

Interpersonal IQ

The capacity to quickly establish rapport and effectively navigate and negotiate complex social relationships and environments defines what he labels as Social IQ. As described earlier, emotional intelligence deals with managing our personal emotional state, and is contrasted with social intelligence as dealing with managing interpersonal interactions and relationships to positively influence others. Social IQ enables business consultants to establish a relationship and serve clients who are not knowledgeable in organizational development and dynamics. Many examples of the value of Social IQ can be found in Daniel Goleman's work [10], and the foundation of Social IQ is anchored in mirroring neurons in the brain. This approach to Social IQ is based on neuroscience which describes the basis of empathy as the ability to both feel the emotional experiences of others and understand their situation from a rational point of view.

Business Intelligence

Henry Cloud [4] has described a predisposition to action resulting from these four types of IQ. It is contended here that the following six characteristics define functional Business Intelligence as:

1. The ability to gain the complete trust of others.
2. Seeing reality without blind-spots.
3. Working in a way that produces outcomes that are expected based on their abilities and available resources.
4. Dealing effectively with problem people, negative situations, obstacles, failures, setbacks, and losses.
5. Creating growth in themselves, their organizations, their clients, and anything else they touch.
6. Transcending their own interests and dedicating themselves to a larger purpose or mission.

DISCUSSION

It is argued here that Business Intelligence comes from developing Educational, Practical, Emotional, and Interpersonal Intelligence skills and abilities. It begins with the ability to understand why someone wants to engage a business consultant in the first place. The top 10 reasons organizations hire business consultants were identified in a recent survey [7] and include the following items. A consultant may be hired to:

1. Provide his or her unique expertise. This is where it pays to not only be really good in the technical aspects of business consulting, but to have some type of track record that speaks for itself.
2. Identify problems. Sometimes employees are too close to a problem inside an organization to identify it. That situation is often helped by a naïve outside view.
3. Supplement the staff. Sometimes an organization discovers that it can save thousands of dollars by hiring consultants when they are needed, rather than hiring full-time employees. Organizations sometimes realize they save additional money by not having to pay benefits for consultants they hire. Even though a consultant's fees are generally higher than an employee's salary, over a given time period, it simply makes good financial sense to hire a consultant.
4. Act as a catalyst. In a typical organization few people like change. When change is needed, a consultant may be brought in to 'get the ball rolling.' In other words, the consultant can do things without worrying about the organization's culture, employee morale, or other issues that get in the way when an organization is trying to create change.
5. Provide much-needed objectivity. Who else is more qualified to identify a problem than a consultant? A good consultant provides an objective, fresh viewpoint--without worrying about what people in the organization might think about the results and how they were achieved.
6. Teach or train employees. These days if you are a business consultant who can show employees how to master a new business aspect like social media or big data analysis, then the telephone probably will not stop ringing for a while. A consultant may be asked to teach employees any number of different skills. A consultant must be willing to keep up with new discoveries in their field of expertise--and be ready to teach new clients how to stay competitive.
7. Do the 'dirty work.' When cuts have to be made or only one point of view can be accepted, someone's feelings are going to be hurt or someone's 'baby' must be declared 'ugly.' When the available information suggests a product should be taken out of production, when years of R&D have been invested in a product that the market just does not want or need, or when the boss's favorite ad is not working, someone has to tell the truth. Managing that conflict is a key skill.
8. Bring new life to an organization. If you are good at coming up with a new business model that works, then you will not have any trouble finding clients. Sometimes the problem is not really a problem, but an opportunity and a good business consultant can find a way of analyzing and displaying the information that shows a viable opportunity that not only solves a problem, but leads to growth.
9. Create a new business. There are consultants who have become experts in this field. Not everyone has the ability to conceive an idea, support it with data and expert analysis, and then develop and sell a plan for the future. If students can do all of that, they will be successful.
10. Influence other people. Asking the question, 'Do you see yourself as a sales person?,' must be answered by the business consultant. Whether students realize it or not, they are always selling. Selling ideas and results of business analysis is a key part of being a business consultant since many business outcomes are grey rather than black and white.

An Example

The Myrtle Beach Area Chamber of Commerce requested help in determining new ways to attract visitors to the Myrtle Beach. A three-person student team was selected from a Marketing Research class to

undertake the project under the guidance of the author. These students enthusiastically accepted the invitation.

The process included meetings with the CEO and Marketing Research Department of the Chamber of Commerce and business leaders in the area. From those meetings, the students developed a plan of action. The objective throughout this project was to discover what would entice people to travel to the Myrtle Beach area during the off-season. They submitted a proposal to the CEO and created a milestone schedule to finish the project before the end of the semester. The students displayed Social and Emotional Intelligence in the process of working with the Chamber of Commerce to identify the problem, creating a plan to solve the problem, and selling the plan to the CEO and Marketing Research Department of the Chamber of Commerce.

The field research phase included qualitative methods used to explore questions pertaining to: hotel accommodations, length of stay, attractions or events, and price. A quantitative survey was then designed and implemented to determine how strongly potential visitors felt about these issues. A multi-method approach was used involving face-to-face, telephone, and internet methods. In all cases a Self-Administered Questionnaire was employed. The students analyzed data using Excel Data Analysis ToolPak. They then created tables, graphs, and other material for a formal written report and a PowerPoint presentation. Their interpretation of the analysis indicated the most important issues in the quantitative findings were age and price. The age group 24-39 was found to be the most frequent and most price sensitive tourists visiting the Myrtle Beach area. These findings led them to conclude that the age group 24-39 is the most important segment for future marketing using a price bundling strategy. The field and reporting phases showcased their Practical Intelligence as well as Social and Emotional Intelligence.

The student team presented the project in two venues: 1) at a dinner meeting of members of the Chamber of Commerce, and 2) at a special presentation of undergraduate and graduate student research projects for the Wall College Board of Visitors. In both cases, the team, the project, and its recommendations were well received. Three of the recommendations were adopted as an action plan by the Chamber of Commerce.

Finally, as a tribute to the students' Business Intelligence, the Chamber CEO wrote an extraordinarily complementary letter to the President of Coastal Carolina University and donated $2,000 to the Marketing Club which has been used to support the students' Club activities.

CONCLUSIONS AND IMPLICATIONS

On the employer side, the approach of looking for candidates with Business Intelligence has been used in employee selection as outlined by Livens, Chan, In Farr, and Tippins in the Handbook of Employee Selection [15]. On the business consulting side, internal and external clients often do not know about such tools and techniques such as SWOT and TOWS. Consultants with high Business Intelligence are able to have an understanding of both their client as people and their client's opportunity or problem. That dual understanding plus a business analysis done by a consultant high in Business Intelligence can lead to effective change and sustainability of the business. Employees in a business needing this kind of assistance also need to have the problem/opportunity and recommendations for action explained in 'street language' which they can understand and which they can then use and communicate to others in the organization.

In summary, students who exhibit Business Intelligence are:

1. Able to quickly establish trust and rapport.
2. Exude confidence born of experience.
3. Able to concentrate on the client's situation and never procrastinate.
4. Exhibit understanding all factors that affect the client business.
5. Be as committed to the client business as the people who work in it.
6. Be effective communicators in very specific rather than vague ways.
7. Be capable of delivering results that have a major impact on the success of the client business thereby justifying their very existence.

Most students do not come to college with these skills. Teaching business students the soft skills and abilities defining Business Intelligence exhibited by effective consultants early in their business program of study is a good way to practice what Randy Pausch [18] calls 'head fake learning,' or learning about something without being aware you are being taught. Business Intelligence is a special case of head fake learning that requires the right approach. The student project described here is an example of real world business consulting by students involving head fake learning in tourism marketing. It shows how all three types of IQ are developed, needed, and how to use them.

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Open Discussion of Instruction Issues for Quantitative Classes Using Data

Robert L. Andrews,
Virginia Commonwealth University,
Department of Supply Chain Management and Analytics,
Richmond, VA. 23284-4000, 804-355-4645, randrews@vcu.edu

Wilma M. Andrews,
Virginia Commonwealth University,
Department of Information Systems,
Richmond, VA. 23284-4000, 804-827-0956, wandrews@vcu.edu

Hiren Kotak,
Virginia Commonwealth University,
Department of Supply Chain Management and Analytics,
Richmond, VA. 23284-4000, kotakhh@vcu.edu

Diya Suzanne Abraham,
Virginia Commonwealth University,
Department of Supply Chain Management and Analytics,
abrahamds@vcu.edu

ABSTRACT

Analytics is having an impact on course offerings within schools of business and beyond. This session will focus on how to provide the best instruction in quantitative course offerings in the business school. The goal of the instruction should be to prepare graduates to be effective users of quantitative procedures in a business world where data driven decision making is receiving more attention. A panel with a diversity of backgrounds and experience will lead a discussion of relevant issues. Members of the audience will be invited to participate and put forth issues that are of interest to them. Issues to be discussed include:

- the analysis procedures and tools that should be included in quantitative classes,
- the skills that are needed to effectively communicate knowledge obtained from analyses,
- the methods for most effectively guiding student learning in these areas.

INTRODUCTION

The panel intends for the session to result in an interactive discussion among the panel and those attending. The panel members have some definite opinions based on their own experiences and interactions with other academics. The plan for the session is for the panel members to make initial presentations from their perspectives to set the stage for a broader discussion. The goal of the session is get the session participants to think about what they teach in their classes and what is offered to provide quantitative methods instruction in their school's curriculum.

The recent emergence of Big Data, Business Analytics and Data Science has changed the face of quantitative analysis. Have our courses changed to keep pace with these changes so that the students are prepared to be effective in a data-driven decision making environment? What are the changes that should be made? Do we need to change the procedures and techniques that we

teach? What software should we be using? These are some of the questions and issues that will be addressed in this session.

IMPORTANCE OF STARTING WITH QUALITY DATA

The process of analyzing data begins by obtaining good and reliable data. The quality and subsequent value of a quantitative analysis using data are no better than the quality of the data being used for the analysis. The GIGO (Garbage In, Garbage Out) expression is certainly applicable for data based analyses. In many classes the focus is almost exclusively on analyzing clean data. However, data in the real world are rarely clean. Often times the 80-20 rule is given for analyzing data with 80% of the total time for an analysis given to obtaining, organizing and cleaning the data, while the actual analysis only requires 20% of the time. We are not proposing that a quantitative analysis class should spend 80% of the class instruction on data preparation. However, some instruction time should be spent on data preparation and assessment of the quality of the data to provide adequate preparation for students. It is also recommended that students are exposed to data quality and management issues with unstructured data as well, but it is impossible to do everything in one class. However, Osborne and Overbay [9] strongly emphasize the importance stating, "Screening data for univariate, bivariate, and multivariate outliers is simple in these days of high-powered personal computing. The consequences of not doing so can be substantial."

MAINTAINING PROPER BALANCE BETWEEN BASIC UNDERSTANDING AND KNOWING HOW TO USE COMPUTATIONAL SOFTWARE

Relative to teaching statistics, James Osborne [8, page 2] states, "we as a discipline need to acknowledge that (a) there is almost no utility to teaching statistics through hand calculations, (b) we should teach statistics the way that professional, practicing statisticians use the methods, and the way they are likely to apply them." Just teaching hand calculations does not prepare students for a big data world. However, just teaching students where to click in a software package to obtain output and giving them guidelines for interpreting output does not provide an understanding of the procedures being used. Striking the right balance is not easy or straight forward.

IMPORTANCE OF COMMUNICATING AN ANALYSIS RECOMMENDATION

A recommendation based on quantitative analysis of data has little value if it is not clearly understood by the decision maker. To act on the analysis results the decision maker must trust the results and it is difficult to trust something that is not understood. The usefulness of quantitative analysis of data is no better than the ability to effectively communicate the findings in a clear and concise way to a decision maker. Kim Love states [7], "One of the biggest challenges faced by any collaborative statistician is communicating statistical information to those with less knowledge of statistics. Many of us with formal education in statistics receive extensive training in theory, methods, and application; however, even with a PhD in statistics, it is not uncommon to have taken one or no courses that focus on communicating this knowledge to those who can benefit from it." Without clear and understandable communication, the decision maker lacks confidence in using the results to make a decision that can benefit the enterprise. The bottom line value of an analysis depends on the final story that is told to the decision maker. Good analysis skills are needed to analyze the data but a great analysis of

pertinent data is no better than the ability to communicate the findings to the decision maker so that it can lead to a better decision.

To support the above assertions, the following citations are given from practicing professionals. Andrews, Custer and Gilbreath [2] reported on an essential set of general skills series based on discussions with and feedback from analytics professionals. One of the essential skills was to "Develop and effectively communicate an actionable solution for the specific business question." Hahn and Doganaksoy [3], based on the experience of practicing statisticians, reported on "Traits of a Successful Statistician" and stated, "You must speak the language of your customers and not expect them to be proficient in yours." Kristian Hammond [4] states, "We will need systems that not only perform data analysis, but then also communicate the results that they find in a clear, concise narrative form." In June, 2014, Lavastorm Analytics distributed the *Analytics 2014: Industry Trends Survey* [6, page 7] report of the findings from their survey that polled a total of 495 business analysts, technologists, data analytics professionals, managers and C-level professionals across a broad variety of industries—including financial services, telecommunications, healthcare and software & internet. When those considering themselves to be data scientists were asked, "what is your biggest challenge in analytics today?" 25.8% of them selected "Building Trust in Insights" as the biggest challenge. James Shrenk [12], a pricing analytics professional, summarizes, "In the end, the most important facet of working with data is in generating insights for those with whom we work. To remain relevant and vital to decision makers (whether they are managers, directors, foundations that provide grants, or university administrators) requires the analyst to be practical and skilled." David Rodgers [11] states, "Nothing else much matters if it cannot be communicated coherently, succinctly and with confidence." What is important for us is the statement of Love [7], "The good news is, contrary to what many of us believe (at least in practice), communication abilities can be practiced and learned."

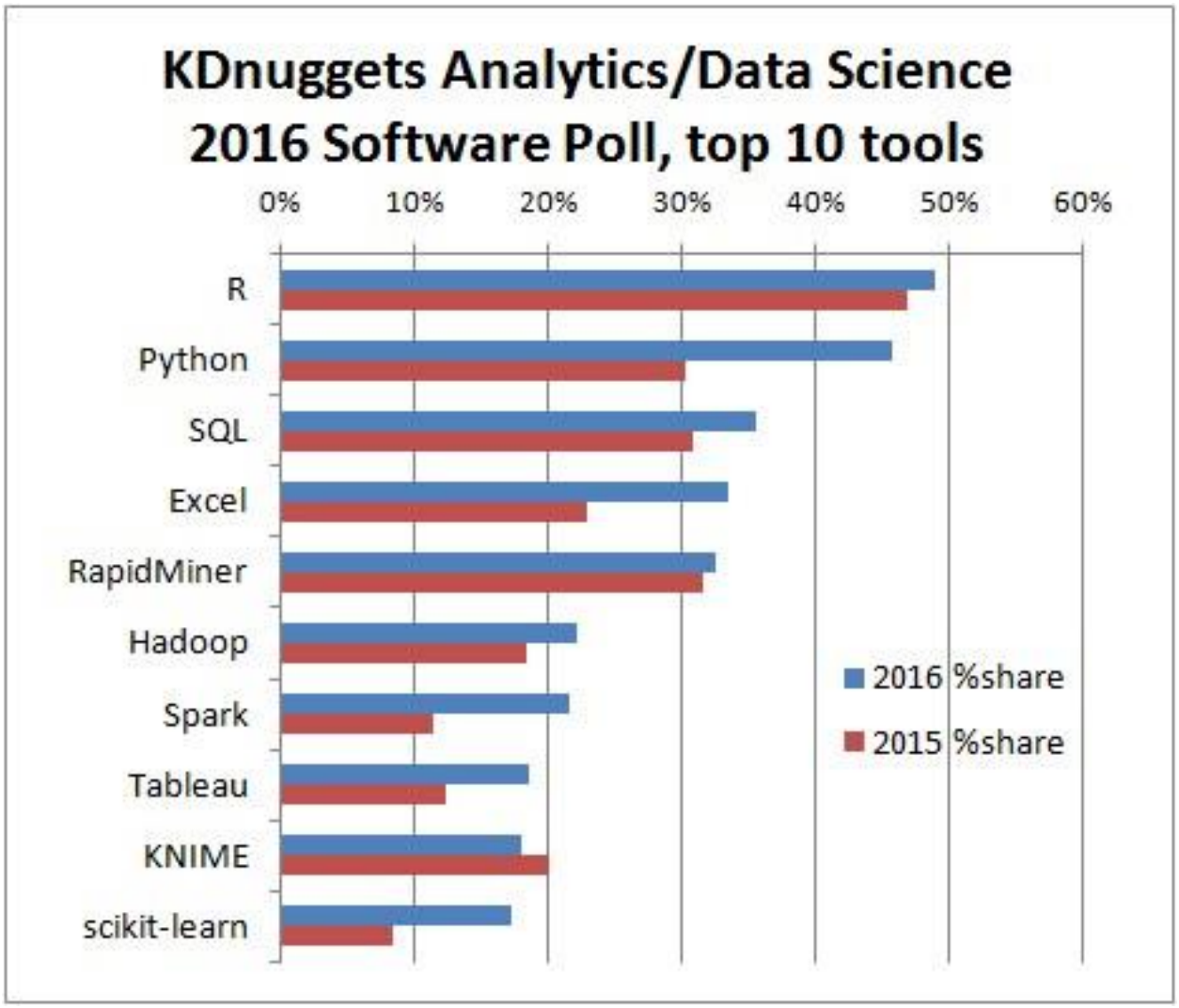
QUANTITATIVE SOFTWARE TOOLS

The software tools available for quantitative classes continues to change and choosing the software to use for a class is not easy and there are many criteria to consider. These criteria include:

- Software usefulness for analysis topics covered in the course and beyond
- Software cost to the student
- Availability and use of the software in the professional world
- Instructors' knowledge of the software
- Software instruction provided by the textbook used in the course.

Learning to use software that will be available and used in the professional world is important for the future of students. KDnuggets [10] does an annual survey of individuals who are vendors or practicing analytics and data science professionals. The graph below for the 2016 survey lists the top 10 software tools out of 102 different tools cited by 2,895 voters. It is important to note that those voting selected the tools that they used and were able select multiple tools. R is the most cited software again this year as it was in 2015 which had about 2,800 voters selecting from 93 different tools. Python and Excel had nice gains in use from 2015 to 2016. This survey includes many individuals with jobs that extend beyond the capabilities expected of a professional with merely undergraduate training. Excel is probably the tool that almost all

analysts would find available in a work environment and its appearance on this KDnuggets list indicates that it is still used by many of these power users. R is the top listed tool and since it is an open source tool it certainly meets the cost to the student criterion. This also means it does not present a cost huddle for use on a job. Many undergraduates obtain jobs at smaller companies that do not have licenses for more expensive software such as SAS. Cost may be one of the reasons that the use of SAS Enterprise Miner in the survey dropped from 10.9% in 2015 to 5.6% in 2016.



SUMMARY

The panel members will draw on their diversity of backgrounds and experiences to lead the discussion of instruction related issues for classes that make use of quantitative analysis of data. Members of the audience will be encouraged to participate in the discussion of the issues and also add issues that are of interest to them.

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Organizational Commitment and Emotional Intelligence in a Service Learning Setting

DR. KURT SCHIMMEL
Slippery Rock University

This paper examines the relationship between emotional intelligence and organizational commitment. To examine the relationship and to explore whether there are underlying clusters of people based on responses emotional intelligence instrument. Then the relationship between these clusters and the normative and affective components of commitment are examined.

Emotional intelligence

Emotional intelligence (EI) is the assessment and expression of emotions, in one's self and others (Mayer and Salovey 1990). Goleman 1995 conceptualized EI as a domain of intelligence dealing with the experience and expression of intelligence. As a domain of intelligence, one would expect different levels of this intelligence to be found in respondents. It would make sense that there would be underlying segments and levels present. This paper utilizes a cognitive oriented measurement of emotional intelligence developed by Schutte, Malouff, Hall, Haggerty, Cooper, Golden, & Dornheim (1998) as the basis of the measurement of EI.

Organizational Commitment

Organizational commitment has been conceptualized as having multiple components. In this study we will explore the affective and normative components. The affective component refers to the emotional attachment, identification with and involvement with an organization (Allen & Meyer 1990). Normative commitment refers to the feeling of obligation to stay with the organization (Allen & Meyer 1990). Organizational commitment has been shown to lead to

improved performance in nonprofit board members (Preston & Brown 2004) . Organizational commitment has been shown to be positively related to emotional intelligence (Nikolaou & Tsaousis 2002).

This paper explores the relationship between emotional intelligence and organizational commitment. Specifically are there underlying segments in the emotional intelligence of the service learning students and do these underlying relationships correspond to different levels of organizational commitment.

Methods

The survey instrument was designed using the Schutte, Malouff, Hall, Haggerty, Cooper, Golden, & Dornheim (1998) 33-item measure of emotional intelligence. A copy of the items is provided in Appendix A. A web survey was developed and included a request for participation as well as reminders sent as suggested by Hair et al. (2010, p. 192).

The survey was sent to all students, however only those who actually were participating in a service learning experience that semester were asked to complete the survey. A total of 658 respondents completed both the pre- and post-experience survey.

Analysis and results

Analysis was conducted using IBM SPSS Statistics 21. K means clustering was used to examine underlying segments in the respondents based on the 33 item emotional intelligence scale. The best solution revealed two underlying cluster and converged in 19 iterations. An examination of the clusters revealed that there were 326 in cluster one and 332 in cluster .two. Cluster one had average scores that were higher than cluster two's average scores on the items. There were significant differences on all emotional intelligence items between the clusters. The following table shows the cluster centers and the Anova resuls for differences between the segments.

ANOVA

	Cluster Center one	Cluster Center two	Cluster Mean Square	Cluster df	Error Mean Square	Error df	F	Sig.
I know when to speak about my personal problems to others	6	5	241.425	1	1.630	656	148.094	.000
When I am faced with obstacles I remember times I faced similar obstacles and overcame them	6	5	278.229	1	1.323	656	210.303	.000
I expect that I will do well on most things I try	6	5	141.255	1	1.219	656	115.855	.000
Other people find it easyto confide in me	6	5	220.716	1	1.114	656	198.173	.000
I find it hard to understand the nonverbal messages of other people	3	3	13.459	1	2.702	656	4.980	.026
Some of the major events of my life have led me to re-evaluate what is important and not important	6	5	203.314	1	1.732	656	117.407	.000
When my mood changes I see new possibilities	5	4	187.891	1	1.651	656	113.792	.000
Emotions are one of the things that make my life worth living	6	4	285.165	1	1.597	656	178.604	.000
I am aware of my emotions as I experience them	6	5	318.335	1	1.104	656	288.447	.000
	6	5	234.385	1	1.531	656	153.074	.000

I expect good things to happen I	5	4	285.326	1	2.547	656	112.020	.000
like to share my emotions with others	6	4						
When I experience a positive emotion I know how to make it last			320.962	1	1.394	656	230.174	.000
I arrange events others enjoy	5	4	348.994	1	1.869	656	186.764	.000
I seek out activities that make me happy	6	5						
I am aware of the non-verbal messages I send to others			174.288	1	1.085	656	160.689	.000
I present myself in a way that makes a good impression on others	6	4	309.492	1	1.537	656	201.357	.000
When I am in a positive mood solving problems is easy for me								
	6	5	235.890	1	.921	656	256.260	.000
	6	5	203.570	1	.899	656	226.523	.000
By looking at their facial expressions I recognize the emotions people are experiencing	6	5	279.661	1	1.007	656	277.630	.000
I know why my emotions change	6	5	327.654	1	1.452	656	225.714	.000
When I am in a positive mood I am able to come up with new ideas	6	5	321.582	1	.974	656	330.183	.000
I have control over my emotions	6	4	250.914	1	1.545	656	162.435	.000
I easily recognize my emotions as I experience them	6	5	353.515	1	.886	656	398.806	.000
I motivate myself by imagining a good outcome to tasks I take on	6	5	403.592	1	1.107	656	364.613	.000
I compliment others when they have done something well I am aware of the non-verbal messages other people send	6	5	239.698	1	.946	656	253.494	.000

When another person tells me about an important event in his or her life I almost feel as though I have experienced this event myself	6	5	243.063	1	1.245	656	195.154	.000
	5	4						
When I feel a change in emotions I tend to come up with new ideas								
When I am faced with a challenge I give up because I believe I will fail			282.411	1	1.762	656	160.311	.000
I know what other people are feeling just by looking at them								
I help other people feel better when they are down	5	4	321.650	1	1.389	656	231.503	.000
I use good moods to help myself keep trying in the face of obstacles								
I can tell how people are feeling by listening to the tone of their voice			23.319	1	2.548	656	9.152	.003
It is difficult for me to understand why people feel the way they do	2	3						
			253.368	1	1.603	656	158.057	.000
	5	4						
	6	5	292.512	1	1.022	656	286.258	.000
	6	4						
			457.390	1	.991	656	461.522	.000
	6	5						
	3	3	235.162	1	1.146	656	205.265	.000
			26.193	1	2.306	656	11.360	.001

To examine the differences between the clusters on the scales of affective and normative commitment anova was conducted. The results indicate there are significant differences in the clusters affective (.000) and normative commitment. (.005). An examination of the means shows that in for both commitment components the level of commitment was directly related to the level of emotional intelligence based on the cluster. Cluster one's average affective commitment was 51.62 while cluster two's average was 44.54. Normative commitment followed the same pattern, cluster one's average was 22.10 and cluster two's average was 19.82.

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Providing What Students Need; Not What Is Easiest for Faculty: In-Depth Strategic Assessment of the Strategy Course

Janice A. Black
Coastal Carolina University

J. Kay Keels
Coastal Carolina University

Nicholas D. Rhew
Coastal Carolina University

It is always interesting to learn what others think of strategic management, what it is, and how it should be taught. From Business Deans who argue (even within the last 6 years) that *anyone* can teach strategy (Business, 2010) to the Wall Street Journal that lists headlines on its link designated as "strategic management" articles ranging from stories such as "Musicians and Promoters: Scalpers May Not Be the Enemy After All" to "The Real-World Test Your Startup Needs to Raise Money" (Wall Street Journal, 2016) it is evident that confusion still exists. Given such a diverse variety of topics that are regularly classified as "strategy", the concept seems to defy a unified singular definition and associated application. The confusion and misunderstanding has been prevalent for quite some time. For example, Grant (2008) suggested two schools of thought: one was associated with term "Business Policy" which was typically non-theoretical and was typically taught by executives via their "war stories" and personal experiences. Nonetheless, these executive-led courses were also considered to be a capstone experiences which required the integration of all functional- and discipline-based courses. The second approach identified by Grant, "Strategic Management", was theory-based and was often taught as a foundation course with much of the theory based in economics and the "Theory of Profits". The editors of this special issue of JMI in which Grant's article appeared have recognized not only these two different streams as (1) the *practice- based approach* and (2) the *theory acquisitive approach* but have, in addition, included a number of other topics worthy of investigation.

For those who research and teach strategy/strategic management -- whether at a research one

institution or at a primarily teaching institution -- gaining the respect of peers for this subject area as a legitimate separate and relevant topic has indeed consumed nearly half a century. Many have wondered if the primary emphasis on tools sets (Kaner, 2005) and dispassionate theories (Ghoshal, 2005) might explain major ethical failures such as Enron while others have maintained that ethics is embedded in the psyche of students many years before they become strategic management students (Gapper, 2005). At the same time, the question still persists as to whether strategic management is really necessary in business education anymore (Bower, 2008)! *Really?!?*

However, it is our position that the above-mentioned issues are not the real problems, but rather they are merely symptoms of panicked responses. Our observation is that our business students are leaving our undergraduate and graduate programs and are subsequently not doing well in the highly complex, ambiguous, and rapidly-changing dynamics of the information technology-driven frenzy that are hallmarks of current business environments. Additionally, today's students are not choosing to enter graduate programs that offer strategic management orientations or strategic management concentrations. Apparently, these students do not understand these concerns, and further, their employers can readily discern that these students do not understand. Nonetheless, these employers continue to expect their new employees to be capable of thinking and acting strategically even more so now than in the past. Furthermore, these employers do not want these new hires entering the workplace at a novice level, but as individuals who have had sufficient experience to be able to identify what to do and to then take action and get it done!

It is our position that it is not so much that classic strategic content and tools are not relevant as it is that our programs of education have not adjusted to the changes in our incoming students, their knowledge and thinking levels. Today's college-level students known as Millennials now range in age from 30 to 18. Hence, they currently populate undergraduate, graduate and some executive education programs. Furthermore, especially at the undergraduate level, the typically identified characteristics of

Millennials have disrupted these students' ability to learn in the ways that drive our traditional teaching methods which were predicated upon very different assumptions of foundational knowledge and thinking ability. We, in our roles as distributers of knowledge, have failed to recognize and appreciate the different needs of our incoming students as well as we should. Regrettably, many current instructors insist on trying to make today's students conform to learning styles and methods that were relevant when these instructors were students. They fail to acknowledge that today's students have had very different learning experiences and have grown up in very different contexts.

So, while agree that pedagogical change is needed and that faculty need to update their appreciation of change and their curricula regularly, we do not support the notion of the claim of the artificial dichotomy between theory and practice being at the root of the discussions presented above. Instead, we maintain that our methods of teaching need to be customized to match the learning needs of our current students – regardless of whether those students are executives or traditional-aged college students completing their first degree. In this paper, we propose to illustrate how a live case project can be customized to today's audience of Millennials while still enabling the integration of theory and practice and to thus give students the full spectrum (theories, practices, tools, and justifications) while training them to progress from the overly-structured and passively-oriented educational foundations that they have previously experienced to the more dynamic, messy and ambiguous world of real-world business today. We begin by profiling and seeking to understand the current student.

MILLENNIAL STUDENTS

Millennial students have been described as being born between 1980 and 2001 in popular business press (Alsop, 2008) and at times have also been known at Generation Y which has had a birth date range from 1977 to 1992 (Yahr & Schimmel, 2013). From the beginning of the new millennium, students in higher education have been entering academia with lower skill sets (Nonis, Hudson,

Philhours, & Teng, 2005). With past generations, there was merely a generational effect associated with viewing the newcomers as deficient via test results, writing, samples, and actual submitted work, the Millennials tend to all show a decline in quality (Leinberger, 2015; Twenge & Campbell, 2012). It appears that, outside a very small boundary of learning environments, Millennials tend to be passive in the classroom and dislike hard work (Litzenberg, 2010; Twenge & Campbell, 2012). Furthermore, when faced with complicated or abstract information, students fail to use appropriate learning strategies such as asking questions (Aydeniz & Gilcrist, 2013). With Millennials, ambiguity is perceived as being unfair and when present, it is perceived as evidence of a bias against them personally (Twenge, 2010).

Millennial-aged students do show higher narcissistic tendencies than the population in general (Balaji & Indradevi, 2015; Twenge J. , 2010; Twenge & Campbell, 2012). This tendency is usually expressed via the need for positive feedback (Foster, 2015). In the classroom, this narcissism is usually accommodated by instructors who demonstrate caring for the students with passion about their topic and enthusiasm for the class (Therrell & Bunneback, 2015). Clearly expressed expectations and positive correlation between material taught and test content were also highly desired (Therrell & Bunneback, 2015). Finally, in contrast to Barnes and Jacobsen, there was an expressed desire for more real-world examples and active learning opportunities in order to engage these students' attention and increase their focus on the material whether in class or engaged in homework (Therrell & Bunneback, 2015). Today's current millennials (those born around the turn of the century) can be seen as curious and desiring to be engaged (Bitterman & Hess, 2015) but in a customized way (personalized to their own tastes) (Balaji & Indradevi, 2015; Rogers, 2015) and in a nervous (Bitterman & Hess, 2015) fashion given their exposure to the economic crises of 2008-2009 (Twenge & Campbell, 2012; Bitterman & Hess, 2015). These students are part of the Millennial generation that is transitioning to the iGeneration (Rogers, 2015) or the Z Generation (Schakett, Schertzer, & Kleine, 2015). High technology information interface devices are the standard with them (Twenge & Campbell, 2012); however, they are less skilled

in functional applications like word processing or spreadsheet use (Leinberger, 2015). They are often considered to be rude due to their use of high tech devices which often precludes the use of face-to-face standard communication efforts. Their schools tend to employ teams and technology in the classroom, and so they can be confused when faculty refuse to allow them to keep their cell phones active in class. They want to act, to use their information immediately (Bitterman & Hess, 2015) rather than just receiving information or reading about it or planning for the action (Bitterman & Hess, 2015) (Therrell & Bunneback, 2015). Yet, Millennials are also the least open to new experiences and creativity of all generations since those of the World Wars (Twenge & Campbell, 2012).

In their upbringing and nurture, these students have generally been protected from risk and uncertainty (Schakett, Schertzer, & Kleine, 2015; Harris, 2010; Weiler, 2004). Consequently, they need to develop skills in coping with uncertainty and ambiguity (Schakett, Schertzer, & Kleine, 2015; Tallent & Barnes, 2015) so that they can differentiate themselves and proceed to controlling their own personal growth and development (Schakett, Schertzer, & Kleine, 2015). Because of this protection, these students typically have few skills in developing their own mental maps of topics and contexts (Mumford, Campion, & Morgeson, 2007). They have been a part of the "No Child Left Behind" culture of testing and retesting and thus simply cannot believe that a deadline or a test result is absolute (Leinberger, 2015). They have been able to earn trophies for just showing up; consequently, earning an award on their own merit and by hard work is a foreign concept (Schakett, Schertzer, & Kleine, 2015; Twenge & Campbell, 2012).

They are strongly influenced in what they remember by how much they like a professor (Gross, Lakey, Edinger, Orehek, & Heffron, 2009). Affect significantly influences today's students.

It should not be surprising that they have a stronger need for help in improving their critical thinking and decision making skills than preceding generations (Schakett, Schertzer, & Kleine, 2015).

Recall that these students abhor ambiguity, the very thing that large and small employers say that they need incoming employees to be able to handle. Yet, we maintain that with the proper adjustments to our teaching practices, these student can learn and exceed the skill sets of earlier generations (Leinberger, 2015; Domke-Damonte, Keels, & Black, 2013).

COLLEGE PEDAGOGICAL PRACTICES THAT WORK FOR MILLENNIALS

Traditional pedagogical means have negative results with many Millennial students including lower grades, lower retention of information performed in national field exams and fewer students choosing to major in courses that they perceive to be difficult or with higher failing rates (Leinberger, 2015; Therrell & Bunneback, 2015; Fletcher, 2006). Much earlier forms of pedagogy relied on students' ability to integrate from a foundation of reading, listening, speaking and writing (composition and penmanship) to sharpen their ability to think clearly and reflectively (Tallent & Barnes, 2015; Leinberger, 2015). Furthermore, students are arriving in our classrooms with little to no skill in writing in cursive style which means that their note-taking skills are negligible, their ability to read cursive feedback provided by faculty is diminished, and when taking in-class essay exams, their speed in answering is slowed down substantially (Leinberger, 2015). Students themselves can see this lack and as recently as 2006, nearly 40% of them acknowledged feeling not prepared for either work or school (Fletcher, 2006).

Student learning preferences like many attributes of this Millennial generation reflect their views having been shaped by popular media (Barnes & Jacobsen, 2015). When considering lectures, video media, or group work, they believe that a lecture is the most educational means for a class and dislike group work the most (Barnes & Jacobsen, 2015). When combined into scenarios of either video or lecture combined with activities, videos, discussion or group project, they find the video and class discussion the most enjoying and educational combination with a lecture and video next (Barnes &

Jacobsen, 2015). Some have noted that the integrated use of technology appears to engage students (Fletcher, 2006) while others note that they lack the technological skills to make them successful in today's colleges and knowledge economy world (Leinberger, 2015).

Many Millennials come to college with at least some exposure to Montessori-like classroom conditions (Bitterman & Hess, 2015) where students have control of what they do and when they do it within the bounds of the classroom opportunities and academic deadlines. Others arrive having been taught to be passive in the classroom (Litzenberg, 2010) and to obtain clear instructions for everything that they do… otherwise, it is ambiguous and thus biased (Twenge J. , 2010). However, both types of Millennial students respond to classes that involved active learning and an immediate application of knowledge with explicit rational for policies, assignments, and tests (Price, 2011). Millennials will usually respond positively to the use of technology in a course (O'Connor, Kieser, & Olivo, 2011) but will need training in advanced use of word processing and spreadsheets (Leinberger, 2015). These Millennials also respond well to personalized support and consultations with the professor (Bergmann & Sams, 2012).

Because of the testing orientation of No Child Left Behind and the preparations that they have learned for that type of test, the ability to test and retest is valued in a classroom by Millennials (Leinberger, 2015). Combined, the acceptance of technology and video use along with the use of testing and retesting indicated that Millennials also are open to being in a flipped classroom scenario (Hutchings & Quinney, 2015) with quizzes to indicate preparation for class. However, due to their learning to use information technology in less formal circumstances, additional training in critical thinking when using the internet as a research tool is needed (Hershatter & Epstein, 2010). Furthermore, while enjoying a less formal classroom structure and autonomy on when and where they work on assignments (Bergmann & Sams, 2012), they really seek and need structure and clarity on the processes, tasks and final expected deliverables in order to learn well (Hershatter & Epstein, 2010). This can to a certain extent be handled with personal interactions in the classroom by faculty where specific individual areas

of “opportunities for improvement” are addressed in a positive coaching fashion (Twenge J. , 2010; Hershatter & Epstein, 2010; Bergmann & Sams, 2012).

PRAGMATIC APPLICATION CONCERNS FOR STRATEGIC MANAGEMENT

Faculty members are faced with multiple desired outcomes while teaching a course beyond its being assigned to them. Three such issues are particularly important here: 1) Positive student evaluations for current year annual reviews and longer term tenure or contract renewal; 2) Meeting of assurance of learning goals; and 3) balancing time allocated to teaching, research and service. For this presentation, we will focus on the first of these three goal, Obtaining Positive Student Evaluations.

Current Student Evaluations of Faculty

For faculty, teaching evaluations matter. Extremely poor evaluations can derail a career. In general, college of businesses who are AACSB accredited have higher evaluations by students of their faculty than do non accredited colleges of business (Wilson, 2015). Appropriate touch used as a teaching tool has been found to increase attitudes toward the professor (Legg & Wilson, 2013). Actually, reading a positive “RateMyProfessor” profile also resulted in increased ratings on subsequent evaluations (Lewandowski, Higgins, & Nardone, 2012). Indeed, previous knowledge of positive evaluations of professors along with how well the student liked the professor just from a very short initial exposure was highly predictive of the final teaching evaluation received by the professor (Gross, et al., 2015). So basically, first impressions and reputation matter and are incredibly difficult to recover from if they are not glowing and alternatively harder to upset if they are glowing. Negative reputations of a professor can bias a class even in the face of disconfirming evidence (McNatt, 2010).

In fact, research has shown that there are pre-existing gender biases towards instructors when holding age and attractiveness constant (Nadler, Berry, & Stockdale, 2013). Nadler and his colleagues’ work indicated that initial impressions strongly predict end-of-term teaching evaluations. In disciplines

where there are a majority of male faculty, female faculty were perceived as less competent but easily recognizing and having familiarity with the female faculty members can attenuate this result (Nadler, Berry, & Stockdale, 2013). Such familiarity is not often found in larger public institutions. One must always remember that faculty are viewed by students from the students' own perspective filtered by their own particular educational tastes. If the students really liked the professor they gave strongly positive teaching evaluations and if they really disliked the professor, strongly negative teaching evaluations were given (Gross, Lakey, Edinger, Orehek, & Heffron, 2009). Their personal tastes strongly influenced whether or not they liked someone or a class (Gross, Lakey, Edinger, Orehek, & Heffron, 2009).

All of these issues create a body of evidence that student evaluations of teaching may not be accurate and may be based on things other than the correct design and administration of a course and support McNutt's conclusion that there is a strong need to proactively take action against any practices that might create unwarranted negative reputations (McNatt, 2010). This appears to be particularly the case when the student body is composed of students who are less mature and not as emotionally savvy (McNatt, 2010). Thus, students with low emotional intelligence and low assertiveness exasperate the problem while those with highly levels of emotional intelligence and higher levels of assertiveness mitigate the problem (McNatt, 2010).

From a pragmatic utilitarian perspective, faculty who have positive "RateMyProfessor" profile, whom the students consider attractive, whose style matches with the student tastes and expectations of the classroom and with whom the students are familiar are the faculty who are more likely to get higher student evaluations. The representative examples of a qualitative study of comments made on marketing professors (Hartman & Hunt, 2013) are examined and classified here into six categories. Two design categories(macro-structure and micro-content) , two professor-based categories (delivery and characteristics) and two student-based categories (taste for education process and affect with respect to

Table 1: Positive Comments Correlated with Higher Teaching Evaluations From "RateMyProfessor" (Hartman & Hunt, 2013)					
Class Structure	Class Concept	Delivery Style	Faculty Personal Characteristics	Student Taste	Affect statements
Provided real examples	Built my Skill set	Easy to Understand	Loves Marketing	Take this class with ***him***	Loved this class
Feedback was helpful		Welcoming	Knows Everything	Interesting class	Great Professor
Easy if you go to class		Very clear and organized	Lots of experience to share	Easy class	Liked *her* a lot
		Respects Student Opinions	Humble	Learned a lot	Nicest ***Guy*** you'll ever meet
		Willing to help	Hilarious	Better person after taking	
		Cares a lot about students		Inspired me to learn	
		Makes it interesting		Big Project was enjoyable	
		Very professional		A Cool ***Guy***	
		Dresses well			

relationships and those involved). Table 1 shows the classification of types of positive comments found when student comments are examined from across the United States. Comments based on the course design and the content of the course were the fewest type of positive statements at 13% (four out of thirty comments) in those two categories. Almost 47% of the comments related directly to the professor (14 out of 30). 64% of those comments related to the way in which the professor delivered the course material. 60% of the comments directly about the professor, and, of that 60% , 60% were related to knowledge or expertise. Twelve out of thirty (40%) were comments based on the students' perspectives. They either addressed comments related to the student's taste in education (67%) or comments about liking having a positive affect for the class or professor (33%). 13% of the comments were gender specific. 25% of those related to the female gender and 75% to the male gender.

Table 2 shows the classification of types of negative comments found when student comments are examined from across the United States.

Table 2: Negative Comments Correlated with Higher Teaching Evaluations From "RateMyProfessor" (Hartman & Hunt, 2013)

Class Structure	Class Concept	Delivery Style	Faculty Personal Characteristics	Student Taste	Affect statements
Discussed Irrelevant Material	Clueless about material	Boring class	Won't help after graduation	Hated this class	Bad Professor
Too many exams	Total Waste of Time	Tense Class	Doesn't like the subject	Don't Take ***him***	Nobody in class liked *her*
		Impossible to get Feedback	Has a bad attitude	Hard, Difficult	
		Presentation is scattered	Never worked in the real world	Had to Work Hard	
		Not helpful	Doesn't care about students	Made me not want to learn	
		Talks so softly you can't hear *her*	Full of *herself*	Jokes are not funny	
		Unprofessional	A total geek	Boring professor	
		Looks sloppy	*She*'s just mean		

Of the negative comments classified, 13% related to the course and its design and content and its perceived value. Fifty-three percent related directly to the professor whether in delivery style or personal characteristics. Half of those addressed negative delivery aspects. The other half addressed faculty personal attributes and characteristics. Thirty percent of the comments were from a studentbased perspective. Just over 77% of those comments related to the students' taste in educational practices. About 22% of the student-based comments related to student affect about the

professor. About 17% of the comments were gender specific. Of those comments, 20% related to men and 80% related to women.

Often when we examine behaviors we look for patterns. One pattern is a tit-for-tat pattern where there is congruence along the dimensions. Another pattern is one that displays a pattern of hygiene factors… its presence is good or bad but the opposite doesn't register. When the original coding schema and examples are used most follow the tit-for-tat pattern. They are congruent across the examples. When the six categories are compared via the number placed in each, we find that the delivery style of the professor and the taste for the educational style of the student display the tit-for-tat pattern. However, faculty personal characteristics has five (38%) positive examples and eight (62%) negative examples. This is beginning to shift to the pattern of negative personality characteristics triggering almost twice as many concepts as positive examples. Affect statements by students has the opposite trigger. About Thirty-three of the comments are negative and 67% are positive. In this instance, affect is triggered by liking and not by disliking. While comments about the course structure and content was steady across positive and negative comments, the number related to the macro course-structure element continued the positive trigger trend (60%: 40%) while the micro class concept category flipped to a negative trigger (33% positive to 67% negative).

This lets us know that students will be more likely to make negative comments if they have a female professor with personality characteristics that they don't like teaching a course that they don't like especially if they have to work hard or if the material is difficult for them. This scenario trips four of the triggers. They will most likely continue on to identify negative things in the course delivery style. Remember from earlier comments that begin familiar with the woman professor and hearing positive things about her will help to mitigate biases in the student evaluation.

Current Faculty Evaluation Issues Implications for Strategic Management

As noted earlier, the strategic management classroom may be organized as an integrative capstone course at the end of the student's career as a business student or as an introductory course to be provided a foundational look and series of theories upon which to base their upcoming learning

(Grant, 2008). Recently, faculty have been using more experiential exercises (Reutzel, Worthington, & Collings, 2012) or when the case studies are provided, they are limited scope and usually use to drive home a specific theoretical approach (Greiner, Bhambri, & Cummings, 2003). From the above faculty evaluation concern, the design and content only make minor contributions to student evaluations. Strategy because it is often considered a hard course because of its integrative nature and requirements of the use of calculations taught in earlier courses is often thought by students to be a "hard" course. This negative general reputation could sensitize the students to provide negative comments in the areas of student taste with a negative halo effect spilling that attitude over into other categories. There may be a stronger spill over and a longer term one if the faculty member is female and doesn't actively design elements into the course to elicit positive comments.

Integrating positive triggers (which can be a range of activities or even attitudes) with the earlier pedagogical tools that Millennial and iGeneration students respond well to is a good way to proactively address this category. We will begin with an integration incorporating course structure and content triggers. We will move to professionalism on the part of the instructor and attitudes to display. Throughout both of these we will weave in the student likes, dislikes, and tastes.

Ideally, the course (especially a last semester strategy course) begins with you entering an earlier course in a previous semester and providing an "expert" view of a strategic topic. Providing a professional presentation modeling the behaviors that you expect from students in strategy with short and interesting talk (similar to a Ted talk) may act as a short "trailer" for you and your course. A positive experience there, will help your teaching evaluations in subsequent courses!

Begin the actual course by having a welcoming start to the course that meets students' expectations with respect to the syllabus. Having a fairly simple straight forward syllabus helps a student understand the structure of the course. You may want to offer students a choice of activities within a topic category to enable the attitude of "caring" and "respecting" students and those triggers to be an integral part of the opening of the course. Structurally having fewer exams and quizzes may enable another positive trigger. Having a term project and clearly stating how this project will help the student and why the student may find it interesting may help too.

As we as faculty members deliver the course, we need to provide professional business examples, at least initially, so that our expertise becomes established in their minds. Pointing out real world examples from text and popular press media along with sharing personal experiences will help students gain an understanding of your expertise. Providing obvious feedback that is explicitly stated to have a purpose to help the students be successful (perhaps by also offering help during non-feedback sessions) can reinforce that the faculty member cares about the students.

Students want the class to be interesting. Many times this is code for "not just sitting here and taking notes". Remember, many students are inherently handicapped in notetaking by not knowing cursive. This means that note taking will not be easy for them and anything perceived as difficult begins to tip the scale to the negative orientation. So, have short lectures centered on graphics that they can copy and flesh out information with short phrases. Millennial and iGeneration students respond well to experiential exercises (again providing real world links) and the sharing of perspectives. While many of their assumptions need to be gently abandoned, this can be done with processes that they enjoy. If these exercises and activities build skills for them to use post-graduation, point that out to them. Detail how they can share these experiences after they graduate and how your feedback now helps them at that time too.

Finally be sure that all of your presentations and your handouts clearly relate to the topics of the day. Do not assume that the students will be able to tell how they relate, provide them in clear language with the explanation of their reason for use, how to be used, and what to do with the deliverable or output of the exercise. Here is a time where feedback along the way may be very helpful for students. Seek out their opinions and comments and clearly tie them back into the activity. When possible deflect tension with a joke or gentle humor. Talk about how humor arises from a surprise and share some of the "office" humor if you are not a good jokester.

Layout each day and practice your parts whenever the course is new to you, you have a new major element, or if you are new to the profession. Planning each part and practicing it. Using presentation formats like you expect your students to use with the higher professional skills that you expect from strategy students, enables you to be a model of how they should present going forward. It doesn't hurt to confirm learning along the way (both in strategic processes and in content) and explicitly reinforce the learning subsequently, too.

This type of deliberate structure and delivery process along with being genuinely interested in each student will strengthen the chances of positive student evaluations. Next, we look at the faculty performance goal of meeting assurance of learning goals.

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RESEARCH METHODS, SECOND TIME AROUND

Meredith Uttley, Lander University, Dept. of Political and Social Sciences

Abstract

I have been teaching the first sociology research class every semester for over ten years. Many semesters, all students passed the course the first time, but increasingly some students need to repeat the class. My dilemma has been to find a way to keep first-time students from relying on repeating students to direct their class activities. In fall 2015, I assessed the skills of that semester's successful students and repeating students separately. Of the eight measures I used to compare the groups, six were significantly different. All of the repeating students successfully completed the class the second time they took it.

Body

The thing that stands out about the vast majority of my sociology students is that they roll their eyes at numbers. That's a problem when I am trying to teach quantitative methods. The other major problem I often encounter is that students will not ask questions when they don't understand material. The course has two group observation exercises, one inductive and one deductive. The problem that I've encountered when I have both new and repeating students together is that new students turn to the repeaters to lead their groups for the observation assignments, while never thinking about the fact that these students are repeating the class because they did not successfully complete it the first time. I created groups that separated new from repeating students. That helped somewhat, but in the fall 2015 semester, nine of 22 students needed to repeat the class. That was just too many second-timers to mix with new students in any capacity. Thus, I created my second-time-around strategy.

I pulled these second-time students into a separate class, but gave them the opportunity to attend the firsttime class if they wanted a structured lecture and discussion about any specific topic. Other than that, the two classes were taught independently. The second-timers during this past spring semester had been particularly passive during their first class last fall. Almost none of them ever asked a question during class or in my office. They did not even ask about the mistakes they had made that cost them points on returned assignments. The first day of the spring class, I made sure that every repeating student had a copy of each of the few sets of power points I had used. They also had the five statistics workbook assignments and all of the quizzes. I explained that the main reason they were repeating the class was their lack of taking responsibility for their learning and telling me when they didn't understand. I told them if they had no questions, I would assume that they knew the material and we would move on. Then I asked them to tell all of us the course content they had the most trouble with as well as the content they understood the best. That led to an impressive discussion among these students about what they needed help with and what they felt confident about. They said more than they had during the entire fall semester. At the end of the hour, we had two comprehensive lists on the board. I asked what they wanted to start with for the next class. They all agreed on the topic. It was their responsibility to go over the relevant material and come to the next class with questions. The semester proceeded in the same manner from class to class. Students chose the topics, sometimes requesting a topic more than once. They took new quizzes to test their understanding.

All of these students passed their second class with at least a C (required), one going from a D to a B. A general lack of asking questions is a common theme among students who must repeat the course, but I wanted to delve more deeply into specific details that distinguish the successful students from those that need a second time around in order to improve performance. I have a complete set of grades from research students for five semesters to use for this research. Each student is included in the data for this project only once, for the semester when they successfully complete the class.

At Lander, we teach two research courses as part of the sociology major requirements. The first class, sociology 398, is designed to expose students to different types of research, the purpose of each, and the skills necessary for conducting their own research. The second class, sociology 421 requires that students use and build on those skills learned in sociology 398 to conduct individual independent research. Both classes are assessed annually as part of the sociology program. For this research project, I used the same data that we use to assess the class as part of the sociology program assessment.

My variables include three indices developed with questions from the required cumulative final exam. The first index, Variables, is composed of five questions asking students to provide the correct definition of a variable, identify dependent and independent variables in context and create hypotheses using the same concept as a dependent variable in one and an independent variable in the other. For this index, I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This index has a score range of 0-5. The two groups of students are significantly different as shown in figure 1 below (P=0.010).

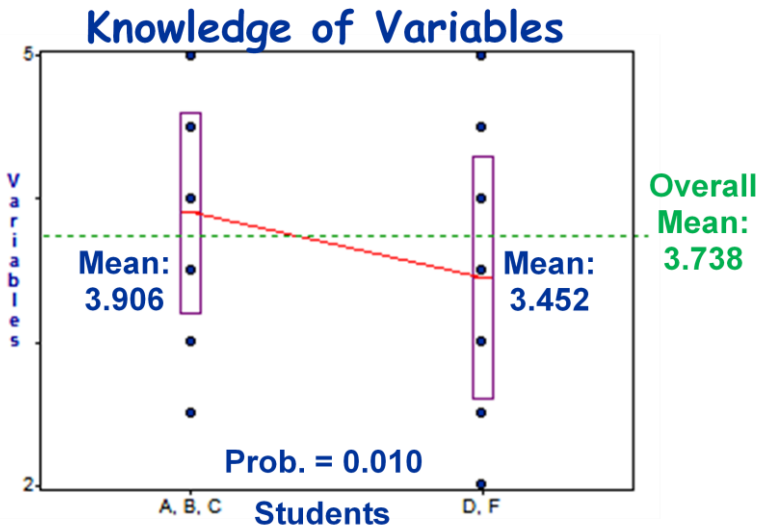

Figure 1: Comparison of successful and repeating research students on their demonstrated knowledge of variables.

The second index, Data Specifics, is composed of ten questions asking students to provide correct information about data distributions, identify variable levels of measurement, explain why the level of measurement is important for research, and why we use percentages as opposed to raw numbers to analyze data. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This

index has a score range of 0-10. The two groups of students are significantly different as shown in figure 2 below (P=0.002).

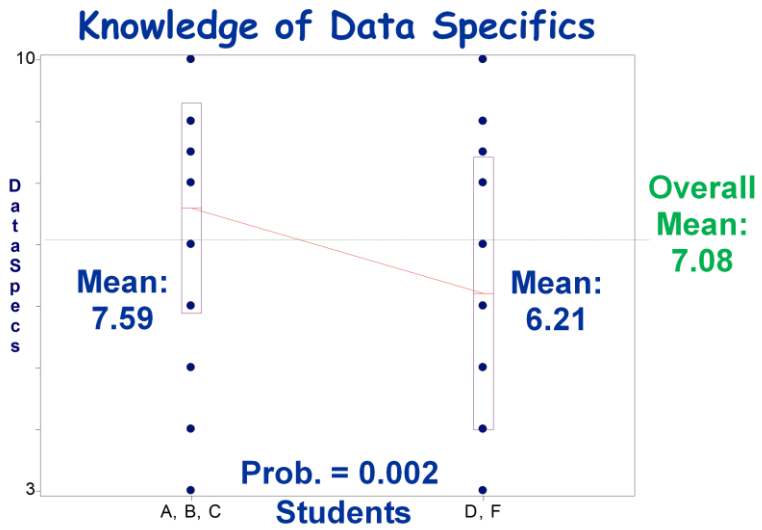

Figure 2: Comparison of successful and repeating research students on their demonstrated knowledge of data-specific information.

The third index, Questions and Hypotheses, is composed of five questions asking students to provide correct information about the definition of a hypothesis, identify the expected result, pick an example of a hypothesis, and identify problems with double-barrel questions, and details of question coding. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This index has a score range of 0-5. The two groups of students are not significantly different as shown in figure 3 below (P= ns). This index obviously combines questions that all students know best, probably because I ask questions about this material over the entire semester.

In addition to these indices, I created another measure, Number of Zeros, which measures the total number of incorrect answers each student gave in the three indices. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This variable has a potential score range of 0-20, but the highest number of zeros from any student was 14. To compute each index, answers were coded as 1 (correct), 0.5 (partially correct – where applicable) or 0 (incorrect). The two groups of students are significantly different as shown in figure 4 below (P=0.000).

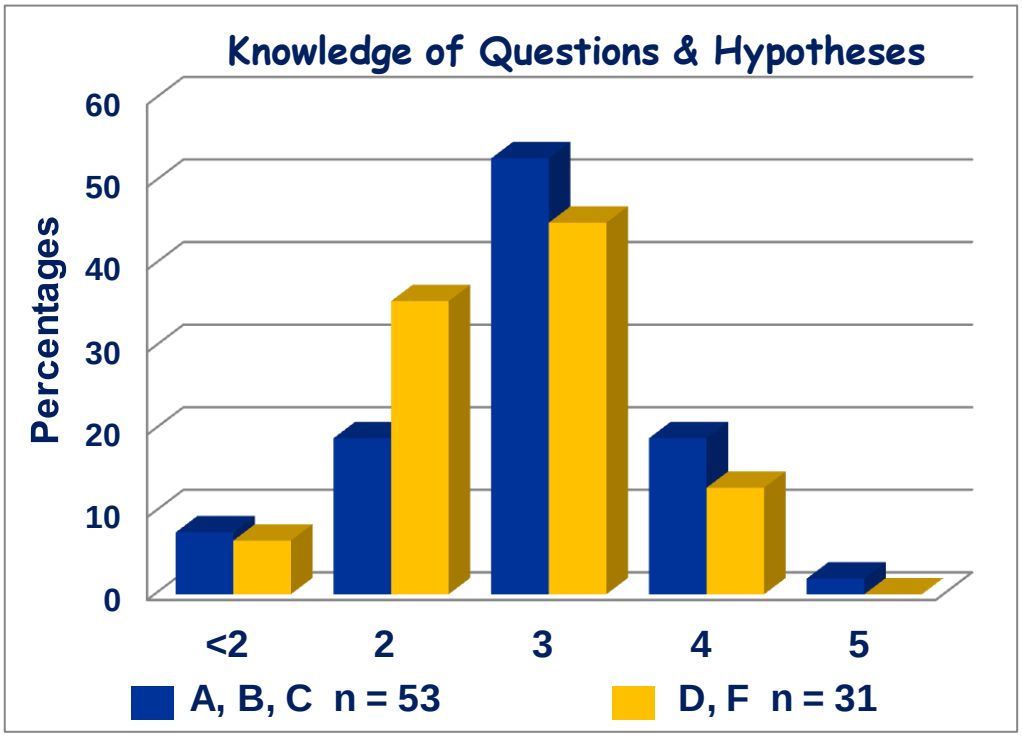

Figure 3: Comparison of successful and repeating research students on their demonstrated knowledge of research questions and hypotheses.

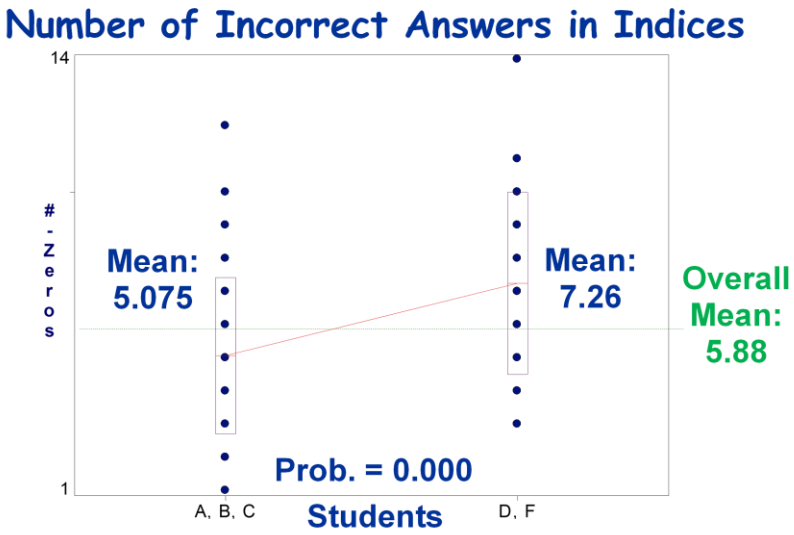

Figure 4: Comparison of successful and repeating research students on their number of totally incorrect answers included in the three indices.

I used four additional measures of student performance that were unrelated to the indices, but are used as part of the sociology program assessment. To prepare for any research project, students must be able to perform a review of the literature. Students begin systematically honing that skill in the first research class (Soc 398) and conduct a full review and an independent research project in the second research class (Soc 421). In the first class, the assignment begins in the library with a detailed review of the available databases

from a reference librarian. This assignment included several specific limitations for acceptable articles such as publication dates, geographic relevance, type of research, and type of journal. Prior to this, students' experiences with finding literature had not been nearly as rigorous so this assignment presents a challenge to all. In addition to finding the articles, students are required to follow APA formatting and identify specifics from each article. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This measure has a score range of 0-38. The two groups of students are significantly different as shown in figure 5 below (P=0.000).

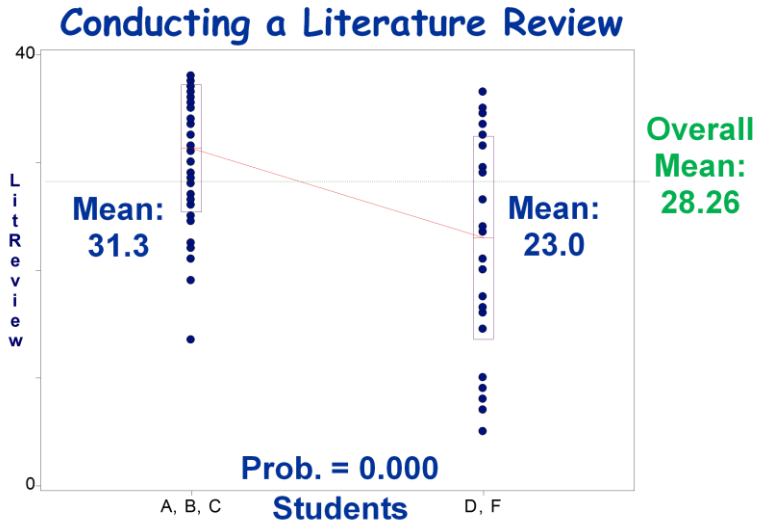

Figure 5: Comparison of successful and repeating research students assessing their conduct of a literature review.

The second non-index-related measure requires that small groups of students design an observation to test a hypothesis. They need to develop the variables to test the hypothesis, pick an appropriate location and collect data. They must enter the data into the class statistical package, analyze the data correctly and present their results to the class. Each student must participate in all phases of the observation and must present the slides they created. The group must conclude by supporting or not supporting the hypothesis and justifying their decision. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This measure has a score range of 8-34. The two groups of students are significantly different as shown in figure 6 below (P=0.010).

The last two measures I used to compare successful and repeating research students required that each of them conduct univariate and bivariate analysis using the class statistical package as part of their final exam. Early in the third week of class, I take students to the library computer classroom where I teach them how to use the stat package, which is loaded on each computer in the room. We follow the book's introduction step by step so that students can write notes and work on anything they do not fully understand again on their own. The stat package, required for the class, is loaded onto the students' computers. From that day forward, students conduct univariate analysis as part of their class assignments or interact with the program as I have them tell me what variables to pull up in class. By the time of their final exam, students have been conducting univariate analyses for at least ten weeks. During the semester, students are allowed to work

together on their workbook assignments, but are required to write their own answers and conclusions. Inadvisedly, a few students never actually perform the statistical analyses themselves. Thus, as part of their final exam, each student has a unique univariate analysis to perform. We again use the library computer classroom so that each student has a separate computer to use. Each analysis is worth 11 points and if students have not previously conducted such analysis themselves, they are at a huge disadvantage. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). The results are shown as two pie charts, on the left for the successful students and on the right for the repeating students. This univariate analysis has a score range of 0-11. While the two groups of students are not significantly different as shown in figure 7 below (P= ns), they do exhibit different means and different score distributions. Given the amount of time that students use the stat package during a semester, it is not surprising that virtually all students are able to perform an adequate univariate analysis.

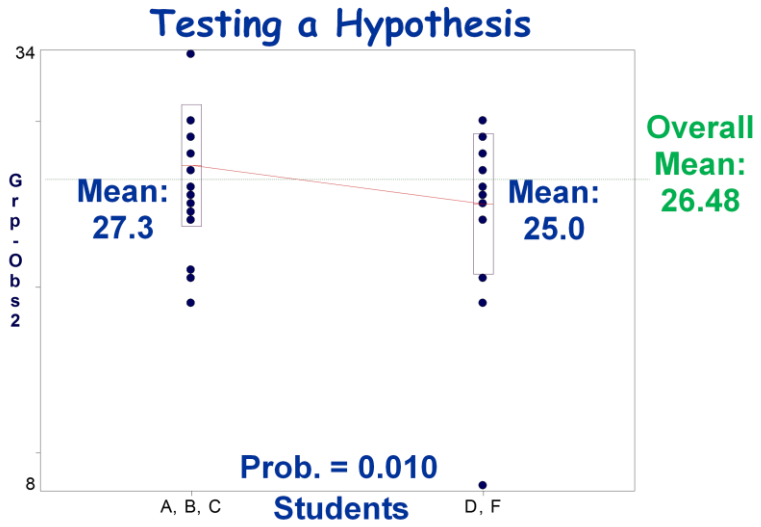

Figure 6: Comparison of successful and repeating research students assessing their conduct of an observation to test a hypothesis.

The last two measures I used to compare successful and repeating research students required that each of them conduct univariate and bivariate analysis using the class statistical package as part of their final exam. Early in the third week of class, I take students to the library computer classroom where I teach them how to use the stat package, which is loaded on each computer in the room. We follow the book's introduction step by step so that students can write notes and work on anything they do not fully understand again on their own. The stat package, required for the class, is loaded onto the students' computers. From that day forward, students conduct univariate analysis as part of their class assignments or interact with the program as I have them tell me what variables to pull up in class. By the time of their final exam, students have been conducting univariate analyses for at least ten weeks. During the semester, students are allowed to work together on their workbook assignments, but are required to write their own answers and conclusions. Inadvisedly, a few students never actually perform the statistical analyses themselves. Thus, as part of their final exam, each student has a unique univariate analysis to perform. We again use the library computer classroom so that each student has a separate computer to use. Each analysis is worth 11 points and if students have not previously conducted such analysis themselves, they are at a huge disadvantage. I

conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). The results are shown as two pie charts, on the left for the successful students and on the right for the repeating students. This univariate analysis has a score range of 0-11. While the two groups of students are not significantly different as shown in figure 7 below (P= ns), they do exhibit different means and different score distributions. Given the amount of time that students use the stat package during a semester, it is not surprising that virtually all students are able to perform an adequate univariate analysis.

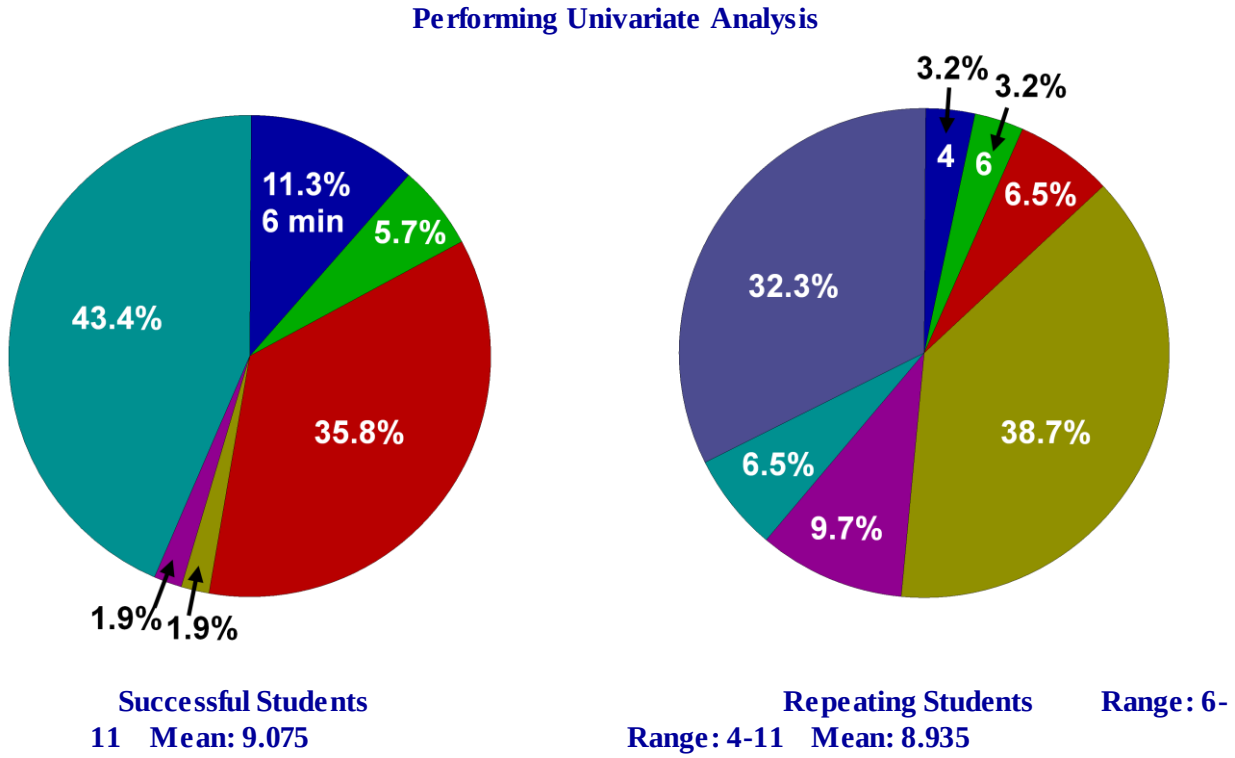

Figure 7: Comparison of successful and repeating research students assessing their performance of univariate statistical analysis.

During the last third of the semester, students begin conducting bivariate statistical analysis. Since students must set their contingency tables up so that the comparative percentages are computed within categories of the independent variable, they find bivariate analysis much more challenging than univariate analysis. I conducted a t-test between those who successfully completed research (Soc 398) with at least a C (n=53) the first time and those who needed to repeat the class because they earned a D or an F (n=31). This bivariate analysis has a score range of 0-17. The two groups of students are significantly different as shown in figure 8 below (P= 0.000). This result is not surprising. Though we spend considerable time during the last part of the class setting up hypotheses for bivariate analyses conducted in class, students have a great deal of difficulty remembering how to set up a table for such analysis. Many are likely to set up the table and percentages for one variable as the potential cause while explaining the table with the other variable as the potential cause. From the equivalent performance of the two groups of students on the index dealing with research questions and hypotheses, it is clear that the students understand the concepts of cause and effect, but are unable to clearly understand the mechanics of setting up a contingency table to be consistent with their thinking.

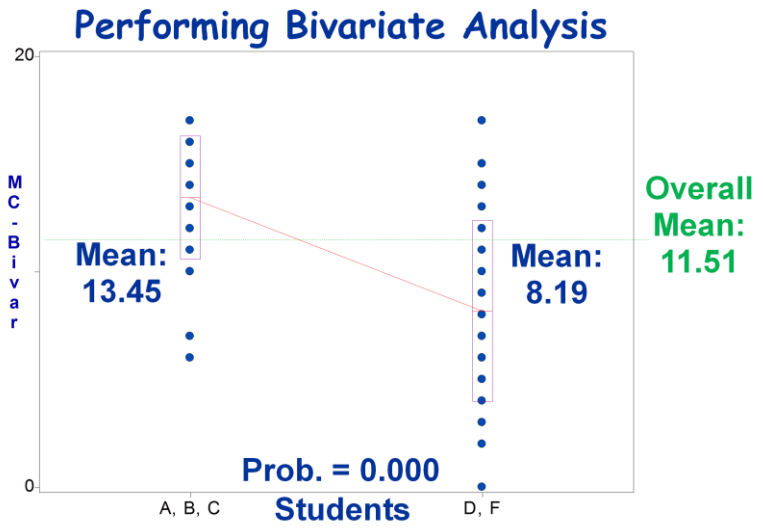

Figure 8: Comparison of successful and repeating research students assessing their performance of bivariate statistical analysis.

I first decided to conduct this research, after I noticed that the scores on a review of the literature differed dramatically between the successful and repeating research students in the fall 2015 semester. After expanding the inclusion of students to cover five semesters and conducting this research, I am surprised that only two comparisons do not differ significantly between the two groups of students. The question is, what now? If repeating students were significantly different on a couple of variables, I could increase the amount of teaching and examples on those topics as I have done on other specific topics before, but there is no way that I can teach and present more examples on a majority of class topics. It's difficult to finish each research class on time as it is. I think it is imperative to make students realize that they are primarily responsible for their learning. So, I will present this research to the class at the beginning of the upcoming fall semester, ask students what group they want to be in and what they are willing to do to accomplish that goal. I will emphasize the importance for each of them to regularly review their knowledge and understanding of class material. The course structure lends itself to this systematic student review because it includes a quiz almost every week of the semester. I will reiterate the importance of asking questions when class material is not clearly understood. Hopefully, I can be more persuasive about student responsibility than I have been in the past. We shall see.

A future research project will include a comparison of the second-timers from their first class to the class which they passed. This is usually their second class, but for a few students it has been their third class. Since I currently have data for only 31 repeating students, I want to wait until that sample increases somewhat to conduct this next project.

RESOURCES FOR TEACHING SUSTAINABILITY

Marilyn Smith, College of Business Administration, Winthrop University, Rock Hill, SC 29733, 803-323-2679 smithm@winthrop.edu

ABSTRACT

Teaching sustainability to business students begins with introducing the triple bottom line (people, profit, and planet), and emphasizing the interrelationships between people, profit and planet. Organizations will not consider these separately, but look at ways to increase profit (perhaps by reducing cost), at the same time they are benefiting people (employees, customers, the community), while if not improving the planet conditions, at least making sure they are minimizing future harm. The workshop will discuss resources such as the UN Global Compact, Dow Jones Sustainability Indices, ISO, Energy Challenge, US Green Business Council, state agencies, simple example cases, GoodGuide, journal articles and books, with audience participation.

WORKSHOP TOPICS

Teaching sustainability to business students begins with introducing the triple bottom line (people, profit, and planet), and immediately emphasizing the interrelationships between people, profit and planet. That is, organizations will not consider these separately, but rather look at ways to increase profit (perhaps by reducing cost), at the same time they are benefiting people (employees, customers, the community), while if not improving the planet conditions, at least making sure they are minimizing future harm. Google Images provides a wealth of illustrations, mostly colorful Venn diagrams, to show the interrelationships by either searching by "triple bottom line of sustainability" or "triple bottom line people planet profit". The resources below will be described, discussed, and/or demonstrated during the workshop, while inviting participants to share their experiences.

Depending on the level of the student and the course, it may be appropriate to introduce the UN Global Compact, "the world's largest corporate sustainability initiative." The Compact lays out five "essential elements of corporate sustainability":

1. Operate responsibly in alignment with universal principles (principled business).
2. Take strategic actions that support the society around them (strengthen society).
3. Push sustainability deep into the corporate identity and commit at the highest level (leadership commitment).
4. Report annually on their efforts (reporting progress).
5. Engage locally where they have a presence (local action).

These five elements are described in more detail in the 48 page "Guide to Corporate Sustainability: Shaping a Sustainable Future" (United Nations Global Compact).

The Dow Jones Sustainability Indices (DJSI) provide a quick way to identify companies which are leaders in sustainability for research and teaching examples. The indices were started in 1999 and are now jointly operated by RobecoSAM and DJSI to offer "benchmarks for investors who integrate sustainability considerations into their portfolios, and provide an effective engagement platform for companies who want to adopt sustainable best practices." (Dow Jones Sustainability Indices)

Duke Energy, the largest electric provider in the country, provides the online Energy Challenge to demonstrate the trade-offs they face trying to meet customer demand for electricity, while doing that at the lowest cost to consumers, yet making a profit for shareholders, and protecting the planet for all. For example, coal is cheap and efficient, but pollutes the air and produces ash. Some citizens have safety concerns about nuclear energy, based on an accident at Three Mile Island in 1979 and the impact of the 2011 tsunami in Japan. Solar and biomass options are safe, but not as efficient as coal or nuclear. The Energy Challenge can be played as a game by individuals or groups to see who can do the best job of making decisions to balance the trade-offs. The challenge begins with the 2010 energy production, the expected demand by 2050, and the current annual CO^2 emissions. The Challenge tracks respective costs of changes selected, the impact on CO^2 emissions, and the effect on energy production, as the player starts to choose between:

- Build new power plants, solar or wind farms.
- Upgrade and/or retro fit current power plants. However, some of the older, smaller plants cannot be retrofitted due to the cost.
- Close current power plants.
- Implement new energy efficiency programs. (Duke Energy)

Three of the International Organization for Standardization (ISO) categories are directly or indirectly related to sustainability.

- ISO 14000 Environmental Management "provides practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities".
- ISO 26000 Social Responsibility is based on the premise that business shares a relationship with society and the environment with guidance on operating "in an ethical and transparent way that contributes to the health and welfare of society".
- ISO 50001 Energy Management helps companies:
  - Develop a policy for more efficient use of energy
  - Fix targets and objectives to meet the policy
  - Use data to better understand and make decisions about energy use
  - Measure the results
  - Review how well the policy works, and
  - Continually improve energy management.

The United States Green Business Council offers Leadership in Energy and Environmental Design (LEED) certification for buildings (homes to corporate headquarters). It is important to note for students that LEED takes a long term and holistic approach; not necessarily using recycled materials or materials that can be recycled. It will also interest students when they can identify LEED certified buildings on their campus or in the immediate community. LEED Version 4 considers:

- "Materials to get a better understanding of what's in them and the effect those components have on human health and the environment.
- A more performance-based approach to indoor environmental quality to ensure improved occupant comfort.
- Brings the benefits of smart grid thinking to the forefront with a credit that rewards projects for participating in demand response programs.
- Provides a clearer picture of water efficiency by evaluating total building water use."

State agencies also give assistance to organizations related to sustainability. For example, in South Carolina, the South Carolina Department of Health and Environmental Control's Green Hospitality Program works with the largest industry in the state to "reduce the environmental impact of its operations and incorporate environmental stewardship and sustainability in its business practices." Also, the Poole College of Management at North Carolina State University established the Business Sustainability Collaborative to develop "leaders who can apply research, technology, and critical thinking to drive and measure sustainable business practices" through "experiential learning, career, development, academic and applied research, and partnership opportunities."

The workshop will include three simple cases which can be used to demonstrate decisions that impact the tripe bottom line. In the first case, a local band booster club decided to stop offering lids and straws with sodas at their concession fund raising, unless requested by the customer. The second case shows the benefits when the owner of a local submarine sandwich shop started composting food waste, and using it to grow tomatoes to be used on sandwiches. The third example deals with a packaging change from a glass peanut jar to plastic to a lighter plastic.

The GoodGuide mobile app provides an in-class activity for demonstrating the health, environmental, and social performance of over 120,000 foods, personal care, and household products. The app is free, so the students can quickly download it, and I have my phone with me when I cover this topic. I take a shopping bag of empty packages and bottles, such as soda, water, shampoo, household cleaners, snacks, etc. The app uses the phone camera to scan the bar code, and then provides the rating in the three areas, as well as an overall rating. The website tells what the ratings mean and how they and determined (methodology). The class then compares the ratings to our perceptions and discusses how much these rating would impact purchase decisions.

Part of teaching sustainability involves using examples of leading companies. A short list would include BMW, Patagonia, New Belgium, Nike, and Timbuk2, which includes large international and small private companies. During the workshop the group can share and brainstorm companies that make good examples.

APPENDIX

Additional Resources

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[4] GoodGuide. http://www.goodguide.com/about/mobile Accessed 8 June 2016

[5]ISO14000 Environmental Management. http://www.iso.org/iso/home/standards/management-standards/iso14000.htm Accessed 8 June 2016

[6] ISO 26000 Social Responsibility. http://www.iso.org/iso/home/standards/iso26000.htm Accessed 8 June 2016

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ROLE OF EDUCATIONAL SUPPLEMENTS IN IMPROVING ACADEMIC SUCCESS
DISCUSSION OF THE PROS AND CONS OF USING SUPPLEMENTS IN AN ANALYTICAL AND APPLICATIONS BASED CURRICULUM

Annie M. Stith-Willis,
Virginia Commonwealth University,
Department of Supply Chain Management and Analytics,
Richmond, VA. 23284-4000, 804-828-7111, amstithw@vcu.edu

Wilma Andrews,
Virginia Commonwealth University,
Department of Information Systems,
Richmond, VA. 23284-4000, 804-827-0956, wandrews@vcu.edu

Robert L. Andrews,
Virginia Commonwealth University,
Department of Supply Chain Management and Analytics
Richmond, VA. 23284-4000, 804-827-0956, randrews@vcu.edu

ABSTRACT

This paper/session explores the potential benefits as well as drawbacks of using the various supplements that are currently available for the books we use and require our students to purchase. Book representatives no longer market just the classroom textbooks but the supplemental products as well. Offers to package the many combinations at a reduced cost is part of the bargaining process. They provide statistics of improved student grades with the use of their supplements in a curriculum that requires a progressive level of understanding of its students in both math and analytical comprehensive courses.

Every book adoption comes with a menu of supplements. Some of the choices include the e-book option, faculty lecture slides, student lecture slides, student solutions manual, homework on-line, lecture videos, and other faculty support. Faculty have to decide what is required and what is optional for their students.

This session will encourage participants to share their experiences with classroom supplements. What has worked? What has failed to achieve the desired or expected results? What has changed in the delivery process of information in the classroom? What are your students' reactions?

INTRODUCTION

In the United States, the cost of textbooks since 2006 has increased by 73 percent.[1] Providing our students with a good quality textbook has become imperative. Offering them several options to

purchase their book has become a standard process of many professors. In the areas of math, statistics, analytics, and other applications based classes the textbook is almost always required. Many of the classes adopt the on-line graded homework supplement and use it to encourage the student to practice and complete assignments outside of the classroom. Others use the on-line testing to provide immediate feedback to their students. Access to the on-line homework and testing is usually an additional cost to each student. Each of these may encourage honor code violations because of the lack of supervision when these assignments are given. The flexibility of time and location on the other hand may help with test anxiety which can be a problem in these classes.

OVERVIEW OF PRESENTATION

The session leaders will use the presentation to conduct a lively conversation about differences and commonalities in current views and practices when it comes to book supplements. We share as practitioners and interactively explore some of the issues discussed above including:

- cost to students
- cost of intellectual compromise
- explore ethical considerations
- long/short range role of assessment
- share/discuss the supplemental use currently practiced by the authors and those in the audience.

All faculties, but especially new/junior faculty choosing their classroom materials, may use this as an avenue to garner advice. Participants can solicit and compare products that have been established by other faculty teaching peer classes. Faculty charged with working on assessment criteria may use this as an opportunity to make comparisons or garner ideas that they can apply to their individual programs.

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SCAFFOLDING RUBRICS TO IMPROVE STUDENT WRITING

Linda Carson
Lander University

ABSTRACT

In the era of accreditation academic accountability and transparency within curriculum is becoming a desired standard within and across disciplines. Through the use of course learning outcomes program outcomes can be strengthened. Scaffolding within curriculums can benefit both accountability and assessment goals. Through the use of Bloom's taxonomy, scaffolding within the course can be used to aide in the accomplishment of the course learning outcomes. Scaffolding within the course curriculum can move students through Bloom's taxonomy levels toward mastery of specific skills. Writing is a major area of assessment as an indication of learning across disciplines. However, students present numerous deficits in their writing skills producing frustration for faculty in both reading the submitted material and achievement of required skills for outcome measures. To address these issues, scaffolding rubrics were used within sociology courses to specifically address both student learning and mechanical writing skills. Preliminary results of using rubrics to enhance student learning and scaffolding in eight courses one 100-level, one 200-level, two 300-level and four 400-level sociology courses will be presented.

INTRODUCTION

Writing is a necessary skill set needed by undergraduates as they pursue careers. However, writing skills for undergraduates have not been meeting employers' expectations. Writing skills have become an issue for all faculty members, no longer can other disciplines expect English 101 faculty as the only faculty to teach writing skills (Hudd, Sardi and Lopriore, 2013). Many professions require writing skills in daily activities and depend on employees to write using critical thinking skills. Undergraduate students continue to struggle to transfer knowledge through critical thinking skills into a variety of situations (Legere, 2013). Writing Across the Curriculum (WAC) a pedagogy movement developed during the 1970's to address writing skills in higher education (Grise-Owens and Crum, 2012). Two major issues stressed in WAC were Writing in the Disciplines (WID) and Writing to Learn (WTL). Writing in the discipline involves "basic writing skills and critical thinking, problem solving and specialized knowledge such that students' command of subject and writing makes it possible for them to write well for different purposes and different audiences" (Schroeder, Grohe, and Pogue, 2008, p. 436). "Writing to learn advocates support implementing certain types of writing exercises that appear to enhance student learning and writing performance" (Schroeder et al., 2008, p. 435). This pedagogy treats writing as an essential element of critical thinking skills both as a learning skill and a professional skill (Grise-Owens and Crum, 2012; Hooper and Butler, 2008). These two issues are beneficial when determining course and outcome goals. Higher education is currently in the era of assessment through course outcomes and program outcomes.

Embedding and scaffolding Bloom's taxonomy into course development can assist in course and outcome goals to address the continued need for assessment. Bloom's taxonomy is a six-level

progression of higher learning skills originally developed in 1956. The taxonomy was revised in 2001 (Armstrong, n.d.) with several modifications. Beginning with the lowest and moving to the highest, remembering, understanding, applying, analyzing, evaluating and creating (http://www.bloomstaxonomy.org/Blooms%20Taxonomy%20questions.pdf). The lowest level *Remember* - students will recall and facts and basic concepts; *Understand* – students can explain concepts; *Apply* – students can apply basic concepts in various situations; *Analyze* – students can identify and draw connections between concepts and ideas; *Evaluate* – students can critique information and *Create* – this is the highest level of the taxonomy – students have the ability to develop new ideas based on information and concepts identified. The six levels cover three larger areas of skills: knowledge, skills, and attitudes. Through the use of Bloom's taxonomy, students are expected to move through all levels of the learning processes. The purpose of designing scaffolding within a discipline is for the student to move through the level of Bloom's taxonomy to develop "deep learning" of material by graduation (Teater, 2011; Laird, Shoup, Ku, and Schwarz, 2008). These levels of learning skills can be embedded in course curriculum to gauge student's progress of learning (Carey and Gregory, 2003). "Incorporating aspects of doing, feedback and digesting into the learning activities and teaching methods is congruent to and supportive of the different learning styles of the students (Teater, 2011, p. 575). Student writing is an assessment method used within disciplines to evaluate student's level of understanding presented material. Freshman college students should not, and do not have the same cognitive skills and graduating seniors. According to the National Center for Education Statistics (2012),
"52 percent of twelfth-graders performed at the Basic level in writing in 2011. The Basic level denotes partial mastery of the prerequisite knowledge and skills that are fundamental for proficient work at each grade"
(https://nces.ed.gov/nationsreportcard/pubs/main2011/2012470.asp). Scaffolding writing assignments from 100-level courses through the curriculum until graduation can increase a student's mechanical writing abilities and their understanding of material from superficial learning to deep learning. Through the use of scaffolding writing assignments, course goals and program goals can be collected and used to make adjustments in both the course and goals. Course assessment goals can be embedded within individual courses (Peterson and Gustafson, 2013; Wehlburg, 2013) and these outcome goals can be combined with additional outcome goals to establish areas of strengths within a course or department (Peterson and Gustafson, 2013). When embedded assignments and tests are entwined with course, program and university goals faculty are not overburdened to report data for all levels of competency assessments (Cassity, 2014). Thus, scaffolding holds two distinct and important justifications: 1). Students have the ability and opportunity to develop "deep learning" and 2). Data can be easily gathered, whether for course or discipline assessment.

Writing is a progressive skill, students need to opportunity to practice writing, receive feedback, and rewrite to develop and improve their skills and understanding of the material (Blankship, 2009). Rubrics can be used successfully to increase both student's writing skills and their understanding of the material. Rubrics are developed to incorporate both mechanical and material understanding expectations to students prior to their writing assignments (Andrade, 2000). Writing rubrics have been used both to assess and provide feedback to student's understanding and knowledge of key issues within many disciplines to meet course and program goals. These rubrics are designed to provide feedback to students regarding their strengths and areas they need to strengthen; they assist in student's development in their cognitive and writing skills of material (Andrade, 2000). Writing rubrics also benefit faculty with consistency in grading, while providing data for course goals and program goals (Anderson and Mohrweis, 2008; Kinne, Hasenbank and Coffey, 2014). Researchers have addressed assessment and student learning goals; better known as course outcome goals;

through the use of rubrics (Jonsson, 2014; Kinne et al., 2014; Lipnevich, McCallen, Miles and Smith, 2014; Ash, Clayton and Atkinson, 2005).

Faculty uses numerous methods to improve students' writing and self-assessment skills; peerreview of written material, drafts of written assignments, written feedback on assignments, and a combination of all the mentioned methods. Using writing rubrics alone to enhance students' self – assessment of written work has not improved either student learning or future written assignments (Jonsson, 2014; Lipnevich et al., 2014; Sharkey, 1990). Kinne et al., (2014) found students have difficulty gaining enough adequate information from peer reviewed material alone. Peer reviews improved with specific rubrics for writing assignments (Nordrum, Evans and Gustafsson, 2013). Faculty report students do not use written feedback on returned assignments to make adjustments in future assignments (Hudd et al., 2013). Researchers have added writing rubrics along with feedback on written assignments to provide information to students for future writing assignment (Kinne et al., 2014; Lipnevich et al., 2014; Nordrum et al., 2013; Andrade, 2000; Sharkey, 1990). Writing rubrics can be used by students to understand the feedback provided on the written assignment, thus improving their self-assessment, understanding of the material and improve future written assignments.

COMBINING SCAFFOLDING WITH COMPETENCY ASSESSMENT

There are important writing skills required at each course level for undergraduates to progress through from their first year to graduation. The scaffolding of skills in each required course teaches students writing skills needed to successfully complete the degree in their discipline. Through embedding specific skills in both writing assignments and testing (Huskin, 2016) at all course levels, can assist the students' understanding of material thus increasing the students' grades while increasing competency assessment scores for the department. "Student writing can be scaffolded to move students toward more complex thinking and stronger compositional skills throughout the course of program of study" (Hooper and Butler, 2008, p. 7). An added bonus of having important writing skills embedded in scaffolded assignments and tests allow faculty to focus on the material a student presented versus the technical issues related to writing. The specific writing skills to scaffold and embed in all course work are based on Bloom's taxonomy, beginning with focusing on remembering and understanding, while introducing apply and analyze at the 100-level courses; at the 200-level courses reinforcement of remembering and understanding with the introduction of apply and analyze; 300-level courses continue to reinforce remembering and understanding but focus on application with the incorporation to analyze and evaluate while beginning to create; and finally at the 400-level courses the use of all six-levels of Bloom's taxonomy through creating a disciplinary specific.

The scaffolding and embedded writing skill results can be used for university level and program level assessments. Scaffolded writing skills are necessary for students to meet both university and program level competencies (Carey and Gregory, 2003). Without scaffolding beginning, in the 100-level courses, it becomes very difficult for students to meet the competency requirements in higher level courses. Scaffolded writing skills are developed using individual course objectives (Pelton, 2014) with the focus of addressing both program and university level competencies. The use of Bloom's taxonomy is important both in developing scaffolding writing assignments for the development of students' competencies (Ash et al, 2005). Program assessment is vital to identifying the strengths and needs of student learning within a program (Meyer-Adams, Potts, Koob, Dorsey and Rosales, 2011). Examples of program goals: Program goal one: Students will demonstrate the ability to describe and appropriately use key sociological concepts. Program goal

two: Students will demonstrate the ability to design, implement, and analyze sociological research. Program goal three: Students will demonstrate the ability to apply sociological theory to the analysis and understanding of concrete social phenomena. Program goal four: Students will demonstrate knowledge of career opportunities in the profession of sociology and related fields. All of the program assessment competencies can be meet through the use of scaffolded writing assignments.

Program assessment competencies are necessary to establish university assessment competencies. Examples of university level competency assessments are Competency 1 – Gaining Universitylevel knowledge and Comprehension of the information; Competency 2 - Application of the information; Competency 3 – Analysis of the information; and Competency 4 - Communicate effectively and Communicate appropriately.

SCAFFOLDING COURSE WRITING ASSIGNMENTS AND EXAMINATIONS

Scaffolding begins in every course with a plagiarism assignment. This assignment is done through a website which offers a tutorial of plagiarism followed by a quiz to gauge students' understanding of plagiarism. Upon successful completion of the quiz a certificate is produced for the student to copy and submit as the student's first writing assignment. Successful completion of this assignment begins teaching and building writing skills for the student. To reinforce completion of this assignment, no written work will be graded without having a certificate for the student in the grade book. In a 100-level course, two writing assignments are used to begin teaching students how to take information from the class and textbook and see the connection in their everyday world through recent newspaper articles. Specific website news outlets are provided along with citation examples for website news outlets. Students are required to select a news event and connect it with discipline definitions and concepts for a specific textbook chapter. These two writing assignments use Bloom's taxonomy to focus on remembering, understanding and introduce application. The writing assignments in 200-level courses continue to build writing and competency skills through the use of two peer-reviewed journal articles (provided by the faculty) and one peer-reviewed journal article they locate through the library database. Students are required to read the peer-reviewed journal articles and develop an essay to describe discipline specific concepts to explain a situation. This course level continues to build on remembering, understanding and application while beginning to add analysis of the material. In-text citation and reference examples are provided to students in this course level. The use of in-text citations and a reference page, students begin to understand their opinions need to have support from other academic sources. The 300-level courses become more complex and detailed in writing skills. This course level requires students to produce an argumentative essay with a thesis statement, a theory, and a literature review, using all levels of Bloom's taxonomy. Students also are required to find peer-reviewed articles from a library database and the *Publication Manual of the American Psychological Association* (American Psychological Association [APA], 2010) is a required textbook. At this course level, students experience several new writing skills and begin to struggle with the assignments. Many students have little or no experience with the development of a thesis statement, literature review or locating peer-reviewed journal articles. To aid in the skill building process, the final product is broken down into individual assignments, so students can build on their writing skills while adding new and more complex skills (Horstmanshof and Brownie, 2013). The 400-level courses require students to produce a research product which builds on all the writing skills previously learned in previous courses. These courses require students to successfully use all levels of Bloom's taxonomy. These courses require the submission of an Institutional Review Board (IRB) application as part of their research product.

Students must have effective and appropriate communication writing skills at this level to pass the IRB application process. So now the question becomes: How to reinforce successful writing skills?

ASSIGNMENT RUBRICS AND FEEDBACK

According to Mansilla, Duraisingh, Wolfe and Haynes, (2009) there are two very significant rationales for using grading rubrics at all levels of undergraduate assignments. Grading rubrics provide transparency and objectivity for all students in the course. A grading rubric also allows students to review their strengths of their assignment and the areas they need to improve prior to the next assignment (Mansilla et al., 2009). All writing assignments have rubrics for students to review the first day of the course to begin discussion of faculty expectations of student's writing skills (Anderson and Mohrweis, 2008). Providing a grading rubric in advance of assigning the writing assignment, faculty to connect and discuss aspects of the writing assignment during regular lectures to begin the connection between definitions and concepts with the future assignment. Providing the grading rubric early in the semester also allows students the ability to begin making connections between the presented material and the course learning objectives. Lipnevich et al., (2014) reported the use of a rubric produced the most improvement in a student's writing skills. Nordrum et al., (2013) combined the use of in-text feedback and assignment rubrics for writing assignments and found student's used the two forms of feedback differently. Students used the in-text feedback to correct common writing errors where the rubric was used to not only identify writing errors but also to give the student a better understanding of where improvement was needed for future writing assignments. Ash, Clayton and Atkinson (2005) focused on the use of a rubric with three writing attempts (a raw, revised and final version) prior to a grade being given. Both the raw and revised writing assignments were given feedback along with a feedback from the rubric. They found all scores improved from the raw draft to the final version. Horton & Diaz (2011) and Lipnevich et al., (2014) also found increased writing skills when students had a rubric prior to the writing assignment and the opportunity to submit writing drafts which faculty provided feedback but not grade until the final submission.

STUDY METHODS

In the 100-level course, students were graded on a summary of the news article, connection to a sociological concept, grammar, and organization, APA format and guidelines from the syllabus. These categories were given in specific detail on the rubric. Students' first writing assignment was returned with in-text comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the second writing assignment. Not all the students submitted a corrected rubric. Twenty-seven students submitted the first written assignment with a Mean score of 32.759 out of 50. Twenty-one students submitted a corrected rubric with a Mean increase to 48.654. In the 200-level course, summary of a peer-reviewed journal article, connection to a theory, grammar and organization, APA format and guidelines from the syllabus. These categories were given in specific detail on the rubric. Students' first writing assignment was returned with in-text comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the second writing assignment. Twenty-two students submitted the first library assignment with a Mean score of 29.750 out of 50. The second library assignment was submitted by 22 students with a Mean increase to 45.341. For the 300-level course, students develop a thesis statement, grammar, wording of the statement and statement length are areas on the grading rubric. These categories were given in specific detail on the rubric. Students' first attempt of this assignment was returned with in-text

comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the final writing assignment. A thesis statement was submitted by 16 students with a Mean of 7.938 out of 12. Sixteen students submitted a correct thesis rubric with a Mean increase of 2.313. The second 300-level course had five students – only four students submitted the thesis written assignment with a Mean of 9.50 only one student submitted a corrected thesis rubric with an increase of 1.25. Another writing assignment at the 300-level is the development of a theoretical basis for a longer paper. The theory assignment is graded on the identification of theory, the theorist, the connection to the students' project, and APA citations. These categories were given in specific detail on the rubric. Students' first attempt of this assignment was returned with in-text comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the final writing assignment. The theory written assignment was submitted by seventeen students for a Mean of 3.265 out of 10. The correct theory rubric was submitted by seventeen students with a Mean increase of 2.941. The second 300-level class had four students that submitted the theory written assignment with a Mean of 4.50. Four students submitted the correct theory rubric with a Mean increase of 3.125. The 400-level classes involve independent research and the submission of an IRB. The IRB is graded on the project description, research procedures, materials, confidentiality, and the consent form. These categories were given in specific detail on the rubric. Students' first attempt of this assignment was returned with in-text comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the second writing assignment. Fourteen students submitted a draft IRB with a Mean of 31.5 out of 50. These students had two more attempts to submit an IRB for approval. Thirteen students submitted a corrected IRB with a Mean increase of 4.643. Twelve students submitted a corrected IRB for approval with another Mean increase of 4.286. In a second class, three students submitted the IRB assignment with a Mean of 27.917; the corrected IRB submission increased the Mean of 5.00. This course also requires a Theory section. The theory assignment is graded on the identification of theory, the theorist, the connection to the students' project, and APA citations. These categories were given in specific detail on the rubric. Students' first attempt of this assignment was returned with in-text comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the final writing assignment. Fourteen students submitted the theory written assignments with a Mean of 6.214 only seven students submitted a correct theory rubric receiving all available points. This course also requires a Methods section. This assignment is graded on the collection of data, identification of variables, operationally defined variables, and the statistical method identified. These categories were given in specific detail on the rubric.
Students' first attempt of this assignment was returned with in-text comments and a scored rubric. On the back of the rubric, students were asked how they were going to correct any category where they did not receive an "exceeds" (the highest score) for the final writing assignment. Seven students submitted a written methods assignment with a Mean of 3.0 the same seven students submitted a correct methods rubric with a Mean increase of 3.857.

It obvious from the above increases, providing a rubric for all writing assignments early in the semester, allowing students to submit a draft in which faculty provides in-text feedback and making corrections on the grading rubric made a positive impact on student's grades. The increase in appropriate writing skills makes reading and grading final papers much easier.

CONCLUSIONS

In an era of competency assessments, the need for creativity in developing assignments that teach students how to be critical thinkers while at the same time to improve effective and appropriate communication skills is difficult. Many faculty members are teaching large numbers of students, they have research and service obligations. To make the challenge more difficult, many students are entering colleges and universities not prepared to meet the rigors of academia. Connecting writing assignments to course objectives, program goals, and university competencies not only provides easy access to available data but this data can be used to strengthen the course, the program and the university. While at the same time, student's abilities to develop effective critical thinking and writing skills can be improved. Although the method I've described and outlined in this paper is time consuming the benefits for increasing the student's ability to write effectively using critical thinking skills is worth the effort.

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Small Town Sustainability for Millennials and Baby Boomers

Keely K. Clay, Kennesaw State University, Marietta, GA, kclay10@kennesaw.edu

Abstract

What is Small Town Sustainability? Let's first answer the question of what is sustainability and what is the importance of it within a small town. Sustainability is using environmentally safe products so that mother earth and all living organisms may enjoy the abundance of life safely in an eco-system. Sustainability was thought at first to be a very catchy trend that would phase out after a few seasons. The truth is that more people are realizing the importance of eco-friendly food, travel, clothing, and living in general. From the tiny house movement, to the smart car, smart home, and the slow food movement, more companies are making sustainability a part of their daily practices. Sustainability practices have not reached all small rural towns, and this is very true of Thomaston, Georgia. Sustainability should be a practice that is felt by everyone but especially by Millennials and Baby Boomers. These two target market generations are thought to be very different in not only age but also in their way of thinking, however, that statement could not be further from the truth. In this paper you will find out why sustainability among Millennials and Baby Boomers are one in the same.

Introduction

Research is showing that the fastest growing target market are the Millennials born between 1980 to 2000. Who are the Millennials you may ask? According to Richard Fry, in an article called Millennials overtake Baby Boomers as America's largest generation; "*Millennials have surpassed Baby Boomers as the nation's largest living generation, according to population estimates released this month by the U.S. Census Bureau. Millennials, whom we define as those ages 18-34 in 2015, now number 75.4 million, surpassing the 74.9 million Baby Boomers (ages 51-69). And Generation X (ages 35-50 in 2015) is projected to pass the Boomers in population by 2028."* Millennials are far more concerned about the world around us than once perceived. Millennials see mother earth as a falling capsule of declining mass that must be saved.

Millennials are not the only target market that will pay more for sustainable goods but also Baby Boomers, born between 1946 and 1964. According to: The Nielsen Global Survey of Corporate Social Responsibility and Sustainability: Baby Boomers are "*Fifty-one percent of the population that is ages (50-64) and are willing to pay extra, an increase of seven percentage points since last year. This segment will remain a substantial and viable market in the coming decade for select products and services from sustainable brands."* Baby Boomers are now at a time in their lives where they can actually take the time to enjoy life. Most Baby Boomers have either retired or are on the verge of doing so, which frees up more time to travel, and to enjoy family. Baby Boomers are also at a point in their lives where they are having money to spend on themselves and not their children as they have done for so many past years. Now that the Baby Boomers children have jobs and families of their own to take care of, Baby Boomers can now focus on their wants and needs for the present and the future. Baby Boomers once were the pioneers of sustainability. Remember the hippies? Many Baby Boomers grow their own food, have solar power for their homes, and use renewable energy sources in many different forms. More and more Baby Boomers are concerned with not only the world around them but what they put on and in their bodies. Baby Boomers of today are not the same Baby Boomers ten to twenty years ago. Baby Boomers today are what you call "the new 50". Baby Boomers look younger, and are living longer. Baby Boomers and Millennials are walking the same line without noticing. Millennials think that they are pioneers of new environmental strategies but the truth is that Baby Boomers have been applying and researching the same things. Millennials have just had more acknowledgements with social media. With Baby Boomers and Millennials having so many of the same ideas, joining the two groups together to work on these common goals should be easy, right?

This is where sustainability comes into play. What is Sustainability? The EPA Environmental Protection Agency says that "Sustainability is based on a simple principle: Everything that we need for our survival and well-being depends, either directly or indirectly, on our natural environment. To pursue sustainability is to create and maintain the conditions under which humans and nature can exist in productive harmony to support present and future generations."

As you may recall from my last paper titled Small Town Sourcing In The USA, I spoke of my hometown and how the labor force has dwindled away due to the closing of many textile manufacturing mills. Today, many find jobs out of town which leave them with the high cost of commuting daily. Thomaston, Georgia has a wealth of knowledge left in these skilled workers that once did daily practices with textiles. With sustainability becoming a growing concern across so many target markets shouldn't one look first in their own backyard to fill the gap? When the target market is mostly made up of Millennials and Baby Boomers then sustainability should be a no brainer, correct? That depends, if we are creating a new concentration of sustainability issues in a rural community, then first we need education on sustainable practices. According to census.gov, population of Thomaston, Georgia as of July 2015 is 26,368. According to censusviewer.com in Thomaston, 18 to 64 years of age account for 56.32% of the

population. The two biggest target markets should work together on one common goal. Just think of how much can be accomplished with two power houses of groups working together. Sustainability is a major issue that covers so many facets that both target market practices in their daily lives and involve the public to do the same. Thomaston, Georgia is a rural community that has known the ups and downs of manufacturing first hand. Thomaston has seen the ups of the economy and growth of a town change to the despair and ruins of manufacturing buildings, land and water systems. Thomaston has the potential to grow and change with the two largest target markets backing the population of the desolate town. Also according to the United States Census, 53.2% of that same population is in the labor force in Thomaston, Georgia. That leaves a lot of people without jobs and futures. Thomaston, Georgia has only known textile manufacturing. To teach new sustainable practices that will allow for growth within this community could change Thomaston and place this community on a higher map.

New sustainable practices should first be explored, with the first being the slow food movement. Slow food movement is cultivating ones' own food. A community garden will sustain the eco system while providing health and nourishment. Next would be a new sustainable crop such as cotton or bamboo that can be easily cared for and harvested by many in the community. The next exploration would be creating garments that are sustainable to the environment from the harvested crops.

Allowing a population to come together and use sustainable practices as a community banded in arms would allow for more growth and community togetherness, by showing one another that together changes can and will be made not only for the better of the environment but for the better of a town and people.

I have begun to make strong connections within the Thomaston, Georgia community. These connections will allow further research on pioneering efforts, and bridge the gap between previous listed target markets and sustainability concerns. My next paper will delve deeper into cost efficient ways of manufacturing for Small Town Sustainability in the USA.

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Solving Hard Generalized Assignment Problems

with Solution Value Contingent Cuts

DR. ROBERT NAUSS

University of Missouri-St. Louis

DR. JEREMY NORTH

Murray State University

ABSTRACT

We define hard generalized assignment problems (GAP) to be those that take more than 1 hour of CPU time to prove optimality. The GAP may be described as finding a minimum-cost assignment of tasks to agents such that each task is assigned to exactly one agent and such that each agent's resource capacity is not violated. Tremendous strides have been made in the capability of "off the shelf" software, such as GUROBI and CPLEX, to solve general integer linear programs (ILP). However, some classes of ILPs remain difficult to solve to optimality in a reasonable amount of time. Certain instances of the GAP exhibit this behavior. In this paper we explore various approaches to improving the efficacy of "off the shelf" optimizers in solving hard generalized assignment problems. We introduce some novel cuts (and methods for deriving said cuts) that are applied with an "off the shelf" solver through the use of CALLBACK functions. Computational results are presented.

Over the past forty years or so, researchers have been devising algorithms to solve special classes of integer linear programs (ILP) in an efficient manner. Some algorithms guarantee optimality in theory (such as branch and bound), while other algorithms are heuristic in nature (such as tabu search) and simply strive to find "good" solutions. With the improvements in "off-the-shelf" optimizing software (such as GUROBI and CPLEX) as well as the availability of faster computers, more integer programs (whether or not they belong to a special problem class) are able to be solved to optimality in a reasonable amount of computation time. However, there are instances where the amount of computation time would be excessive (over 60 minutes ranging to over 1 day) in order to "prove" optimality. In these instances, the software may be stopped prematurely, and if a feasible solution (UB) has been found, then an optimality gap (or, in effect the difference between UB and a global lower bound (zlow) to the ILP) is produced.

In this paper we confine our attention to hard generalized assignment problems (those where an optimal solution value cannot be proven by GUROBI or CPLEX in less than 60 minutes of CPU time). The GAP may be described as finding a minimum-cost assignment of tasks to agents such that each task is assigned to exactly one agent and such that each agent's resource capacity is not violated. Applications of the GAP range from jobs assigned to computers in computer networks, to loading for flexible manufacturing systems, and to single source facility location (for a given fixed set of facilities, the resultant optimization problem is a GAP).

The GAP may be formulated as an ILP model with binary variables. Let n be the number of tasks to be assigned to m agents and define $N = \{1, 2, ...n\}$ and $M = \{1,$

2,...m}. Let:

c_{ij} = cost of task j being assigned to agent i

r_{ij} = amount of resource required for task j by agent i

b_i = resource units available to agent i.

The decision variables are defined as:

$$x_{ij} = \begin{cases} 1, \text{if task } j \text{ is assigned to agent } i \\ 0, \text{if not.} \end{cases}$$

The 0-1 ILP model for the GAP is:

$$(P) \qquad \text{minimize} \quad \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij} \tag{1}$$

subject to:

$$\sum_{j=1}^{n} r_{ij}x_{ij} \le b_i, \forall i \in M \tag{2}$$

$$\sum_{i=1}^{m} x_{ij} = 1, \ \forall j \in N \tag{3}$$

$$x_{ij} = 0 \text{ or } 1, \ \forall i \in M, j \in N. \tag{4}$$

The objective function (1) totals the costs of the assignments. Constraint (2) enforces resource limitations for each agent, and constraint (3) assures that each task is assigned to exactly one agent. All data elements are allowed to be real. We note, however, that certain efficiencies follow if the data elements are assumed to be integral.

To further tighten the feasible search space of (P), we generate additional feasibility cuts. We utilize an initial upper bound on the optimal solution to (P) by running the original problem (P) in GUROBI or CPLEX for a short period of, say, 1 to 10 minutes. Generally, even for hard GAPs, both optimizers are able to generate a good

feasible solution, z*, in this timeframe. A global lower bound, zlow, is also generated by GUROBI or CPLEX. Typically, zlow is strictly larger than the root node linear programming (LP) relaxation. We add a range constraint that constrains the original objective function, namely,

$$\text{zlow} \quad <= \quad \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij} \quad <= \quad \text{z*}. \qquad (5).$$

We then solve variants of the LP relaxation of (P|1-5) where we replace the original objective function (1) with the following objective function: minimize $\sum_{j=1}^{n} x_{ij}$ for a particular agent i. We repeat solving the LP relaxation of this revised problem for each agent i. We may then add the cardinality cuts: $\sum_{j=1}^{n} x_{ij} \geq < mncardi > \forall i \in M$ where <*mncardi*> is the minimum cardinality for agent i (i.e. the minimum number of tasks that must be assigned to agent i). We solve related LP variants to generate a maximum cardinality cut for each agent i as well as the minimum amount of resource that must be expended for each agent i (see constraint (2)). In summary we generate cuts for (P) (for given z*and zlow) of the following types for each agent, i:

(6) minimum cardinality

(7) maximum cardinality

(8) minimum resource usage

(9) minimum objective function contribution

(10) maximum objective function contribution.

In a similar vein we may attempt to add cuts for each job j. These cuts restrict (for a given zlow and z*) for each job, j:

(11) minimum resource used

(12) maximum resource used

(13) minimum objective function contribution

(14) maximum objective function contribution

(15) minimum cij/rij contribution

(16) maximum cij/rij contribution.

Finally for a given zlow and z*, we solve two linear programming relaxations of (P|(1-16)) where we replace the objective function by (a) minimize ∑∑ij rijxij and (b) maximize ∑∑ij rijxij. These give the minimum and maximum total resources used in an optimal solution to (P). This can be represented as a range constraint (17) for resources used: minresource <= ∑∑ij rijxij <= maxresource.

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Note that cuts (11) -(16) are equivalent to setting particular variables xij to 0 in any feasible solution with objective value less than z*. This is easily seen as follows. Suppose for job j^ we have found the maximum objective function contribution (14) to be cmaxj^. Then it follows that any variable xij^ with cij^ > cmaxj^ may be set to 0 in any optimal solution to (P). Similar logic holds for cuts (11) -(13) and (15)-(16).

We then proceed to generate (on a contingent basis), tightened constraints for (6) -(17) based on possible improved feasible solution values for (P) that may be found as we solve the problem (P|1-17) with GUROBI. Recall that z* and zlow were generated by a 1-10 minute GUROBI run (a z* value from a heuristic may also be used). Thus, we know that an optimal solution value for (P) resides in [zlow, z*]. Then for selected (say 5 to 10) possible values, zs ϵ [zlow, z*], we generate, as outlined above, strengthened cuts

of the form (6) to (17). Note that these tightened cuts are only activated after an improved feasible solution value, say, z# <= zs is generated. Such tightening can be handled "on the fly" by utilizing an appropriate CALLBACK function in GUROBI whenever an improved feasible solution is generated.

While it is true that the initial cuts (6) -(17) based on the objective value z* are valid, the question remains of their efficaciousness. Clearly the cuts serve to reduce the feasible region of (P), but their addition to the GAP problem can cause longer processing time at each branch-and-bound node. (Note that linear programming solution times are positively correlated with the number of constraints in the LP).

Additional global cuts may be added to (P) as follows: Suppose at some point in the solution process, we have generated a number of improved feasible solutions (say ten or so). We then find that set of xij variables that are equal to 1 in all of five or so of the most recent (best) feasible solutions found. Call this variable set LM1. We temporarily pause GUROBI. Then solve the reduced problem (P| xij =1 for all xij in LM1). If |LM1| is relatively large compared to |M|, we have a much smaller GAP problem with |M-LM1| jobs and N agents that should be relatively easy to solve with GUROBI from scratch. The resulting optimal solution value zR may either be < z* or >= z*. In the former case we update z* to the improved value zR. In the latter case we leave z* as is. In both cases we may now add the global cut $\sum$(ijεLM1) xij <= |LM1-1| to (P) (or indeed (P| (6) -(17))) and resume from our pause and continue solving with GUROBI. (In the case where the reduced problem (P| xij =1 for all xij in LM1) cannot be solved to optimality in a short amount of time (say, 10 minutes or so, we return to solving (P|(6)-(17).)

We demonstrate this behavior for over 40 hard GAP problems where each

problem was run with “plain vanilla” GUROBI and also with various selections of the additional constraints (6) -(17) for 3600 seconds (or 1 hour). The attachment shows that the best performing constraints are a combination of minimum resource constraints for each agent, minimum and maximum cardinality constraints for each agent, and minimum and maximum total resources used. This combination of additional constraints finds improved incumbent solutions and a tighter integrality gap for over 80% of the problems. Further when we reduce the search time for the additional constraint versions due to the 600 seconds of CPU to generate z* and 300 seconds for generating the cuts (or 2700 seconds instead of 3600 seconds CPU time), we still improve over “plain vanilla” GUROBI runs.

A natural extension would be to utilize this approach for other special classes of ILPs such as facility location problems, fixed charge network problems, etc. that GUROBI cannot solve to optimality in a reasonable amount of CPU time.

Tax Policies that Encourage Tenant Medical Office Building Green Utility Retrofits

Billie Ann Brotman
Professor of Finance and Real Estate
Kennesaw State University

Abstract

This paper exams the financial impact of upgrading an existing medical office building with an energy efficient design or equipment from a tenant/lessee perspective. The empirical study highlights the importance of utility cost, credit availability and producer price index for office construction on the amount of medical office building spending put in place. The independent variables prime interest rate, cost of natural gas per therm and electricity cost per KWH are significant variables. A cost-benefit model is developed that inputs several personal income tax rates, incorporates a debt-service coverage ratio, analyzes investment tax credit and rebate scenarios and varies the level of energy savings. The cost-benefit case study results provide insight into which factors enable higher net construction spending when considering a green energy retrofit project. Both the regression model and the case study model focused on the tenant who rents medical office space using a triple net lease. The tenant paradigm limits the analysis to energy savings, the tax implications of having these savings and benefits associated with borrowing when financing the green retrofit. The availability of low cost borrowing and increased investment tax credit (ITC) rates increases net retrofit construction spending.

Introduction

Medical practices occupy medical office space rented using a triple net lease. Under this type of lease the medical practice pays the electricity, water and natural gas bills, real estate taxes and maintenance expenses associated with operating the property. Increases in these expenses reduces profitability. Upgrades to the property under most net leases is the tenant's responsibility during the term of the lease. The owner of the building does not compensate the tenant for building upgrades. The medical practice attempts to minimize the cost associated with using the occupied space in order to increase the overall profitability of the group. Factors that need to be considered by the tenant prior to doing a building energy retrofit include loan availability, investment tax credits plus energy rebates provided by utility companies and the cost of the construction retrofit. Replacement decision analysis compares the additional cost associated with the retrofit to the marginal revenues generated by the green upgrade.

Green retrofits to equipment and the structure can be internally financed or a loan can be secured for the upgrade. Commercial lenders and the small business administration (SBA) offer green loans to tenants of buildings. The credit worthiness of the borrower serves as collateral for the retrofit green loan. Commercial loans can be secured using the expected investment tax credit that will be paid by the federal government as collateral. The Small Business Administration (SBA) under loan program 504 makes loans to tenants of buildings for improvements made for the leased facility. The loan rates fluctuate monthly and can have terms of up to 10 years with a 10 percent down payment. The applicant needs to demonstrate that the green retrofit reduces energy utilization by 10 percent. This loan is an example of the type of lending available in the market place. Medical office buildings may not qualify for this specific loan, but other lenders offer similar loan arrangements. The important aspect of this lending example is that the loan rate continuously fluctuates with the prime interest rate and lending for an energy retrofit can be secured for a period of 10 years.

The Debt Service Coverage Ratio in the context of this paper compares the Net Energy Savings generated by the retrofit to the annual payment on the loan. This ratio for an office building can vary from 1.22 to 1.25. Higher numbers reduce the amount on the loan that a lender will underwrite. Using the accounting balance sheet formula where assets are equal to the loan plus owner equity, a reduction in the loan amount reduces spending on the energy efficient asset being purchased. The availability of cheap and available credit make the private decision to purchase energy efficient assets more likely.

The business energy investment tax credit was originally signed into law in 2005 and took effect in January of 2006. It has been annually renewed. The Consolidated Appropriations Act signed in December 2015 provides for a 10 or 30 percent tax credit on specific energy technologies starting in 2016. The issue addressed by this paper, is whether tax credits and utility rebates at high levels are likely to provide the necessary incentive mechanism to spur the adoption of energy efficient technologies in medical office buildings by a tenant occupant.

Literature Search

Energy Star is a federal government agency rating system. Score for facility space used to provide services for medical, dental and psychiatric outpatient care. A statistical analysis of the respective medical office building is performed and the actual energy use by the building yields a 1 to 100 percentile ranking for energy consumption relative to a national norm. The U.S. Department of Energy collects national norm data for medical office buildings. Energy Star is a federal government rating system.

Research studies have compared Energy Star ratings to rankings assigned by Leadership in Energy and Environmental Design (LEED). Scofield study (2013) examined 2011 energy data for 953 New York City office buildings. Twenty-one (21) of the buildings were certified by LEED. The study found that LEED-certified and non-LEED certified building used the same amount of energy and generated the same level of greenhouse gases. The results of this study cast doubt of the use of Energy Star scores as a good measure of energy success. The author concluded that the Energy Star ranking system used as a

benchmarking tool of energy usage requires validation. The Scofield study (2014) specifically studied the Energy Star rating system for Medical Office Buildings. It reviewed energy models used to assign Energy Star rankings and the data used in building these models. This study found that the Energy Star scores produced by the models being used had little credibility.

Hiser and Baker (2011) studied the costs and benefits associated with the Energy Star and LEED building labels for existing buildings. The hypothesis of the study was that Energy Star ratings are a better overall investment rating for real estate owners as compared to commercial buildings with a LEED rating. This hypothesis was not reject. The rated office building was compared to the typical office building and CO2 emissions and the emission abatement percentage was determined. Energy Star and LEED standards result in energy savings an average carbon emission reduction of 25.8 percent. This study developed income statements using different utility expense reduction scenarios to calculate the likely change in the property's appraised value.

The U.S. Green Building Council the creator of the LEED-certification ratings, a private for-profit group, in a 2015 article indicated that LEED-certified buildings have lower operating costs when compared to non-LEED buildings. LEED certified buildings used 25 percent less energy and resulted in a 19 percent reduction in aggregate operating costs. Information about attracting tenants, building sell-asking price differences, increased worker satisfaction, higher rental rates were also presented as advantages for having a LEED-certified building.

Empirical Study

The objective of the empirical study is to determine whether medical office construction spending is influenced by electricity and natural gas prices and the prime interest rate. Is investor behavior considering energy efficient construction influenced in a predictable manner by the cost of available credit and by utility expenses especially those related to natural gas rates and electricity rates? It is assumed that newer construction is more energy efficient than existing older construction. Technological changes continuously improve the efficiency of heating furnaces, air conditioning compressors, computers/equipment, lighting, windows and insulation. Newer buildings would incorporate more of the latest energy efficient designs.

The regression variables selected were those that influence the tenant of an office building subject to a triple net lease. Rent per square foot, vacancy rates and resale value appreciation or depreciation rates were not included in equation 1, because these factors directly influence the owner of the medical building's profitability not the tenant retrofit decision. The medical practice is responsible for utility bills and upgrades done to the building during occupancy. These upgrades can be financed by using internal cash flows or by securing a loan for the retrofit. The unemployment rate indirectly influences internal cash flows or demand for medical services due to loss of medical insurance coverage; and for this reason the unemployment rate variable was included in the regression analysis. Under a net lease the tenant pays utility bills and upgrades to the building while the lease is in effect. The owner of the property normally does not compensate the medical practice for improvements made to the building during tenancy.

The regression used the monthly dollar amount of medical office construction put in place for medical office buildings as the dependent variable (Y) for years January 2000 through December 2015. This medical construction information and other cost variables are available online from the U.S. Bureau of Labor Statistics. The monthly prime rate is published online by J. P. Morgan Chase. The independent variables were the prime interest rate, cost of gas and electricity, producer price index for medical office services and the unemployment rates. The unemployment rate affects demand for medical services while the other independent variables influence the costs of providing medical care in a medical office setting. The regression was linear and specified as:

$$Y = C - b_1 PRIME + b_2 GAS + b_3 ELECTRICITY - b_4 UNEMPLOYRATE - b_5 PPImedoffice + e_t \quad (1)$$

It explained 58 percent of the variation in the amount of medical office construction spending put in place during the 15 year time period. The prime interest rate (PRIME) coefficient was negative indicating that as rates fell during the period the amount of construction spending rose. Many construction loans are tied to the prime rate and the interest rate charged to the borrower fluctuates as the prime rate changes. Utilities had positive coefficients. New construction put in place was positively influenced by increases in electricity cost per kilowatt hour and natural gas cost per therm. As the unemployment rate (UMEMPLOYRATE) rises, given that approximately 50 percent of population get their health insurance coverage through employer plans, then the income of medical providers is expected to fall due to lower demand. The amount of new medical office construction needed would be expected to fall. The variables prime, gas per therm and unemployment rates have confidence levels of 99 percent. Electricity per KWH was significant at a 5 percent level. Higher energy prices directly encourage new medical office construction. The negative variable sign for producer price index medical office building (PPImedoffice) indicates that the higher the cost of providing medical services to patients, the lower the amount spent on new construction spending. This variable has a probability of 16.5 percent which indicates the variable is insignificant.

Table 1: Regression Result

Dependent Variable: MEDOFFICECPUT
Method: Least Squares
Date: 03/21/16 Time: 09:52
Sample: 2000M01 2015M12
Included observations: 192

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	540.1566	191.4594	2.821259	0.0053
PRIME	-22.53508	4.719669	-4.774715	0.0000
GAS	416.7463	33.02062	12.62079	0.0000
ELECTRICITY	2374.043	1135.863	2.090078	0.0380
UNEMPLOYRATE	-29.07058	4.843915	-6.001463	0.0000
PPIMEDOFFICE	-3.120637	2.238812	-1.393881	0.1650

R-squared	0.580031	Mean dependent var	551.0260
Adjusted R-squared	0.568741	S.D. dependent var	115.6087
S.E. of regression	75.92054	Akaike info criterion	11.5 800
Sum squared resid	1072091.	Schwarz criterion	11.6 980
Log likelihood	-1100.688	Hannan-Quinn criter.	11.5 923
F-statistic	51.37796		
Prob(F-statistic)	0.000000		

All of the statistical data can be accessed online at the respective federal agency websites and commercial websites. The regression results suggest that the cost of energy and credit influence medical office building construction spending in a predictable manner.

Case Study

The case study is designed from a medical practice perspective. The practice is renting 5,000 feet of office space using a triple net lease. The medical group is considering upgrading an energy inefficient feature of the building. Making the retrofit will reduce energy costs by either: 10, 20, 30 or 40 percentage. An income statement is generated using rates noted in the article Trends in Office Building Operations 2011.

Federal personal tax brackets for 2015 are used in the model and range from 10 to 39.6 percent. A state income tax of 6 percent (i.e., tax rate charged in Georgia) is added to the federal income tax brackets making the combined tax rate range 16 to 45.6 percent. The tax deductibility of state taxes on federal returns was not modeled. Higher marginal income tax brackets make purchasing retrofitted energy saving features cheaper. The government is paying a larger percentage of the construction cost associated with the retrofit for higher income tax rates than for lower tax brackets.

An investment tax credit (ITC) is taken and rebates received almost immediately lowering the net cost of the new green construction retrofit. It is assumed to be a percentage of the construction cost ($\%\Delta C_0$). The retrofit energy upgrade is depreciated using a 10-year straight-line method; and the lease will be in effect for at least 10 years. The tenant is not compensated by the medical office building owner for any improvements made to the property. As a consequence, the salvage value of the retrofit equals zero. It is a simple interest loan and the initial loan amount is owned at the end of 10 years. The energy improvement is expected to operate economically for 10 years after installation.

Equations 2 and 3 are based on the balance sheet accounting identity: Assets = Liabilities + Equity. The asset is the value of the new green construction, the loan associated with the retrofit is the liability and equity is defined as the present value of the tax adjusted energy savings and tax adjusted depreciation expense deduction.

The equations also incorporate the concept of the incremental cost. To be feasible, the net construction cost associated with green retrofit construction ($\Delta C_0 - ITC_0$) needs to be less than or equal to the incremental benefits associated with the green retrofit. Decreases in utility expense variable (ΔE_t) is a direct result of doing the green retrofit and enhances profitability.

The availability of lending especially at low interest rates increases the likelihood that new green construction is feasible. The Debt Service Coverage Ratio is set at 1.22 and the capitalization rate is 7.70 percent as reported by A. Cross (2015). The discount rate is the return required by the tenant. The lender receives the interest income as compensation for making the loan. The tenant or medical practice is assuming the risk that the retrofit will perform as advertised and will continue to save energy at the advertised rate for the next 10 years. The risk premium earned by the tenant is 4.20 percent the difference between the prime loan rate of 3.50 percent and the required return of 7.70 percent. A lower debt service ratio makes doing a green retrofit more feasible. The case study will use a Debt-Service ratio of 1.22. The right hand of the equation will be solved under different scenarios to determine the likely financial rewards associated with the retrofit. From a feasibility standpoint, the maximum financial benefit determined sets a ceiling on the amount that can be spend on the retrofit unless the retrofit is being mandated by a government entity. The adjustment (1 - %) indicates that taking an ITC lowers the amount the retrofitted asset can be depreciated during year 1 through year 10. A 10 percent ITC would reduce the basis for depreciation to 90 percent (100% - 10%).

$$\Delta C_0 - ITC_0 \leq \Delta L_0 + PV\Delta E_t - PV\Delta I_t)(1 - t_p) + PV(M^{-1}(1-\%)\Delta C_0)t_p] + (PVS_n - PVL_n) \quad (2)$$

Equation 3 sets the ITC equal to a percentage of the construction cost incurred due to undertaking the green retrofit. $PV(M^{-1}(1-\%)\Delta C_0)t_p$ represents the tax benefits from taking a depreciation write-off when determining an individual's tax liability. Lower utility expenses does not include the benefits associated with deducting depreciate expense when determining tax liability.

$$\Delta C_0 - \%\Delta C_0 \leq \Delta L_0 + PV\Delta E_t - PV\Delta I)(1 - t_p) + PV(M^{-1}(1-\%)\Delta C_0)t_p] + (PVS_n - PVL_n) \quad (3)$$

The Gross Potential Income shown in Table 2 is calculated for an urban medical office building using data published by IREM. The vacancy rate, utility expenses and other costs per square foot where available for the year 2011. Utility costs for the median office building located in an urban area in the United States was $2.20 per square foot of rentable space. The cost was higher for the urban area than the suburban area estimates. The Net Operating Income earned varied depending on the urban-suburban settings and location within the country.

Table 2: Reference Income Statement: Urban Location

Gross Potential Income 5000' x $20.30'		**$101,500**
Less: Vacancy Losses (1-.91)*		**9,135**
Effective Gross Income		**$ 92,365**
Operating Expenses:		
Utilities $2.20'	**11,000**	
Janitorial/Maintenance $2.65'	**13,250**	
Administrative/Benefits $1.17'	**5,850**	
Insurance $1.26'	**6,300**	
Real Estate & other taxes $2.62	**13,100**	
Less: Total Operating Expenses		**49,500**
Net Operating Income ($9.90')		**$ 42,865**

*the median U. S. medical office building occupancy rate is 91%

Energy savings are based on the initial reference income statement amount of $11,000. For example, a 10 percent saving results in an annual reduction of $1,100 ($11,000 x .10). Since this is a replacement of equipment or a retrofit to the existing building example a reduction in local real estate taxes is unlikely. Many cities lower real estate taxes owed for a period of time, but this tax advantage is normally available for new construction and not for changes to existing buildings. Local utility companies frequently give rebates for installing furnaces and other equipment that meets certain minimum energy standards. These rebates should be added to the ITC in equations 2 and 3.

Table 3 shows the total dollar amount generated by altering the level of the energy savings, ITC percentages and personal federal plus state income tax rates. Total dollar energy savings and per square foot amounts are indicated. The total savings figure shows how much can be spent on an energy building retrofit that lowers utility bills. Spaces with smaller or larger square footage using the same costs per square foot estimates and other assumptions would result in the same energy savings per square foot as those indicated in table 3. The table serves as a reference template when using the square footage amounts. It cross references expected energy savings with income tax rates and the available ITC + rebate rate.

Table 3: Tax Rates, ITC+ Rebate Percent, Income Tax Rates and Energy Saving Energy Savings

t=16%,ITC	10% Total	10% SQ'	20% Total	20% SQ'	30% Total	30% SQ'	40% Total	40% SQ'
16%, 0%	$17,791	$ 3.56	$35,583	$7.12	$53,374	$10.67	$71,166	$14.23
16%, 10%	19,768	3.95	39,537	7.91	59,305	11.86	79,073	15.81
16%, 20%	22,239	4.45	44,479	8.90	66,718	13.34	88,957	17.79
16%, 30%	25,416	5.08	50,833	10.17	76,249	15.25	101,665	20.33
16%, 40%	29,652	5.93	59,305	11.86	88,957	17.79	118,610	23.72
t=45.6%,ITC	10% total	10% SQ'	20% Total	20% SQ'	30% Total	30% SQ'	40% Total	40% SQ'
45.6%, 0%	$20,540	$ 4.11	$41,079	$8.22	$61,619	$12.32	$82,158	$16.43
45.6%, 10%	22,822	4.56	45,644	9.13	68,465	13.69	91,287	18.26
45.6%, 20%	25,674	5.13	51,349	10.27	77,023	15.40	102,698	20.54
45.6%, 30%	29,342	5.87	58,685	11.74	88,027	17.61	117,369	23.47
45.6%, 40%	34,233	6.85	68,465	13.69	102,698	20.54	136,930	27.39

The marginal benefit per square foot ranges from $3.56 to $27.39. The higher the marginal income tax bracket the higher the amount that can be spend on green retrofit construction. The rows on the chart follow a pattern. Every 10 percent increase in energy savings causes the amount per square foot to grow at a constant rate. For example, the 10%SQ' coupled with 16%, 0% grows at a constant rate of $3.56. The overall energy rate of growth at 16%,0% is 300% ($14.23-3.56/3.56). The columns of the chart show a direct relationship exists between the level of ITC and rebate levels and the amount that can be spend on new construction. The overall growth rate is 66.6 percent for all columns and exists for all marginal income tax brackets.

Relative contributions to energy savings can be determine by comparing: the percentage change in construction spending to the percentage change in the change in the energy level or the percentage change in the ITC rate. A higher index ratio number indicates a higher energy savings impact from the variable in the denominator. For the rows the index number of 7.5 (300%/40%) indicates the multiplier effect associated with increased energy savings. The index number of the columns is 1.665 (66.6%/40%) for the multiplier effect on a given level of energy to changes in the investment tax credit levels. Changes in energy saving rates is the largest factor generating revenues for retrofit construction spending.

Conclusions

The empirical and case studies indicate that new retrofit construction and new construction spending in medical office buildings is sensitive to utility expenses. The tenant has a financial incentive to purchase more energy efficient heating/cooling systems or to rent a green office space and pay a higher rent per square foot. New retrofit construction depending on the availability of tax credits and utility company rebates, energy savings level and marginal income tax rate ranged from a low of $3.56 to a high of $27.39 per square foot. According to 2016 New Furnace Installation Cost and adjusted by brand/efficiency levels purchasing and installing a new natural gas furnace costs between $1.98 and $5.15 per square foot. These replacement furnace costs are lower or within the numbers shown in Table 3. The total dollar energy savings shown in Table 4 for the tax bracket 16 percent ranged from $17,791 to $118,610 and for the tax rate 45.6% ranged from $20,540 to $136,930. These saving levels are sufficiently high enough to enable targeted system retrofits.

The medical practice has a choice of retrofitting an office space that they currently occupy or renting a greener office space. A 2015 research study by Devine and Kok indicates that environmentally friendly office buildings earn higher rents and have lower vacancy rates. This would suggest that tenants are sensitive to the impact of energy costs on their bottom line and may opt to relocate to newer or existing green retrofitted buildings.

ITC and utility rebates encourage retrofitting furnaces, air conditioning compressors and appliances but this may be happening at the end of the existing equipment's useful life. The results shown on Table 3 indicate that the financial incentive to shift to energy efficient equipment is greater than taking advantage of a rebate or ITC. An upfront financial incentive probably encourages slightly earlier retrofit changes that were already planned to occur in the near future.

Higher marginal income tax rates incentive encourage retrofitting for a tenant occupant. The difference in square foot savings existing between a tax rate of 16 percent and 45.6 percent is approximately 15 percent for the respective energy saving levels for the same ITC + rebate level. The progressive nature of the federal personal income tax schedule encourages tenant green medical office building retrofits.

Green upgrades either by the medical building tenant or owner user of the building is encourage by high and increasing utility prices. This incentive is reduced when energy prices are lower or falling. The energy saving factor would become less financially important and the tax credits and utility rebates become the primary incentives encouraging green retrofits.

Additional Author Information

Author: Billie Ann Brotman, (Department of Economics, Finance and Quantitative Analysis, Michael Coles College of Business, Kennesaw State University, Kennesaw, GA 30144 Contract Information: Eastern Standard Time 470-578-6496 (w), 770-432-4572 (h), 470-314-1720 (c) or email addresses: babrotman@aol.com bbrotman@kennesaw.edu

Bio: Billie Ann Brotman is a professor of Finance and Real Estate at Kennesaw State University. She teaches course in Corporate Finance, Real Estate Appraisals and Real Estate Finance and Investments. Her published research focuses on the practical application of real estate appraisal approaches and investments.

Keywords: Green Retrofits, Sustainable Construction, Green Replacement Decision, Green Cost-Benefit Analysis, Green Present Value Approach, Green Feasibility Analysis

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Telemedicine: Distributed Decision Support with Partial Compatibility Evidence

DR. BEL RAGGAD
Pace University

DR. SOFIENNE MANSOURI
Higher Inst of Medical Technology, Tunis

Abstract

Intelligent decision support systems have been utilized in various functional areas of the modern enterprise. For example, researchers have advanced divers uncertainty management techniques in operation management, marketing, finance, etc. Healthcare organizations have also been studied with significant attention given to improving the performance of its telecommunication and information systems, but little paid to it medical information processing engine. The most central part of a telemedicine system is mainly its patient satisfaction part that still remains unstudied. A telemedicine system can then benefit from an intelligent decision support that can assist the e-doctor in collecting and combining patient evidence before generating a sound recommendation about the patient medical conditions.

This article is an extension of Raggad et al (2014) which proposed a method to construct a belief structure based on e-patient medical records and the feasible medical space associated with the e-consultation process. This article introduced several claims where partial compatibility of evidence is processed to generate decision support information to e-doctors. E-doctor assertions are processed and optimal medical conditions are generated in a risk-driven manner. The paper also provides a numerical example to demonstrate the working of the proposed method.

Key words: Telemedicine, Belief structure, Mass functions, Dempster and Shafer Theory, Risk.

Introduction

In the last few decades, a significant progress has been made in the IT community to advance the telemedicine field. Advancement in secure data sharing among patients, health providers, and insurance agencies with assured mutual trust and information privacy established a robust platform for real-time healthcare delivery. The entire nation started to accept the deployment of electronic health information systems and the federal government has sponsored it (Blavin, F., et al. 2013, Stoten, S., 2009).

The major part of telemedicine that has seen great development is the use of telecommunications to provide medical information and services. This includes simple data transfer among members of the telemedicine environment including emails and videoconferencing. A more advanced example would be the use of satellite technology to broadcast a consultation between providers at facilities in two countries, using videoconferencing equipment and robotic technology.

Telecommunication has been enhanced to allow physicians and specialists in remote health to deliver health care, diagnose patients, and provide therapy in a real-time manner. Telemedicine software systems have been also enhanced to allow for medical diagnostic activities but these have been limited to

augmenting the performance of the communication effort and not necessarily the decision support part of the diagnosing effort (Xu, E., Wermus, M., and Bauman, D.B., 2011).

Major applications involved in the telemedicine effort include radiology, pathology, cardiology and ehealth education. Telemedicine adopted a variety of approaches including Store-and-Forward, HomeHealth, Real-Time, and other asynchronous methods (Stoten, S., 2009, Talmon J AE., et al., 2009, Kiernan, TE. J. and Demaerschalk, B.M., 2010).

In this paper we refer to telemedicine simply as the use of technology to provide health care at a distance. We see that this recent field is certainly playing a great role in delivering healthcare nationwide and the entire nation is committed to it. Moreover, there is consistent reporting on its advances in terms of telecommunication and information technology adopted for rapid and real-time health care delivery (Duan, L., Street W.N., and Xu, E., 2011). There is however little attention paid to the information processing power needed to collect evidence and combine it before generating accurate medical recommendation when e-consultations are processed.

Communication between all telehealth members have been improved and secured. This enabled the transfer of health data where needed to speed up the delivery of health care even to remote locations. While secure electronic records of healthcare enrollment information and historical medical information of patients are now accessible to telehealth members their processing towards health care delivery is still unverifiable due to the lack of sound information processing (Blavin, F., et al. 2013, Demiris G, and Tao D., 2010).

This paper intends to model the decision process by which evidence about the patient medical conditions is collected and combined before the final medical recommendations are generated. In order to manage the great deal of uncertainty associated with this medical decision process, this paper proposes a method to construct belief structures based on e-patient medical records and the feasible medical space associated with the e-consultation process. E-doctor's assertions are processed and optimal medical conditions are generated in a risk-driven manner. The paper also provides a numerical example to demonstrate the working of the proposed method.

The telemedicine decision support environment

As in Raggad et al (2014), a telemedicine decision support environment consists of the following components:

1. A set of medical specialties
2. A set of e-doctors
3. A set of e-patients
4. A set of local medical databases or local hospitals
5. A telemedicine policy set

In such a computing environment, as depicted in Figure 1, an e-patient contacts an e-doctor to initiate an e-consultation e. In an e-consultation, there are two parts: patient information, and doctor information. The e-consultation patient information contains two parts: clinic information and declared information.

The patient clinic information contains basic vital information, as pulse, blood pressure, temperature, etc. The patient declared information contains the patient declaration on the health complaint, often referring to the intensity of the pain and its location.

The e-consultation doctor information part consists of a set of assertions. This set of assertions will be evaluated by the e-doctor in real-time after obtaining patients medical records from local databases in local hospitals members of the telemedicine environment, and available medical knowledge about the assertions containing the medical conditions retained by the e-doctor given e-consultation patient information.

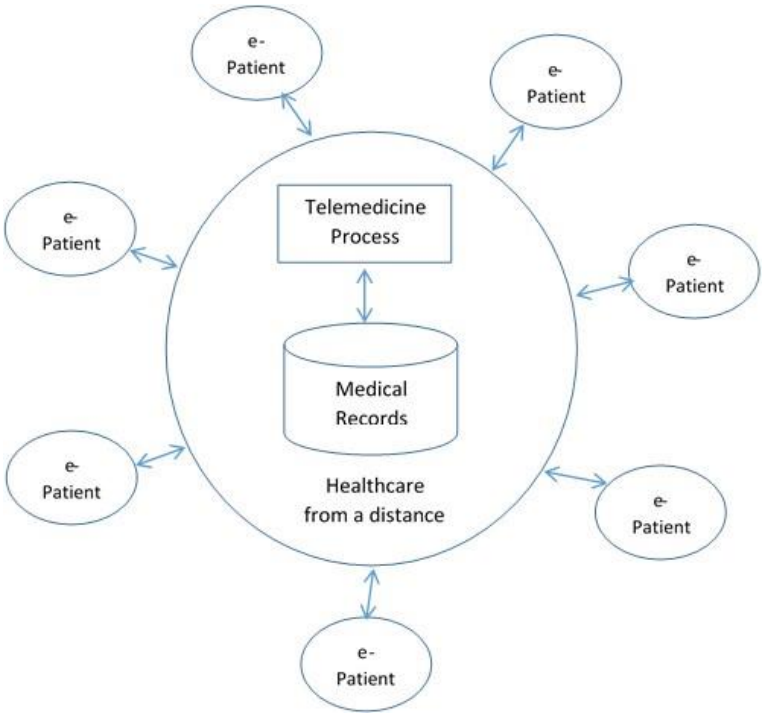

Figure 1: A simple telemedicine model

Raggad et al a(2014) dopted the following notations in studying a telemedicine process:

$V = \prod_{j=1,M^v} V_j$ = Structured medical domain space;

V_j = Attribute number j in the medical domain space, made of countable objects in $Dom(V_j)$, the domain of the attribute;

F = a subset of V containing the feasible medical space where solutions relevant to the e-consultation;

e = e-consultation compatible with the structure of the domain space V;

$D_k=\{d_{ij}^k, i=1, N_D^k; j=1,M_D^k\}$ = e-patient data obtained from hospital k;

$D= \{D_k, k=1, M_D\}$= data obtained from all hospitals;

Δ_α = Partial order relation on all data sets;

R (a, α) = Risk associated with taking the assertion a with a compatibility level of α.

The e-doctor starts an e-consultation by asking the e-patient about his/her medical conditions according to standard questionnaires pre-defined by the telemedicine policy. A standard questionnaire is required so that future e-consultations by other e-doctors can be easily consolidated. For every consultation e, $e=\{e^1, \ldots, e^{Me}\}$ and where $e^k=(e^k_1, \ldots, e^k_{Ne}), k=1,M_e\}$ where $\{e^k_1, \ldots, e^k_{Me}\}$ is a subset of $\{V_1, \ldots, V_{Mv}\}$. The econsultation is then, by construction, a set of tuples compatible with the the data space V. For example, an e-consultation may be {e^1=({Fibromyalgia, Rheumatoid Arthritis}, {56, 140/82, High Fever, 85}, {Fatigue, High Cholesterol}); e^2=({Rheumatoid Arthritis}, {56, 140/82, High Fever, 85}, {Fatigue, High Cholesterol}); e^3=({ Osteoarthritis}, {56, 140/82, High Fever, 85}, {Fatigue, High Cholesterol})}. This econsultation has the following structure: {(e^k_1=Assertion, e^k_2=vital measures, e^k_3=Medical Complaint); k=1,3}. This e-consultation shows that the e-doctor is unsure about three medical conditions: {Fibromyalgia, Rheumatoid Arthritis, Osteoarthritis}. The e-doctor has to obtain patient's medical records in local medical databases at local hospitals that are members of the telemedicine environment and use those records to validate the e-consultation on hand.

In real life, however, not all the patient's medical records are useful. There will be records that contain similar symptoms that are associated with medical conditions other than the ones diagnosed by the edoctor. We then have to adopt a compatibility relation among available evidence to avoid the inclusion of any incompatible piece of evidence in the medical diagnosis process. This compatibility relation is an partial order relation Δ_α defined as $\{x\Delta_\alpha y$ if and only if $|x\cap y|/|x| \geq\alpha,\ 0\leq\alpha\leq1\}$ where α is a level of compatibility defined by the e-doctor. The collected medical records data D should be compatible with both the e-consultation information and the feasible space F on the current medical conditions of the patient. The e-doctor then needs to evaluate the assertions on the patient's medical conditions and select the most appropriate assertion.

The evidence presented to the e-doctor at the end of the e-consultation is very heterogeneous in type and are associated with a great deal of uncertainty that cannot be processed using the known Bayesian formalism or any other sound statistical model. We will later propose the construction of a mass function suitable for the evidence on hand and build a belief structure using this mass function to represent this evidence and produce belief measures on the generated assertions. The e-doctor can then select the assertion that has the highest belief measure and assess risks associated with the selected assertion.

The e-doctor has then to follow the following steps:

1. Estimate to what extent the patient medical record data D provide evidence support to the assertions on patient's medical conditions defined in the e-consultation data subset e;
2. Estimate to what extent is the patient medical record data D compatible with all possible medical conditions; i.e., the feasible space of medical conditions F specifying the medical knowledge on related medical conditions defined in the e-consultation data subset;
3. Construct a belief structure on the retained medical conditions;
4. Use the evidence collected in steps 1, 2, and 3 to select the most appropriate assertion.

The evidence support function

Consider then an e-consultation e, $e=\{e^1, \ldots, e^{Me}\}$ and where $e^k=(e^k_1, \ldots, e^k_{Ne}), k=1,M_e\}$ where $\{e^k_1, \ldots, e^k_{Me}\}$ is a subset of $\{V_1, \ldots, V_{Mv}\}$, and a set of medical data subsets $\{D_k, k=1,M_D\}$ obtained from local databases at local hospitals members of the telemedicine environment. Also let Δ_α be a partial order relation on all the data sets on hand. If x and y are elements of a set E, we say that $x\Delta_\alpha y$ if and only if $|x \cap y|/|x| \geq \alpha$. The intersection defines the amount of support x provides to y, or alternatively, the amount of α-compatibility between x and y (i.e., a compatibility with level α).

Given two subsets E and G and x in G, we define the evidence support $s_G{}^\alpha(x)$ of x in G as the set of y in G such that $y\Delta_\alpha x$. That is, $s_G(x) = \{y \varepsilon G, \text{ such that } y\Delta_\alpha x\}$. The subset G is a poset with respect to the partial order relation Δ_α and it may hence have elements that are related to x (α-compatible with) and others that are not related to x (not α-compatible). Only the compatible elements y in G such that $y\Delta_\alpha$ x are accepted to support x.

The belief structure on e-doctor assertions

Let F, defined above, be our frame of discernment. The belief structure for G in F is defined as follows:

$$m_G{}^\alpha: 2^V \rightarrow [0\ 1]$$
$$m_G{}^\alpha(x) = |s_G{}^\alpha(x)|/\ |s_G{}^\alpha(F)|$$

where $s_G{}^\alpha(F) = \{\{y \varepsilon G \text{ such that } y\Delta_\alpha x\},\ x \varepsilon F\}$

Throughout the paper, it is sometimes useful to denote as follows:

$$|s_G{}^\alpha(x)| = |x\Delta_\alpha G| = \text{Cardinal of } \{y \varepsilon G, \text{ such that } y\Delta_\alpha x\}.$$

We then have the following:

$$m_G{}^\alpha(y) = |y\Delta_\alpha G|/|F\Delta_\alpha G|,$$
$$m_G{}^\alpha(F) = |F\Delta_\alpha G|/|F\Delta_\alpha G| = 1.$$

At this point, we can have the information we need to evaluate the assertions on medical conditions identified in the e-consultation by the e-doctor. We need to compute the Belief value of all assertions and select a* from e*, the e-consultation tuple that has the highest belief, as follows:

$$e^* = \text{argmax}_{[ei \varepsilon e]}\ Bel(e_i)$$
$$a^* = \text{Projection}_{[\text{Assertions}]}(e^*).$$

The e-consultation ends with the e-doctor generation of the medical recommendations including necessary prescriptions of medications.

Finally, and as in any decision process under uncertainty, there will be always risk associated with edoctor medical decision process. This is risk is defined as the plausibility of the evidence against the selected assertion; that is, the plausibility of the negation of e*. This amount is also equal 1 minus the Belief of e*. We then have:

$$R(\text{assertion}(e^*), \alpha) = \text{Risk (e-doctor decision)} = Pl(\text{not } e^*) = 1 - Bel(e^*).$$

The telemedicine system should also let aware the e-patient that the e-doctor recommendation is associated with a decision risk of 1 – Bel(e*).

Unfortunately, in practice, the computations above may be very lengthy and expensive when the feasible medical space F is large. The normalization factor can be very costly when F is large. The normalization factor is originally computed as the total support of D in F; that is, we have to consider every element in F and count the number of element in D that are compatible with this element in F. This is simply too long and too expensive. We can show, as in (Wang, W., and McClean. S., 2008), that we can instead consider the elements in D and count the number of elements in F that are compatible with this element in F. This may be written as $\sum_{f\in F}$ [{dεD such that $d\Delta_\alpha$ f}] = $\sum_{x\varepsilon D}$ [{fεF such that $d\Delta_\alpha$f}]. This will be translated in the claims to follow.

Claim 1: m_G^α is a mass function.
Proof: Simply because m_G^α: $2^F \rightarrow$ [0 1] and $|s_G^\alpha(F)|$ is a normalization factor in $m_G^\alpha(y) = |s_G^\alpha(y)|/|s_G^\alpha(F)|$ where $s_G^\alpha(F)$ = {{yεG such that $y\Delta_\alpha x$}, xεF}. eop.

Claim 2: For α=1, $m_G^1(x) = |s_G^1(x)|/|s_G^1(F)|$where $|s_G^1(F)|$ = {{yεG such that y‹x}, xεF}and the number of subsets compatible with e_i is equal to $2^{|ai|-|ei|}$.
Proof: Δ_α becomes ‹, for α=1. Then see (Wang H. and Liu, J. 2008, Wang, W., and McClean. S., 2008). eop.

Claim 3: For α=0, the number $z^{\alpha=0}(e_i)$ of α-compatible subsets in an e_i, a value of an attribute V_i in F is equal to $z_{\alpha=0}(e_i) = \sum_{k=1,|ei|} \binom{|ei|}{i} 2^{|ai|-k}$.

Proof: To simplify the notation, let us ignore the subscript k indicating the assertion in e^k. Every subset of elements in e_i generates a set of subsets for each combination of those elements. That is, each combination generates $2^{|ai|-c}$ where c is the size of the combination (Claim 2, or Wang H. and Liu, J. 2008, Wang, W., and McClean. S., 2008). Then, for every i=1,$|e_i|$ there are $\binom{|ei|}{i} = |e_i|!/i!(|e_i|-i)!$ combinations of size $2^{|ai|-i}$. eop.

Claim 4: The number $z_\alpha(e_i)$ of α-compatible subsets in an e_i, a value of an attribute V_i in F is equal to $z_\alpha(e_i) = 2^{|ai|-\eta(\alpha|ei|)}$ where η(x) denotes the next higher integer.
Proof: In total we have z(e_i) subsets. The α-compatibility is defined by '$e_i\Delta_\alpha y$ if and only if $|e_i \cap y|/|e_i| \geq \alpha$.' That is, $|e_i \cap y| \geq \alpha|e_i|$.That is, among the z($e_i$) subsets we are only interested in those subsets with a size equal to or greater than $\alpha|e_i|$. We need to round $\alpha|e_i|$ to the next higher integer $\eta(\alpha|ei|)$. The rest is straightforward. eop.

The e-doctor information process

The e-doctor is now equipped with an e-consultation e in F, the e-patient medical data set D={D_k, k=1,M_D} where D_k={d_{ij}^k, i=1, N_D^k; j=1,M_D^k} from all local hospitals members of the telemedicine environment, and the medical feasible set F. It is important to note that if e is not in F then the e-doctor cannot generate medical recommendations. We are then only looking for those medical records that are supporting the information in the e-consultation records. The information support is defined by the αcompatibility relation '$x\Delta_\alpha y$ if and only if $|x \cap y|/|x| \geq \alpha$.' That is, we are looking for the subset of D that

are α-compatible with the e-consultation record e, i.e., $\{x \varepsilon D / x\Delta_\alpha e\}$. The number of elements of D that are α-compatible with e is given by $s_D{}^\alpha(e)$.

The e-consultation record $e=\{e^j = (e^j{}_1, \ldots, e^j{}_{Ne}), j=1,M_e\}$ is in the medical feasible space $V=\prod_{j=1,MV} V_j$. We can then compute $s_D{}^\alpha(e)$ as the product of all $s_D{}^\alpha(e_i)$, $i=1,M_e$. That is:

$$s_{D\alpha}(e_j) = \prod_{i=1,Ne} s_{D\alpha}(e_{ji}),$$

The term $s_D{}^\alpha(e_i)$ is in turn defined as computed earlier as follows:

$$s_D{}^\alpha(e^j{}_i) = 2^{|ai|-\eta(\alpha|eji|)} \text{ where } \eta(x) \text{ denotes the next higher integer.}$$

Claim 5: The number of subsets of D compatible with e is $s_D{}^\alpha(e)$ equals $2^{\sum i=1,Me\ [|ai|-\eta(\alpha|ei|)]}$.
Proof: To simplify the notation, let us ignore the subscript k indicating the assertion in e^k. Then $e=\{e_i = (e_{i1}, \ldots, e_{iMe}), i=1,N_e\}$ is in the medical feasible space $V=\prod_{j=1,MV} V_j$. We have $s_D{}^\alpha(e) = \prod_{n=1,Me} s_D{}^\alpha(e_n)$, then because $s_D{}^\alpha(e_i) = 2^{|ai|-\eta(\alpha|ei|)}$ where $\eta(x)$ denotes the next higher integer we obtain the equation. eop.

At this point, the e-doctor can act on the information he/she has on hand. All the information available is assembled in terms of an α-compatibility level. The e-doctor should decide how much information he/she needs to process by deciding on the α value between 0 and 1. If the e-doctor adopts an α-value of zero then he/she will use all information available to him/her, even when this information is least compatible with data from medical records at local hospitals, and the feasible medical space. An α value of 1 means that the e-doctor only accepts information that is fully compatible with the available data from the patient medical records and the medical feasible space. We can think of, at least, two types of e-doctors: the total e-doctor, and the prudent e-doctor. The total e-doctor uses all available information corresponding to α=0. The prudent e-doctor only uses information that is fully compatible (α=1) with patient's medical records at local hospitals and the feasible medical space.

The total e-doctor

The total e-doctor uses all available information on medical records and in the feasible medical space. This corresponds to α=0. In this case, the number $z^0(e_i)$ of compatible subsets in an e_i, a value of an attribute V_i in F is equal to $z^0(e_i) = \sum_{k=1,|ei|} (^{|ei|}{}_i)2^{|ai|-k}$. On all e, the number of compatible subsets, for α=0, is then equal to $z_0(e) = \prod_{i=1,Me} z_0(e_i)$ or $\prod_{i=1,Me} [\sum_{k=1,|ei|} (^{|ei|}{}_i)2^{|ai|-k}]$.

Let us now go back to our belief structure to assist the e-doctor in making his/her medical recommendations. F was defined above to be our frame of discernment. The belief structure for our patient medical data set D in relation to F is defined as follows:

$$m_D{}^\alpha: 2^V \rightarrow [0\ 1]$$
$$m_D{}^\alpha(e) = |s_D{}^\alpha(e)| / |s_D{}^\alpha(F)|$$
$$\text{where } s_D{}^\alpha(F) = \{\{y \varepsilon D \text{ such that } y\Delta_\alpha x\}, x \varepsilon F\}$$

Then after imposing α=0, for the case of our total e-doctor, we obtain a new belief structure as follows:

m_D^0: $2^V \rightarrow$ [0 1]

$m_D^0(e) = |s_D^0(e)| / |s_D^0(F)|$

where $s_D^0(F) = \{\{y \varepsilon G \text{ such that } y \Delta_0 x\}, x \varepsilon F\}$

We then obtain:

$$s_{D0}(e) = \prod_{i=1,Me} [\sum_{k=1,|ei|} (|ei|_i) 2_{|ai|-k}];$$

$$s_{D0}(F) = \sum_{x \varepsilon F} \{\prod_{i=1,Me} [\sum_{k=1,|xi|} (|xi|_i) 2_{|ai|-k}]\};$$

$$m_D^0(e) = |s_D^0(e)| / |s_D^0(F)|.$$

The total e-doctor, as for any other e-doctor, will accept his/her amount of decision risk defined as the plausibility of the evidence against his/her selected assertion. His/her risk is then given by the plausibility of the negation of $e_{\alpha=0}$*. This amount is also equal 1 minus the Belief of $e_{\alpha=0}$*. We then have:

$$R(\text{assertion}(e_{\alpha=0}^*),0) = \text{Risk (total e-doctor decision)} = Pl(\text{not } e_{\alpha=0}^*) = 1 - Bel(e_{\alpha=0}^*).$$

The telemedicine system should also let aware the e-patient that the e-doctor recommendation was made based on all available evidence and the e-doctor played the role of a total e-doctor.

The prudent e-doctor

The prudent e-doctor uses only that available information on medical records and in the feasible medical space that is fully compatible. This corresponds to α=1. In this case, the number $z^1(e_i)$ of compatible subsets in an e_i, a value of an attribute V_i in F is equal to $z^1(e_i) = 2^{|ai|-|ei|}$. On all e, the number of compatible subsets, for α=1, is then equal to $z^1(e) = \prod_{i=1,Me} z^1(e_i)$ or $\prod_{i=1,Me} 2^{|ai|-|ei|}$.

Let us now go back to our belief structure to assist the e-doctor in making his/her medical recommendations. F was defined above to be our frame of discernment. The belief structure for our patient medical data set D in relation to F is defined as follows:

m_D^α: $2^V \rightarrow$ [0 1]

$m_D^\alpha(e) = |s_D^\alpha(e)| / |s_D^\alpha(F)|$

where $s_D^\alpha(F) = \{\{y \varepsilon D \text{ such that } y \Delta_\alpha x\}, x \varepsilon F\}$

Then after imposing α=1, for the case of our prudent e-doctor, we obtain a new belief structure as follows:

$y \Delta_\alpha x$ becomes $y \lessdot x$;

m_D^1: $2^V \rightarrow$ [0 1]

$m_D^1(e) = |s_D^1(e)| / |s_D^1(F)|$

where $s_D^1(F) = \{\{y \varepsilon G \text{ such that } y \lessdot x\}, x \varepsilon F\}$

We then obtain:

$$s_{D1}(e) = \prod_{i=1,Me} 2^{|a_i|-|e_i|};$$

$$s_{D1}(F) = \sum_{x \varepsilon F} \{\prod_{i=1,Me} 2^{|x_i|-k}\};$$

$$m_D^1(e) = |s_D^1(e)| / |s_D^1(F)|.$$

The prudent e-doctor, as for any other e-doctor, will accept his/her amount of decision risk defined as the plausibility of the evidence against his/her selected assertion. His/her risk is then given by the plausibility of the negation of $e_{\alpha=1}$*. This amount is also equal 1 minus the Belief of $e_{\alpha=1}$*. We then have:

$$R(\text{assertion}(e_{\alpha=1}*),1) = \text{Risk (Prudent e-doctor decision)} = Pl(\text{not } e_{\alpha=1}*) = 1 - Bel(e_{\alpha=1}*).$$

The telemedicine system should also let aware the e-patient that the e-doctor recommendation was made based on all available evidence and the e-doctor played the role of a prudent e-doctor.

Numerical example

Consider an e-patient consultation in a telemedicine environment associated with one local hospital. We used several arbitrary medical conditions {ci, 1-1,35} taken from the medical database. Assume that this hospital is HIPAA certified and that medical records are authorized to be exchanged with the permission of the e-patient in a secure manner to the e-patient privacy satisfaction. Assume that the e-consultation has generated the following record e as follows:

$$e=\{e^1, e^2\}$$

$$e^1 = (\{a_1:\{ c10, c6\}, \{c7, c4, c2\})$$

$$e^2 = (\{a_2: \{c10\}, \{c7, c4, c2\})$$

Assume that the e-doctor arranged to obtain the e-patient medical record shown in the following dataset D:

e-Patient Medical Dataset D = <D_1 = <{c1}, {c2}>; D_2 = <{c3}, {c4, c5}>; D, = <{c6}, {c7}>; D_4 = <{c6}, {c4}>; D_5 = <{c8}, {c9}>; D_6 = <{c10}, {c4}>; D_7 = <{c6, c11}, {c7}>; D_8 = <{c10, c3}, {c4, c5}>; D_9 = <{c6, c3}, {c4, c5}>>

Also let the feasible space be given by the following data set:

Feasible Medical Space for e-Consultation = <F_1 = <{c6, c10, c12}, {c13, c7}>; F_2 = <{c6, c13, c14}, {c15, c16, c17}>; F_3 = <{c6, c18, c19}, {c7, c20, c21}>; F_4 = <{c6, c22, c23}, {c7, c16, c24}>; F_5 = <{c6, c3}, {c25, c4, c5}>; F_6 = <{c6, c10}, {c4, c7, c2}>; F_7 = <{c10}, {c4, c7, c2}>; F_8 = <{c10, c26}, {c7, c27, c25}>; F_9 = <{c10, c28}, {c 29, c30, c4}>; F_{10} = <{c8, c10}, {c2, c9, c16}>; F_{11} = <{c31, c32, c10}, {c17, c33, c34}>; F_{12} = <{c10, c35, c36}, {c34, c35, c36}>>

The computation of the normalization factors are given in Table 1:

Table 1: Computation of the normalization factor $\|s_D^\alpha(F)\|$		
Feasible tuples	α=1	α=0

F_1	2	5
F_2	0	0
F_3	1	2
F_4	1	2
F_5	2	2
F_6	1	5
F_7	1	2
F_8	0	0
F_9	1	2
F_{10}	0	0
F_{11}	0	0
F_{12}	0	0
Total:	9	20

We then obtain the following belief values:

Case of prudent e-doctor, with α=1:

$m_D^1(e^1) = |s_D^1(e^1)|/|s_D^1(F)| = 2/9 = 0.22$ m_D^1
$(e^2) = |s_D^1(e^2)|/|s_D^1(F)| = 1/9 = 0.11$
$Bel_D^1(e^1) = .33$
$Bel_D^1(e^2) = .22$

Case of total e-doctor, with α=0:

$m_D^0(e^1) = |s_D^0(e^1)|/|s_D^0(F)| = 5/20 = 0.25$ m_D^0
$(e^2) = |s_D^0(e^2)|/|s_D^0(F)| = 2/20 = 0.10$
$Bel_D^0(e^1) = .35$
$Bel_D^0(e^2) = .10$

Risks associated with the prudent doctor are as follows:

$R(\text{assertion}(e^1), \alpha=1) = 1 - Bel_D^1(e^1) = .67$
$R(\text{assertion}(e^2), \alpha=1) = 1 - Bel_D^1(e^2) = .78$

Risks associated with the prudent doctor are as follows:

$R(\text{assertion}(e^1), \alpha=0) = 1 - Bel_D^0(e^1) = .65$
$R(\text{assertion}(e^2), \alpha=0) = 1 - Bel_D^0(e^2) = .90$

One can then see that the optimal solution for both the prudent e-doctor and the total e-doctor is to select the assertion a_1:{ Fibromyalgia, Rheumatoid Arthritis } that has the highest belief value. The prudent edoctor has shown higher risk since he/she has made the decision based merely on the fully compatible evidence. The total doctor who added the partially compatible evidence available to him/her has secured a higher belief value and a lower risk associated with the selected assertion.

Managerial implications

We studied a business environment, where telemedicine is the target business, with the objective to secure a lasting business value generation capability. In this data-based computing environment, unless telemedicine customers are satisfied there may be no business value to maintain. This satisfaction target relies mainly on the quality of the decision support information generated to e-doctors

We proposed a method to collect, assemble, and combine evidence before decision support is generated. E-consultations can benefit from our proposed method and e-doctors can assemble patient's medical records and combine them with available relevant medical knowledge before producing medical recommendations. We showed how to transform medical data into belief structures that can be combined and processed. Belief measures may be obtained and the medical assertion that corresponds to the highest belief is the one retained. Medical recommendations are designed according to the retained belief values.

The belief model we presented is generic in the sense that it can be applied to any other decision support case where there is a great deal of uncertainty. When a Bayesian model cannot be constructed, and only partial information is available, the construction of a belief model is consequential. In this case, optimal decisions can be made and risks assessed in a statistically sound way.

Conclusion

This paper treated telemedicine as a business problem where information of e-patients is only partial and uncertainty cannot be handled in a Bayesian manner. In addition to demonstrating a method to construct belief structures based on e-patient medical records and the feasible medical space associated with the econsultation process, we introduced partial compatibility of evidence to maximize the use of available partial information. . E-doctors assertions are processed and optimal medical conditions are generated in a risk-driven manner.

Professionals working at the decision support level in telemedicine can transform available data into belief structures that can be easily combined using Dempster's rule and processed to provide the decision support they need with better accuracy while taking into account of all available invaluable partial information.

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The British Industrial Revolution - A Travel Study Course to England to study: Developing Student Perspective on Business Theory through Distance in Space and Time

DR. EDWARD SHOWALTER

Randolph-Macon College

Abstract

This paper outlines the development of a Travel Study Course to England focused on the British Industrial Revolution. Learning objectives and course requirements are included. The author makes observations about the secondary effects of the experience on the student's perspectives toward the current domestic and international business environment, and theory. These secondary effects may be equally or more important than the direct student learning outcomes.

Introduction

For several years, students from a small liberal arts college have had the opportunity to participate in a one month January term trip to England to study Business and/or Economics. The nature of the course(s) offered has varied and most recently has included a course on the Industrial Revolution in Great Britain. This paper outlines the development of the course to date including learning objectives and course requirements and makes observations about the possibly more important secondary effects

of the experience on the student's perspectives toward the current domestic and international business environment and theory.

The Travel Program

While travel and study abroad issues are not the focus of this paper, there are some specific elements of the travel program and partner institution that are central to the success of the course. The College has a longstanding partnership with Wroxton College near Banbury, England. Wroxton College is a satellite site of Fairleigh-Dickenson University in New Jersey. Wroxton College runs regular semester programs in the Spring and Fall, but those programs do not coincide with the January Term class, so the facility is available for the course. Wroxton is housed in a 17th century Jacobean mansion with a few out-buildings and has classroom, housing, and dining facilities on site.

The course is divided into two segments. The first week and the beginning of the second classes are held on the College's home campus. The travel portion comprises the remainder of the four week course. With the exception of a four-day, three-night stay in London the students and faculty reside at Wroxton.

Single day excursions include visits to sites/destinations such as Stonehenge, Bath, Oxford, Warwick, and Stratford. Many of the

single day excursions are not directly related to a specific course, but additional excursions are course specific. The most important for the Industrial Revolution course is a trip to the Black Country Living Museum in Dudley (Black County Living Museum)

Course Objectives and Key Questions

Student Learning Objectives are fairly straightforward:

1. Develop an understanding of the timeline, influences on and impact of the Industrial Revolution in Great Britain.
2. Develop an understanding of environmental forces with an emphasis on how they shaped industrialization in Great Britain.
3. Explore one historic industrialization topic in detail.
4. Develop and present findings of industrialization topics.
5. Journalize observations and reflections.

As a resource to aid students in accomplishing their objectives they are asked to focus on five key questions:

1. What defines the Industrial Revolution?
2. What was Britain's role in the Industrial Revolution: Why did these things happen in Great Britain?
3. What has been the impact of the Industrial Revolution on a given industry?
4. What has been the impact of the Industrial Revolution on Great Britain?
5. What has been the impact of the Industrial Revolution beyond Great Britain?

Course Activities - Deliverables

Five specific activities are required of the students in the course: daily journal, timeline presentation, tutorials,

substantive postings, and a culminating presentation on a focused topic.

Journal: Throughout the course they are to keep a journal reflecting on their experience. The syllabus includes several guidelines steering the students toward a more reflective rather than reporting mode in their journal entries. This particular exercise is graded primarily at the end of the course, but the instructor may review collect a journal at any time for review. This exercise helps the student remember the activities of the day and to reflect on their learning throughout the experience.

Timeline: In the segment of the course prior to departure, students divide into groups to prepare a timeline of the Industrial Revolution in Britain including the immediate antecedent and subsequent period spanning 1700 to 1950. Based on the size of the class, the time period is broken up into four or five equal segments and each group is responsible for creating and presenting their period according to a specified structure. These presentations take place the day before departure, and are presented in chronological order. This exercise creates a broader sense of the entire period for the class.

Tutorials: In keeping with the tradition of the British education system, students participate in a series of tutorials.

For this courses tutorials the instructor gives the students a series of quotes and they are required to prepare an outline of their research and be prepared to discuss their findings in a small group format with the instructor. An example of a quote used is: "The Industrial Revolution was another of those extraordinary jumps forward in the story of civilization." (Stephen Gardiner) and the students are asked to focus on the question: What characterizes an "extraordinary jump forward"? This exercise develops the student's skills in independent research, critical thinking, and small group communication.

Substantive Posting: Over the course of the term, students are expected to complete three substantive reflection postings per week on a forum through the College's course management software. These posts should include both 1: at least one accurate fact relating to an issue in the course (a list of issues is included in the syllabus) and identified within a time period segment as defined in their timeline and 2: a reflection of the impact of that fact as it relates to one of the Key Course Questions. The information for posts may come from course texts or any other academically viable source including well recorded observations during the travel. Students are also expected to reply to posts from other students. This exercise engages the students in interactive writing and research as well as discussion.

Culminating Experience Presentation: At approximately the halfway point of the course, students self-select groups of two or three and prepare a presentation on a focused topic from the course material. These presentations are made on the last day of the class before returning home. This exercise adds an element of deeper exploration and research to the course where many of the course activities are more focused on breath.

Faculty Observations – Developing Perspective

Merriam-Webster provides the following definition of "perspective" a: the interrelation in which a subject or its parts are mentally viewed:, b: the capacity to view things in their true relations or relative importance. (MeriamWebster.com.) This interrelation and concept of relative importance is perhaps the strongest student learning outcome, even though it is conceivably a secondary outcome to the stated learning outcomes.

Developing an historical understanding of Business, Management or Economics is often included as an outcome for courses in those areas, and is usually addressed through a chapter or chapter section on the historical development the theories being discussed. This author certainly has no objection to this method, and has used it and continues to as appropriate is their teaching. Nevertheless, the result of this method is often rote memorization of an order of events, or the ability to describe

the development of a particular theory. Rarely is there the development of a true change in perspective or mental view. Experiential learning through travel study provides a higher likelihood that such a change will occur. Faculty observation supports this change in student perspective. Much like the story of the blind men each describing an elephant differently based on where they could touch the animal, the students go into a travel course based on their own limited viewpoint and experience. Two factors help them develop a greater perspective – time and distance.

Time and distance function to separate what they are studying from current business practices. This separation – long ago and far away – makes reading or hearing about it seem less real. By taking them to the sites and directly studying the topics it becomes far more tangible. The highlight for this course is the day-long trip to the Black County Living Museum. The Museum has collected buildings and various artifacts from the period of the British Industrial Revolution and re-created or refurbished them. Student have the opportunity to see chain being made by hand (link by link), to see functioning steam engines, to visit a turn of the 20th century school (complete with a lesson) and to tour though a coal mine in the pitch dark. These exhibits and others

are supplemented by living-history performers who recount the life and work of their period.

Following the visit to the museum one of the students posted on the class forum:

> One of my favorite parts of this trip was getting to go down into a working coal mine. While learning about the Industrial Revolution in England a reoccurring topic was the dangers and hardships that the coal mine workers endured in their job. While down in the mine I learned how children younger than 10 were working down in the mines. Also, one thing that really stuck out to me was when our tour guide said that children workers would often eat candle sticks because they were made out of animal fat. This shows how terrible the conditions were for these workers, and how little they were paid.

Another posted:

> The first thing I thought of was why they would call this area the "Black Country", I soon discovered it was because the smog that was produced with the use of machines that were booming during the early stages of the Industrial Revolution. A big part of life in this area was the need for coal in order to active these great machines of innovation. It was very interesting to learn about all the jobs people had to do in order to successfully gather coal in a productive manor. I was aware that children were used in factories during this time period, but I had no idea they were allowed to work in those scary coal mines. It not only was this harsh labor, but it was also incredibly detrimental to these children's bodies. …

These are just two of the responses that partially demonstrate a change in perspective taking place for the students, in these cases their perspective toward child labor and labor conditions in general. Other examples of changing perspective can be found in the postings and journals of the students.

This sort of change in perspective makes a huge difference when these students discuss the impacts of technological development or labor disputes in later classes.

Next Steps

This trip will travel again in January 2017. While the changes in perspective are observable anecdotally, the author plans to develop a pre-test post-test instrument to quantitatively measure changes in perception to see if they are indeed as significant as perceived.

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The Effect of Geographic Location, Lagged Unemployment Rates, and the National Unemployment Rate on State-level Monthly Unemployment Rates

William Levernier, Georgia Southern University, PO Box 8152, Statesboro, GA 30460-8152
Mark Yanochik, Georgia Southern University, PO Box 8152, Statesboro, GA 30460-8152

ABSTRACT

This paper examines fluctuations in state-level monthly unemployment rates from January 1976 to December 2014. Using data from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics series, patterns in the monthly unemployment rates of the 50 states and the District of Columbia are examined. The primary focus of the paper is to determine how state-level unemployment rates are affected by geographic location, using both Census Regions and Census Divisions to indicate location. A second focus is to determine the effect that the national unemployment rate has on state-level unemployment rates. The third, and final, focus is to determine how a state's current unemployment rate is affected by its past unemployment rates. The major findings of this paper are that states in the South Census region and East South Central Census division tend to have higher unemployment rates than states located elsewhere; 2) State-level unemployment rates are strongly affected by the national unemployment rate, but the strength of the effect varies greatly from state to state; and 3) A state's current unemployment rate is affected by its past unemployment rates.

INTRODUCTION

In this paper we examine the extent to which state unemployment rates are affected by geographic location, the national unemployment rate, and past unemployment rates in the state. These issues are examined using seasonally adjusted state-level monthly unemployment data from January 1976 to December 2014 for the fifty states and the District of Columbia.

In the next section, we briefly review the literature on state-level unemployment, focusing on empirical studies that attempt to explain state-level unemployment as a function of business cycles and labor market stationarity. Following the literature review, we discuss the BLS data used in this study and provide descriptive statistics. In this section, we describe the following variables: the mean monthly state unemployment rate, the mean monthly difference between the state and US unemployment rate, the monthly state means by Census Region, and the monthly state means by Census Division. We next present and discuss the regression models employed in this paper. The paper ends with a summary and concluding remarks.

LITERATURE REVIEW

State and regional unemployment in the United States has been studied broadly in previous literature. For the purposes of this study, we will examine the literature that focuses on the following areas of American state and regional unemployment: US business cycles and the degree of labor market stationarity.

The relationship of state and regional unemployment to US business cycles has received critical attention in previous research. Owyang, et. al. (2005) explores the phases of growth rates in states relative to the US aggregate business cycle, using a regime-switching model to explain the characteristics of state-level growth

rates. They find that in individual states, expansion growth rates are related to education and age compositions, whereas recession-phase growth rates are related to industry mix.

Crone (2005) looks at the components of state-level business cycles and argues that, instead of grouping states, as the Bureau of Economic Analysis (BEA) does, into regions based on socioeconomic characteristics, regions should be defined based the similarity of factors that contribute to state business cycles. Crone applies an *k*-means cluster analysis to business cycle components and is able to identify an alternate regional grouping of states that has some improved cohesion characteristics over the BEA regions.

Owyang, et. al. (2008) examines business cycles in the US with a dynamic factor model that identifies common factors that underly fluctuations in state-level income and employment growth. These authors find state-level fluctuations exhibit three common influences: the aggregate fluctuations in real activity associated with the national business cycle, the state's degree of industry mix, and non-industry factors such as agglomeration and the characteristics of neighboring states.

An interesting study of the asymmetry of US state-level business cycles is Ewing and Thompson (2010). The authors explore two types of asymmetry in the adjustment process of a stationary time series. Using state-level coincident indexes, these authors conclude that clearly state business cycles differ from national business cycles with respect to timing and severity. The found that state economic growth rates could be characterized in three ways: stationary processes with asymmetric adjustments, symmetric stationary processes, and non-stationary.

Izraeli and Murphy (2003) examine the impact of industrial diversity on state unemployment rates and per-capita income. The authors argue that industrial diversification can serve as a type of unemployment insurance during downturns in the business cycle. Using panel data for seventeen states, they find a strong link between industrial diversity and reduced unemployment.

There have been a number of papers that study the extent that labor market stationarity effects state and regional unemployment. Romero-Avila and Usabiaga (2007) examine the existence of infrequent shocks and the degree of persistence of state unemployment rates. Using unit root tests, these authors conclude that state unemployment rates tend to be stationary and follow the hysteresis paradigm, which is in contrast to the more commonly held belief by researchers that state unemployment is closely related to the natural rate, structuralist paradigm. The authors suggest that their findings have significant policy implications. They believe that because of the degree of stationarity of state unemployment rates, stabilization policy may have more long lasting effects on state unemployment rates than previously understood.

An extension of Romero-Avila and Usabiaga's work is found in Sephton (2009). His evidence suggests that both the hysteresis and structuralist models of state unemployment can be useful in explaining state unemployment. However, the time period under consideration accounts heavily into which view is more accurate. Sephton concludes that over the last 30 years most state unemployment rates were characterized by stationarity fluctuations around a shifting trend, which overall supports the hysteresis paradigm.

A paper that compares US state unemployment rates and European Union unemployment rates is Romero-Avila and Usabiaga (2009). The authors employ panel stationarity tests to examine the main unemployment paradigms, looking specifically at data from the US states and the EU over roughly the last 30 years. The authors' findings suggest that US state unemployment is characterized by stationarity, whereas EU unemployment rates exhibit more closely the hysteresis paradigm. Romero-Avila and Usabiaga also conclude that adverse macroeconomic shocks, such as interest rates and oil prices, cause permanently higher

unemployment rates in the EU than in the states. From this finding they conclude that EU countries should adopt stabilization policies that allow greater labor market flexibility.

THE DATA AND DESCRIPTIVE STATISTICS

The state-level data used in this study are obtained from the U.S. Bureau of Labor Statistics, "Local Area Unemployment Statistics" series (www.bls.gov/lau/). The national unemployment data are obtained from the U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey" series (www.bls.gov/cps/#data). Seasonally adjusted data were used for both the state and national data.

To determine the effect of geographic location on a state's unemployment rate, we used Census regions and Census divisions as our geographic definitions. A map that shows the regional and divisions is included in the Appendix at the end of the paper.

Table 1 reports the mean seasonally adjusted unemployment rate for each state, along with the Census region and Census division in which it is located. There is substantial discrepancy in the mean unemployment rates. The mean rates vary from a low of 3.58 percent (Nebraska) to a high of 8.34 percent (West Virginia). Twenty-one states have a mean rate higher than that of the United States and 30 have a mean rate that's lower. Of the twenty-one that have a higher mean rate than the U.S., nine are in the South Census region and six are in the West Census region. Further, eleven states have a mean rate that's above 7.00 percent (five are in the South Census region and four are in the West Census region), while eleven states have a mean rate that's below 5.00 percent (six are in the Midwest Census region and two are in the Northeast Census region).

Table 2 reports the results for the mean difference between a state's monthly unemployment rate and the U.S. unemployment rate. The difference in the two unemployment rates for a particular month can be either positive or negative. As such, the mean value for a state can either be positive or negative. The mean difference ranges from a high of 1.86 percent (West Virginia) to a low of -2.90 percent (Nebraska). Twenty-one states have a mean with a positive value, which indicates that, on average, the unemployment rate in those states is higher than that of the United States (nine of these states are in the South Census region and six are in the West Census region).

Table 1
Mean Monthly Unemployment Rate: Jan. 1976 – December 2014 (Sorted from highest to lowest)

State	Mean	Census Division	Census Region
WV	8.34	South Atl.	South
MI	8.22	ENC	Midwest
AK	8.04	Pacific	West
DC	7.77	South Atl.	South
MS	7.72	ESC	South
CA	7.46	Pacific	West
LA	7.42	WSC	South
AL	7.34	ESC	South
OR	7.32	Pacific	West

WA	7.17	Pacific	West
IL	7.05	ENC	Midwest
KY	6.92	ESC	South
OH	6.88	ENC	Midwest
NM	6.79	Mountain	West
NY	6.70	Middle Atl.	Northeast
AR	6.69	WSC	South
SC	6.68	South Atl.	South
RI	6.64	New	Northeast
NV	6.64	Mountain	West
TN	6.58	ESC	South
PA	6.58	Middle Atl.	Northeast
USA	**6.48**		
NJ	6.43	Middle Atl.	Northeast
AZ	6.41	Mountain	West
IN	6.37	ENC	Midwest
FL	6.33	South Atl.	South
ID	6.16	Mountain	West
TX	6.14	WSC	South
GA	6.12	South Atl.	South
MO	6.10	WNC	Midwest
ME	6.01	New	Northeast
MT	5.93	Mountain	West
NC	5.88	South Atl.	South
WI	5.68	ENC	Midwest
MA	5.66	New	Northeast
CT	5.56	New	Northeast
CO	5.55	Mountain	West
DE	5.52	South Atl.	South
MD	5.37	South Atl.	South
OK	5.22	WSC	South
HI	5.07	Pacific	West
UT	4.99	Mountain	West
MN	4.97	WNC	Midwest
WY	4.96	Mountain	West
VA	4.81	South Atl.	South
VT	4.81	New	Northeast
KS	4.72	WNC	Midwest
IA	4.72	WNC	Midwest
NH	4.44	New	Northeast
ND	3.95	WNC	Midwest
SD	3.75	WNC	Midwest
NE	3.58	WNC	Midwest

Table 2
Mean Monthly Difference State – US Unemployment Rate: Jan. 1976 – December 2014
(Sorted from highest to lowest)

State	Mean	Census Division	Census Region
WV	1.86	South Atl.	South
MI	1.74	ENC	Midwest
AK	1.56	Pacific	West
DC	1.29	South Atl.	South
MS	1.25	ESC	South
CA	0.98	Pacific	West
LA	0.94	WSC	South
AL	0.87	ESC	South
OR	0.85	Pacific	West
WA	0.69	Pacific	West
IL	0.58	ENC	Midwest
KY	0.44	ESC	South
OH	0.40	ENC	Midwest
NM	0.31	Mountain	West
NY	0.22	Middle	Northeast
AR	0.22	WSC	South
SC	0.21	South Atl.	South
RI	0.17	New	Northeast
NV	0.16	Mountain	West
TN	0.10	ESC	South
PA	0.10	Middle	Northeast
NJ	-0.05	Middle	Northeast
AZ	-0.06	Mountain	West
IN	-0.11	ENC	Midwest
FL	-0.15	South Atl.	South
ID	-0.32	Mountain	West
TX	-0.33	WSC	South
GA	-0.36	South Atl.	South
MO	-0.38	WNC	Midwest
ME	-0.46	New	Northeast
MT	-0.55	Mountain	West
NC	-0.60	South Atl.	South
WI	-0.79	ENC	Midwest
MA	-0.81	New	Northeast
CT	-0.92	New	Northeast
CO	-0.92	Mountain	West

DE	-0.96	South Atl.	South
MD	-1.10	South Atl.	South
OK	-1.25	WSC	South
HI	-1.41	Pacific	West
UT	-1.48	Mountain	West
MN	-1.51	WNC	Midwest
WY	-1.51	Mountain	West
VA	-1.66	South Atl.	South
VT	-1.67	New	Northeast
KS	-1.75	WNC	Midwest
IA	-1.76	WNC	Midwest
NH	-2.04	New	Northeast
ND	-2.53	WNC	Midwest
SD	-2.73	WNC	Midwest
NE	-2.90	WNC	Midwest

Table 3 and Table 4 show the monthly state mean unemployment rates by Census Region and by Census Division, respectively. Table 3 indicates that the mean monthly rate of states in the South Census region is higher than that of states in the other Census regions, and that of states in the Midwest Census region is lower than that of states in the other Census regions. Additionally, the mean state – U.S. rate difference for all regions except the South is negative. Table 4 indicates that the mean monthly rate of states in the East South Central Census division is higher than that of states in the other Census divisions, and that states in the West North Central Census division is lower than that of states in the other Census divisions.

Table 3
Monthly State Means by Census Region

Census Region	Number of States	Mean State Rate	Mean State – US Rate Difference
Midwest	12	5.50	-.978
Northeast	9	5.87	-.606
South	17	6.52	.045
West	13	6.35	-.130

Table 4
Monthly State Means by Census Division

Census Division	Number of States	Mean State Rate	Mean State – US Rate Difference
East North Central (ENC)	5	6.84	0.363
East South Central (ESC)	4	7.14	0.665
Mountain	8	5.93	-0.546
Middle Atlantic	3	6.57	0.092
New England	6	5.52	-0.956

Pacific	5	7.01	0.535
South Atlantic	9	6.31	-0.163
West North Central (WNC)	7	4.54	-1.936
West South Central (WSC)	4	6.37	-0.106

The analysis so far suggests that there is a geographic pattern in state-level monthly unemployment rates over the 1976 to 2014 period. Generally, states in the South and West Census regions have higher unemployment rates than states in the Northeast and Midwest Census regions with states in the South having the highest rates and states in the Midwest having the lowest rates. It further suggests that states in the East South Central section of the South and in the Pacific section of the West have the highest unemployment rates, and that states in the West North Central section of the Midwest have the lowest unemployment rates.

THE MODELS AND REGRESSION RESULTS

Two sets of regression models are run for this paper. In the first set of models, all 50 states and the District of Columbia are included as observations in a single regression equation. To ascertain whether there are differences in monthly unemployment rates across geographic space, dummy variables related to the location of a state are included as explanatory variables. In the second set of models, separate regressions are run for each state and the District of Columbia.

There are two general forms of the regression equations that include all states as observations;

$$\mathbf{Rate}_{i,t} = \mathbf{a} + \mathbf{b}\,\mathbf{US}_t + \mathbf{D}_i \qquad (1)$$

$$\mathbf{Rate}_{i,t} = \mathbf{a} + \mathbf{c}\,\mathbf{Lag3}_{i,t} + \mathbf{d}\,\mathbf{Lag6}_{i,t} + \mathbf{D}_i \qquad (2)$$

where $\mathbf{Rate}_{i,t}$ is the seasonally adjusted unemployment rate for state i in month t.
$\mathbf{US}_t$ is the U.S. seasonally adjusted unemployment rate in month t.
$\mathbf{D}_i$ is a vector of geographic dummy variables for state i.
$\mathbf{Lag3}_{i,t}$ is the seasonally adjusted unemployment rate for state i three months prior to month t.
$\mathbf{Lag6}_{i,t}$ is the seasonally adjusted unemployment rate for state i six months prior to month t.

Three versions of the geographic dummy variable are estimated. In one model Census region dummy variables are utilized (the Midwest region is the omitted region); in a second model Census division dummy variables are utilized (the West North Central division is the omitted division); and in a third model state dummy variables are utilized (Nebraska is the omitted state). The mean monthly unemployment rate of the omitted region/division/state is lower than the other regions/divisions/states.

There are also two general forms of the regressions that estimate an equation for each state;

$$\mathbf{Rate}_{i,t} = \mathbf{a} + \mathbf{b}\,\mathbf{US}_t \qquad (3)$$

$$\mathbf{Rate}_{i,t} = \mathbf{a} + \mathbf{c}\,\mathbf{Lag3}_{i,t} + \mathbf{d}\,\mathbf{Lag6}_{i,t} \qquad (4)$$

The regression results reported in Table 5 indicate that the U.S. unemployment rate and the location of a state both have a statistically significant effect on a state's unemployment rate. The coefficient on the U.S. Rate is .8896, indicating that, on average, a change in the national unemployment rate of one percentage point induces a slightly smaller .89 percentage point change in the unemployment rate of a given state.

Further, the geographic dummy variables all suggest the existence of a geographic pattern in state unemployment rates. In the model that utilizes Census region dummy variables (where the Midwest region is the omitted region) the results indicate that a state in the South will have an unemployment rate that's 1.0180 percentage points higher than a state in the Midwest. The results also suggest that a state in the West will have an unemployment rate that's .8317 percentage points higher than a state in the Midwest, and a state in the Northeast will have an unemployment rate that's .3320 percentage points higher.

In the model that utilizes Census division dummy variables (where the West North Central (WNC) division is the omitted division) the results indicate that in four of the remaining eight regions, a state's unemployment rate will generally be at least approximately two percentage points higher than a state in the WNC division. At the high end, a state in the East South Central division is found to have an unemployment rate that's 2.6105 percentage points higher than a state in WNC division. States located in the Pacific, East North Central (ENC), and Middle Atlantic divisions are also found to have an unemployment rate that's at least two percentage points above a state in the WNC division. The results further indicate that the only division dummy with a value less than 1.0 is New England, which has a value of .9356, indicating that a state in the New England division has an unemployment rate that's .9356 percentage points higher than a state in the WNC division, on average.

The dummy variable coefficients for the model that utilizes state dummy variables (Nebraska is the omitted state) are not reported in Table 5 in order to conserve space. The coefficients on all 50 state dummy variables are statistically significant at the .01 level and all have a positive value. Twenty of the state dummy variables have a coefficient of at least 3.0, indicating that the state's unemployment rate for a given month is typically at least three percentage points higher than Nebraska's rate. At the low end, only three state dummy variable have a value less than 1.0. The three states are New Hampshire, North Dakota, and South Dakota. Two of the states are in the Midwest Census region.

Table 5
OLS Regression for Equation (1): Region, Division, and State Dummy Variable Models

Variable	No Geographic Dummies	Census Region Dummies	Census Division Dummies	State Dummies
Intercept	.3600 (7.94)	-.2499 (5.61)	-1.2040 (27.74)	-2.1661 (38.86)
US Rate	.8896 (118.17)	.8896 (121.33)	.8896 (12.48)	.8896 (169.70)
Census Region Dummy Variables		**(3)**		
South		1.0180 (35.15)		
West		.8317 (27.95)		
Northeast		.3320 (10.86)		
Census Division Dummy Variables (8)				
New England			.9356 (28.75)	
Middle Atlantic			1.9873 (62.56)	

ENC			2.2900 (62.26)	
South Atlantic			1.7529 (54.21)	
ESC			2.6105 (74.18)	
WSC			1.8270 (44.01)	
Mountain			1.3747 (47.24)	
Pacific			2.4437	
			(64.26)	
State Dummy Variables (50)				
State Variables				Not Reported Individually
R-Squared	.441	.479	.581	.731

Notes: The absolute values of the t-statistics are in parenthesis.
The coefficients on all geographic dummy variables are positive and are statistically significant at the .01 level in all three models that contain geographic dummy variables.
The covariance matrix is corrected for heteroscedasticity in all models using White's correction.

The regression results reported in Table 6 indicate that the lagged unemployment rates in a state and the location of a state both have a statistically significant effect on a state's current unemployment rate. Two lagged rates are included in the regressions: a three-month lag and a six-month lag. The two lags are found to have opposing effect on the current unemployment rate in a state, however. The three-month lag has a strong positive affect, while the six-month lag has a substantially weaker negative effect on the current rate. The magnitude of the three-month lag coefficient is about 1.7, indicating that a one percentage point increase in the unemployment rate three months ago will increase the current rate by about 1.7 percentage points. The magnitude of the six-month lag coefficient is about -.7, indicating that a one percentage point increase in the unemployment rate six months ago will decrease the current rate by about .7 percentage points. It's not surprising that the effect of the unemployment rate six months ago is weaker than the effect of the unemployment rate three months ago, but it's unclear why the unemployment rate six months ago negatively affects the current unemployment rate.

The effect of the geographic dummy variables is much weaker than in Table 5 (i.e., equation 1). A likely reason for this finding is that when lagged unemployment rates are included in the model, the importance of geographic location is greatly diminished. The coefficients on the dummy variables are still generally significant at the .01 level, but the magnitudes of the coefficients are much smaller than was previously reported.

Table 6
OLS Regression for Equation (2): Region, Division, and State Dummy Variable Models

Variable	No Geographic Dummies	Census Region Dummies	Census Division Dummies	State Dummies

Intercept	.1581 (27.14)	.1494 (25.98)	.1387 (24.15)	.1335 (16.78)
State Rate, 3 month lag	1.6577 (143.81)	1.6570 (143.82)	1.6552 (143.97)	1.6512 (144.41)
State Rate, 6 month lag	-.6841 (60.98)	-.6843 (61.00)	-.6859 (61.28)	-.6884 (61.69)
Census Region Dummy Variables (3)				
South		.0268 (5.10)		
West		.0199 (3.96)		
Northeast		.0037 (0.76)		
Census Division Dummy Variables (8)				
New England			.0239 (4.68)	
Middle Atlantic			.0536 (7.44)	
ENC			.0694 (8.75)	
South Atlantic			.0512 (8.65)	
ESC			.0814 (9.89)	
WSC			.0546 (6.25)	
Mountain			.0393 (7.22)	
Pacific			.0712 (10.81)	
State Dummy Variables (50)				
State Variables				Not Reported Individually
R-Squared	.984	.984	.984	.984

Notes: The absolute values of the t-statistics are in parenthesis.
The coefficients on all geographic dummy variables are positive and are statistically significant at the .01 level in all three models that contain geographic dummy variables, with the following exceptions: the Northeast dummy variable in the model with Census region dummy variables and the New Hampshire, North Dakota, and South Dakota dummy variables in the model with State dummy variables. The New Hampshire coefficient is significant at the .05 level, but the North Dakota and South Dakota coefficients aren't significant at even the .10 level. The covariance matrix is corrected for heteroscedasticity in all models using White's correction.

Table 7 reports the results of a separate regression for each state for equation (3). There are substantial differences among the state-level regression equations. The slope coefficients vary greatly from a low of .3165 (North Dakota) to a high of 1.6585 (Michigan). Twelve states have a slope coefficient that's at least

1.10, and 14 have a slope coefficient that's less than .70. The three states with the lowest slope coefficients are all are in the Midwest Census region and the West North Central Census division (North Dakota, South Dakota, and Nebraska). The R-squared values also vary substantially among the statelevel regressions, from a high of .899 (Virginia) to a low of .262 (Louisiana).

Table 7
OLS Regressions for Equation (3)

State	Census Region	Census Division	Intercept	US Rate	R-Squared
All States			.3600 (7.94)	.8896 (118.17)	.441
AL	South	ESC	-1.9699 (8.54)	1.4430 (36.57)	.811
AK	West	Pacific	5.1526 (3.97)	.4482 (14.42)	.260
AZ	West	Mountain	-.5150 (4.19)	1.0648 (49.54)	.834
AR	South	WSC	1.5420 (11.38)	.7962 (37.22)	.697
CA	West	Pacific	.3179 (1.92)	1.1023 (40.38)	.788
CO	West	Mountain	.3827 (2.70)	.8003 (37.93)	.703
CT	Northeast	New England	.0071 (0.03)	.8505 (23.71)	.596
DE	South	South Atl.	-.6205 (4.42)	.9448 (43.45)	.651
DC	South	South Atl.	2.7741 (14.45)	.7706 (7.42)	.618
FL	South	South Atl.	-.7222 (4.28)	1.0855 (38.16)	.823
GA	South	South Atl.	-.1776 (0.98)	.9700 (31.04)	.782
HI	West	Pacific	1.8032 (7.82)	.4954 (15.92)	.265
ID	West	Mountain	.3528 (2.52)	.8997 (44.27)	.759
IL	Midwest	ENC	-.7327 (6.47)	1.2058 (63.87)	.892
IN	Midwest	ENC	-2.3670 (16.30)	1.3517 (56.34)	.837
IA	Midwest	WNC	-.1706 (1.12)	.7574 (28.25)	.648
KS	Midwest	WNC	1.7697 (15.97)	.4583 (26.51)	.569
KY	South	ESC	-.0184 (0.15)	1.0761 (51.65)	.736
LA	South	WSC	2.9330 (9.80)	.6964 (14.93)	.262
ME	Northeast	New England	.5366 (4.77)	.8422 (50.62)	.719
MD	South	South Atl.	.5571 (6.00)	.7431 (50.15)	.789

MA	Northeast	New England	.4808 (3.01)	.7928 (30.56)	.542
MI	Midwest	ENC	-.2518 (9.91)	1.6585 (41.14)	.798
MN	Midwest	WNC	-.1034 (0.95)	.7826 (47.99)	.840
MS	South	ESC	1.4350 (9.28)	.9759 (40.65)	.646
MO	Midwest	WNC	-.0219 (0.20)	.9476 (57.59)	.873
MT	West	Mountain	1.9867 (13.08)	.6106 (27.43)	.566
NE	Midwest	WNC	.9138 (9.69)	.4129 (27.12)	.525
NV	West	Mountain	-2.7047 (10.45)	1.4417 (32.52)	.795
NH	Northeast	New England	.4004 (3.66)	.6206 (34.59)	.512
NJ	Northeast	Middle Atl.	.0594 (0.38)	.9780 (38.26)	.691
NM	West	Mountain	2.3318 (13.37)	.6856 (26.75)	.570
NY	Northeast	Middle Atl.	1.5881 (12.58)	.7842 (40.72)	.691
NC	South	South Atl.	-1.4838 (7.95)	1.1384 (38.98)	.768
ND	Midwest	WNC	1.9131 (13.69)	.3165 (13.29)	.291
OH	Midwest	ENC	-1.2873 (6.93)	1.2613 (40.19)	.841
OK	South	WSC	1.5954 (9.91)	.5604 (21.59)	.402
OR	West	Pacific	.2849 (2.24)	1.0852 (56.36)	.812
PA	Northeast	Middle Atl.	-.1801 (0.99)	1.0431 (32.92)	.848
RI	Northeast	New Eng.	-.7763 (3.77)	1.1452 (33.11)	.641
SC	South	South Atl.	-.7044 (3.97)	1.1421 (43.02)	.812
SD	Midwest	WNC	1.0611 (16.24)	.4171 (41.06)	.663
TN	South	ESC	-1.0554 (7.30)	1.1830 (47.91)	.862
TX	South	WSC	2.8274 (21.64)	.5138 (26.62)	.418
UT	West	Mountain	-.4448 (3.32)	.8399 (41.49)	.730
VT	Northeast	New Eng.	.6919 (6.78)	.6293 (36.85)	.629
VA	South	South Atl.	-.1739 (2.20)	.7699 (63.66)	.899
WA	West	Pacific	.3748 (2.78)	1.0481 (46.74)	.840
WV	South	South Atl.	.4706 (0.89)	1.2186 (13.36)	.390

WI	Midwest	ENC	-1.1679 (7.09)	1.0604 (39.57)	.811
WY	West	Mountain	1.7330 (8.67)	.5018 (16.30)	.267

Notes The absolute values of the t-statistics are in parenthesis.
The coefficients on the US Rate variable is statistically significant at the .01 level in all equations. The covariance matrix is corrected for heteroscedasticity in all models using White's correction.

Table 8 reports the results of a separate regression for each state for equation (4), where the independent variable are the state lagged unemployment rates. As in the previous table, there are substantial differences among the state-level regression equations. The coefficients on the state unemployment rate lagged three months vary from a low of 1.3075 (Louisiana) to a high of 1.8519 (Rhode Island). The coefficients on the state unemployment rate lagged six months also vary greatly, from a low (in magnitude) of -.3525 (Louisiana) to a high of -.8753 (Rhode Island). For all states, the magnitude of the coefficient on the three month lag is larger than that on the six month lag. The R-squared values are much larger than those reported in Table 7 and there is little state-to-state variation in the R-squared values.

Table 8
OLS Regressions for Equation (4)

State	Census Region	Census Division	Intercept	State Lag, 3 Months	State Lag, 6 Months	R-Squared
All States			.1581 (27.14)	1.6577 (143.81)	-.6841 (60.98)	.984
AL	South	ESC	.2323 (5.08)	1.7069 (37.67)	-.7386 (16.43)	.983
AK	West	Pacific	.2664 (4.96)	1.6550 (43.66)	-.6883 (18.48)	. 978
AZ	West	Mountain	.3830 (8.32)	1.7688 (59.86)	-.8288 (28.55)	.981
AR	South	WSC	.1404 (4.03)	1.6861 (34.25)	-.7073 (14.34)	.987
CA	West	Pacific	..2315 (7.06)	1.8094 (59.77)	-.8407 (27.98)	.990
CO	West	Mountain	.2523 (6.77)	1.7509 (50.59)	-.7969 (23.02)	.981
CT	Northeast	New England	.1635 (6.31)	1.7752 (70.90)	-.7938 (31.48)	.990
DE	South	South Atl.	.2020 (5.13)	1.5726 (26.94)	-.6119 (10.35)	.976
DC	South	South Atl.	.3907 (7.56)	1.6984 (57.13)	-.7488 (24.66)	.975
FL	South	South Atl.	.1947 (5.58)	1.7403 (34.12)	-.7715 (15.10)	.986
GA	South	South Atl.	..2535 (5.19)	1.4401 (20.29)	-.4824 (6.87)	.958
HI	West	Pacific	.1766 (5.61)	1.6027 (36.20)	-.6402 (14.60)	.979
ID	West	Mountain	.2501 (3.05)	1.4755 (19.48)	-.5168 (7.23)	.959

IL	Midwest	ENC	.2852 (5.96)	1.7087 (45.78)	-.7492 (20.22)	.980
IN	Midwest	ENC	.2019 (4.46)	1.5565 (25.44)	-.5878 (9.95)	.975
IA	Midwest	WNC	.1285 (4.34)	1.6494 (25.90)	-.6763 (10.93)	.983
KS	Midwest	WNC	.2716 (6.44)	1.6740 (32.89)	-.7315 (14.66)	.969
KY	South	ESC	.2329 (5.47)	1.6868 (35.44)	-.7206 (15.29)	.981
LA	South	WSC	.3346 (5.09)	1.3075 (9.64)	-.3523 (2.62)	.943
ME	Northeast	New England	.2203 (5.12)	1.6102 (28.47)	-.6480 (11.65)	.975
MD	South	South Atl.	.1555 (4.46)	1.5984 (37.99)	-.6889 (17.08)	.979
MA	Northeast	New England	.1615 (7.83)	1.8368 (74.04)	-.8657 (36.02)	.993
MI	Midwest	ENC	.2661 (4.42)	1.6471 (25.64)	-.6802 (11.23)	.979
MN	Midwest	WNC	.1885 (5.57)	1.6910 (41.19)	-.7292 (18.62)	.979
MS	South	ESC	.2975 (5.36)	1.4519 (29.98)	-.5512 (13.41)	.973
MO	Midwest	WNC	.2639 (5.37)	1.6204 (38.46)	-.6641 (16.22)	.971
MT	West	Mountain	.1691 (4.24)	1.6925 (42.81)	-.7214 (18.27)	.983
NE	Midwest	WNC	.1355 (4.30)	1.5969 (35.93)	-.6346 (14.67)	.973
NV	West	Mountain	.1679 (6.71)	1.8222 (61.80)	-.8479 (28.53)	..992
NH	Northeast	New England	.1941 (7.02)	1.7312 (41.29)	-.7758 (18.71)	.981
NJ	Northeast	Middle Atl.	.2267 (6.31)	1.6875 (43.44)	-.7242 (18.86)	.983
NM	West	Mountain	.3211 (6.50)	1.7245 (42.46)	-.7727 (18.77)	.979
NY	Northeast	Middle Atl.	.2598 (6.22)	1.6916 (49.62)	-.7316 (21.38)	.981
NC	South	South Atl.	.2370 (6.33)	1.5029 (26.01)	-.5434 (9.57)	.963
ND	Midwest	WNC	.1187 (3.90)	1.5817 (32.63)	-.6123 (12.85)	.975
OH	Midwest	ENC	.2493 (4.80)	1.6446 (32.34)	-.6816 (13.91)	.976
OK	South	WSC	.3015 (5.29)	1.5564 (17.12)	-.6150 (6.61)	.954
OR	West	Pacific	.3620 (5.98)	1.6224 (25.09)	-.6823 (10.73)	.968
PA	Northeast	Middle Atl.	.1931 (4.03)	1.7134 (37.17)	-.7438 (17.14)	.984
RI	Northeast	New Eng.	.1521 (6.69)	1.8519 (55.94)	-.8753 (27.31)	.994
SC	South	South Atl.	.2951 (6.00)	1.6884 (39.07)	-.7323 (17.31)	.977

SD	Midwest	WNC	.1866 (5.61)	1.5772 (27.18)	-.6266 (10.95)	.965
TN	South	ESC	.2547 (4.90)	1.6392 (35.83)	-.6774 (15.45)	.976
TX	South	WSC	.3121 (7.12)	1.6945 (27.30)	-.7458 (12.43)	.973
UT	West	Mountain	.2225 (5.61)	1.7133 (23.00)	-.7583 (10.12)	.978
VT	Northeast	New Eng.	.2113 (5.96)	1.6009 (26.64)	-.6470 (11.63)	.975
VA	South	South Atl.	.2019 (5.19)	1.6362 (37.80)	-.6787 (15.91)	.973
WA	West	Pacific	.2074 (3.48)	1.6744 (22.79)	-.6998 (10.17)	.988
WV	South	South Atl.	-.0754 (0.95)	1.5936 (22.48)	-.6383 (9.70)	.985
WI	Midwest	ENC	.2215 (4.58)	1.6475 (23.65)	-.6834 (10.34)	.976
WY	West	Mountain	.2610 (17.74)	1.6774 (31.34)	-.7298 (13.89)	. 972

Notes The absolute values of the t-statistics are in parenthesis.
The coefficients on the two lagged variables are statistically significant at the .01 level in all equations.
The covariance matrix is corrected for heteroscedasticity in all models using White's correction.

In Table 9, the regression results reported in Table 7 are used to predict the unemployment rate for each state for a given U.S. unemployment rate. Six different U.S. unemployment rates are used to make the predictions: 4.0 percent, 5.0 percent, 6.0 percent, 7.0 percent, 8.0 percent, and 9.0 percent. For a historical context, the U.S. unemployment rate was 9.0 percent or higher 48 times during the period considered in this study, and was 4.0 percent or lower 11 times. As such, these two rates can be considered extreme.

The predictions indicate a wide range of state unemployment rates for a given U.S. unemployment rate. The predictions also indicate that the range between the unemployment rate of the state with the highest rate and that with the lowest rate is likely to increase as the U.S. unemployment rate increases. When the U.S. unemployment rate is an unusually low 4.0 percent, the range in predicted state unemployment rates is 4.38 percentage points, but when the U.S. unemployment rate is an unusually high 9.0 percent, the predicted range is a much larger 7.78 percentage points.

The predictions also indicate that some states are likely to have an unemployment rate lower than the national average when the U.S. unemployment rate is low, but have an unemployment rate higher that the national average when the U.S. unemployment rate is high. Indiana, Nevada, Rhode Island, and Tennessee, for example, are predicted to have an unemployment rate below the national average when the U.S. unemployment rate is 4.0 or 5.0 percent, but are predicted to have an unemployment rate above the national average when the U.S. rate is 7.0, 8.0, or 9.0 percent.

Table 9
Predicted State Unemployment Rate for Various U.S. Unemployment Rates

State	US = 4.0	US = 5.0	US = 6.0	US = 7.0	US = 8.0	US = 9.0
AL	3.80	5.25	6.69	8.13	9.57	11.02

AK	6.95	7.39	7.84	8.29	8.74	9.19
AZ	3.74	4.81	5.87	6.94	8.00	9.07
AR	4.73	5.52	6.32	7.12	7.91	8.71
CA	4.73	5.83	6.93	8.03	9.14	10.24
CO	3.58	4.38	5.18	5.98	6.79	7.59
CT	3.41	4.26	5.11	5.96	6.81	7.66
DE	3.16	4.10	5.05	5.99	6.94	7.88
DC	5.86	6.63	7.40	8.17	8.94	9.71
FL	3.62	4.71	5.79	6.88	7.96	9.05
GA	3.70	4.67	5.64	6.61	7.58	8.55
HI	3.78	4.28	4.78	5.27	5.77	6.26
ID	3.95	4.85	5.75	6.65	7.55	8.45
IL	4.09	5.30	6.50	7.71	8.91	10.12
IN	3.04	4.39	5.74	7.09	8.45	9.80
IA	2.86	3.62	4.37	5.13	5.89	6.65
KS	3.60	4.06	4.52	4.98	5.44	5.89
KY	4.29	5.36	6.44	7.51	8.59	9.67
LA	5.72	6.41	7.11	7.81	8.50	9.20
ME	3.91	4.75	5.59	6.43	7.27	8.12
MD	3.53	4.27	5.02	5.76	6.50	7.25
MA	3.65	4.44	5.24	6.03	6.82	7.62
MI	4.12	5.77	7.43	9.09	10.75	12.41
MN	3.03	3.81	4.59	5.37	6.16	6.94
MS	5.34	6.31	7.29	8.27	9.24	10.22
MO	3.77	4.72	5.66	6.61	7.56	8.51
MT	4.43	5.04	5.65	6.26	6.87	7.48
NE	2.57	2.98	3.39	3.80	4.22	4.63
NV	3.06	4.50	5.95	7.39	8.83	10.27
NH	2.88	3.50	4.12	4.74	5.36	5.99
NJ	3.97	4.95	5.93	6.91	7.88	8.86
NM	5.07	5.76	6.45	7.13	7.82	8.50
NY	4.72	5.51	6.29	7.08	7.86	8.65
NC	3.07	4.21	5.35	6.49	7.62	8.76
ND	3.18	3.50	3.81	4.13	4.45	4.76
OH	3.76	5.02	6.28	7.54	8.80	10.06
OK	3.84	4.40	4.96	5.52	6.08	6.64
OR	4.63	5.71	6.80	7.88	8.97	10.05
PA	3.99	5.04	6.08	7.12	8.16	9.21
RI	3.80	4.95	6.09	7.24	8.39	9.53
SC	3.86	5.01	6.15	7.29	8.43	9.57
SD	2.73	3.15	3.56	3.98	4.40	4.82
TN	3.68	4.86	6.04	7.23	8.41	9.59
TX	4.88	5.40	5.91	6.42	6.94	7.45

UT	2.91	3.75	4.59	5.43	6.27	7.11
VT	3.21	3.84	4.47	5.10	5.73	6.36
VA	2.91	3.68	4.45	5.22	5.99	6.76
WA	4.57	5.62	6.66	7.71	8.76	9.81
WV	5.34	6.56	7.78	9.00	10.22	11.44
WI	3.07	4.13	5.19	6.25	7.31	8.38
WY	3.74	4.24	4.74	5.25	5.75	6.25
High	6.95	7.39	7.84	9.09	10.75	12.41
Low	2.57	2.98	3.39	3.80	4.22	4.63
Avera ge	3.92	4.81	5.70	6.59	7.48	8.37

SUMMARY AND CONCLUDING REMARKS

This paper has examined long-term trends in the seasonally adjusted monthly unemployment rates of the 50 states and the District of Columbia. The primary focus of the paper is to ascertain the role that geographic location, the national unemployment rate, and prior unemployment rates in the state play in the determination of a state's unemployment rate at a particular point in time.

We find that state-level unemployment rates are affected greatly by geographic location, using both Census regions and Census divisions as indicators of location. Generally, the results indicate that states located outside the Midwest Census region have higher unemployment rates than states located in the Midwest Census region, and suggest that states located outside the West North Central Census division have higher unemployment rates than states located in the West North Central Census division. The results also indicate that the unemployment rate in a state is positively affected by the U.S. unemployment rate, but that the effect varies greatly. Finally, the results indicate that for all states the unemployment rate in a particular month is positively affected by its unemployment rate three month ago, but negatively affected by its unemployment rate six months ago.

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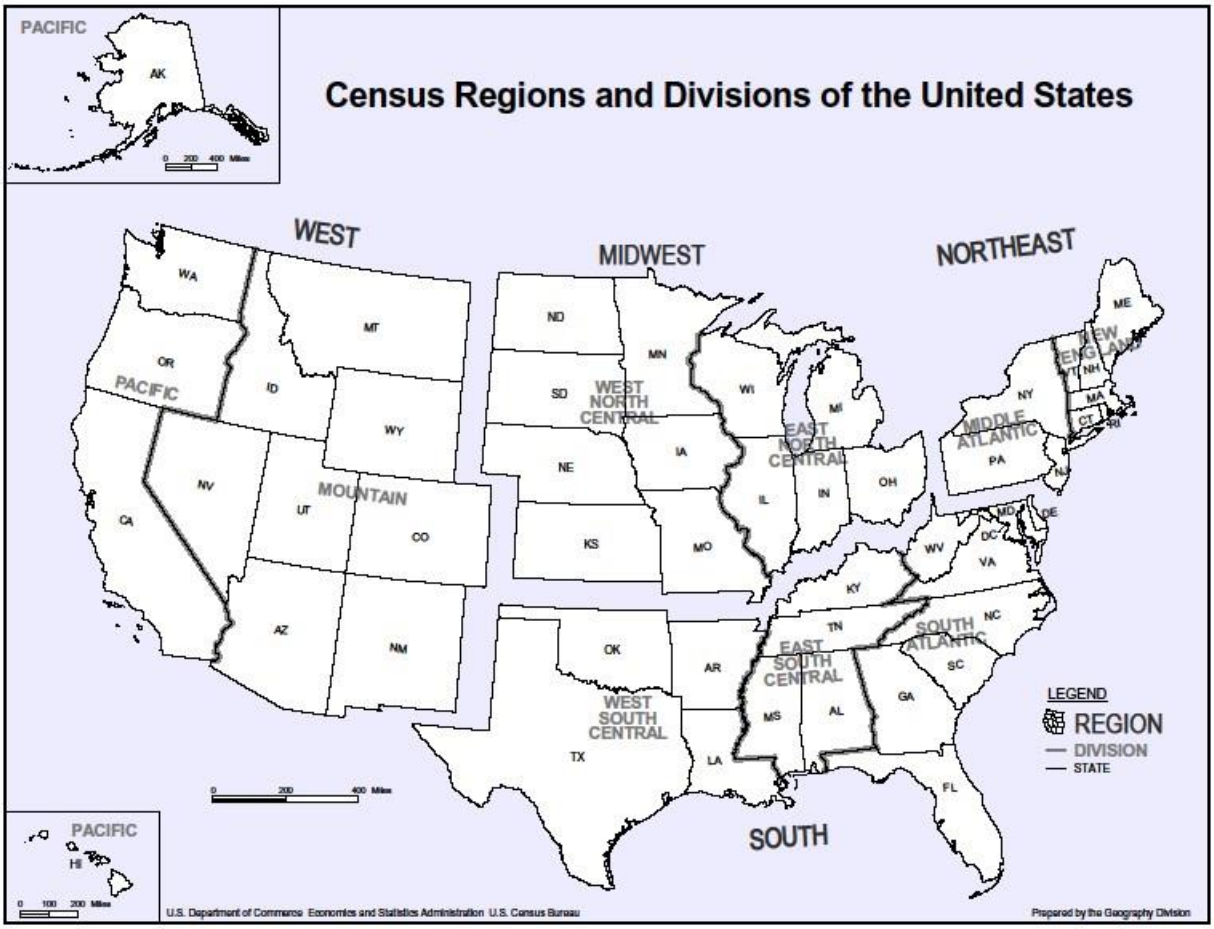
APPENDIX



The importance of public trust for Georgia DOT's Work Program at Open Houses

Marcel Maghiar, Jennifer Kowalewski, Cheryl Aasheim, Gustavo Maldonado
Georgia Southern University

ABSTRACT

Georgia Department of Transportation's (GDOT) mission to design, build and maintain state roads and bridges, provides numerous benefits to the state of Georgia. GDOT oversees other modes of transportation in addition to roads and bridges including railroads, airports, rivers, and intercostal waterways. GDOT is attempting to make the public more aware of its mission to serve the state of Georgia. One method it uses to get the public involved is through hosting Public Meetings and Open Houses. The agency is actively attempting to increase the public meeting attendance through efforts which may enhance interest and better understanding or trust of GDOT's work program. The proposed research focuses on determining citizens' interest in participation to Public Meetings and Open Houses by investigating people's overall public knowledge in GDOT and their level of trust toward the state organization.

According to past research, state governments and agencies are generally more trusted than the Federal government. In a 2013 poll by Pew Research Center, 57% of those polled indicated that they trusted their state government. Mass Communication scholars have determined that trust remains paramount overall in message acceptance (Cappella & Jamieson, 1997). When individuals understand what a government agency does, their tendency is to have more trust.

Cappella and Jamieson have studied people's level of trust and level of knowledge for more than two decades, developing surveys to gauge individuals' level of trust and knowledge in government organizations. For the proposed research, the authors have developed a survey instrument based on the work of Cappella and Jamieson that will help GDOT (1) understand the level of trust that individuals have in USDOT vs GDOT and (2) determine whether individuals understand the mission, the nature, and the benefits of GDOT itself, as well as the organization's projects.

To this end, the authors administered a survey to people in the state of Georgia to understand their level of acceptance and knowledge of the GDOT and its work programs. The survey was developed in Qualtrics, an online survey tool, and sent to more than 2,500 individuals through email. A snowball sampling method was used to send the survey to students, faculty, and individuals within various organizations around the state. Survey participants were asked to take the survey and to forward the survey link to people they know in the state. The team offered an incentive to people taking the survey by offering four $50 gift cards, winners being randomly selected. The survey design consisted of 4 sections, with a total number of 33 questions. The sections contained questions to determine the respondent's: (i) personal feelings about statements related to trust for the US DOT versus the GDOT, (ii) knowledge about GDOT as a state transportation agency and its work program in the state of Georgia, (iii) level of involvement in

open houses and GDOT projects, and (iv) demographics information. The preliminary analysis of the data collected will be presented. Over 400 respondents took the survey. The results of this survey will:

1. Provide useful information about individuals' trust and knowledge that can be used to develop a plan to make the information from GDOT better understood by the public and to determine how to spread the messages about important projects.
2. Assist in planning an approach that is customized to the GDOT, as well as possibly be used in general for other state DOTs.
3. Assist with the specific types of problems the agency needs to address when getting the public involved in GDOT projects.

Findings of the research will help to develop strategies for successful communication at Public Meetings and Open Houses to enhance the public's understanding and awareness of GDOTs projects. It will also address the consequences of not implementing improvements associated with GDOT's work programs.

This research is part of a larger ongoing project for GDOT. The results of this survey will be combined with two other surveys to produce a conceptual guide customized for GDOT that outlines communications strategies to improve understanding and acceptance, while increasing public participation and awareness of its projects. The research team is interdisciplinary consisting of two civil engineers with experience in construction, a mass communications specialist, an information technology specialist and a few graduate and undergraduate students in the aforementioned disciplines.

THE LEAD CONTAMINATION CRISIS IN FLINT, MICHIGAN: AN INITIAL LOOK AT PUBLIC SECTOR AND HEALTH CARE TIME LINE DECISION MAKING AND CRISIS HANDLING

Cynthia K. Snyder, The Pennsylvania State University, ckg2@psu.edu
Robin M. Snyder, http://www.RobinSnyder.com, robin@robinsnyder.com

ABSTRACT

The unfolding of the lead contamination crisis of the water supply in Flint Michigan comprises a case study that spans issues in public sector and ethical issues, management decisions and response, quantitative measurements, public health care management and education, and long term health implications. No amounts of lead within the human body are safe, leading to long term health and economic ramifications. This paper describes the public health concern of lead exposure in the vulnerable population of infants and children, with impact on the health care system, highlighting the case study of Flint, Michigan, with graphics that including a word cloud and time line.

INTRODUCTION

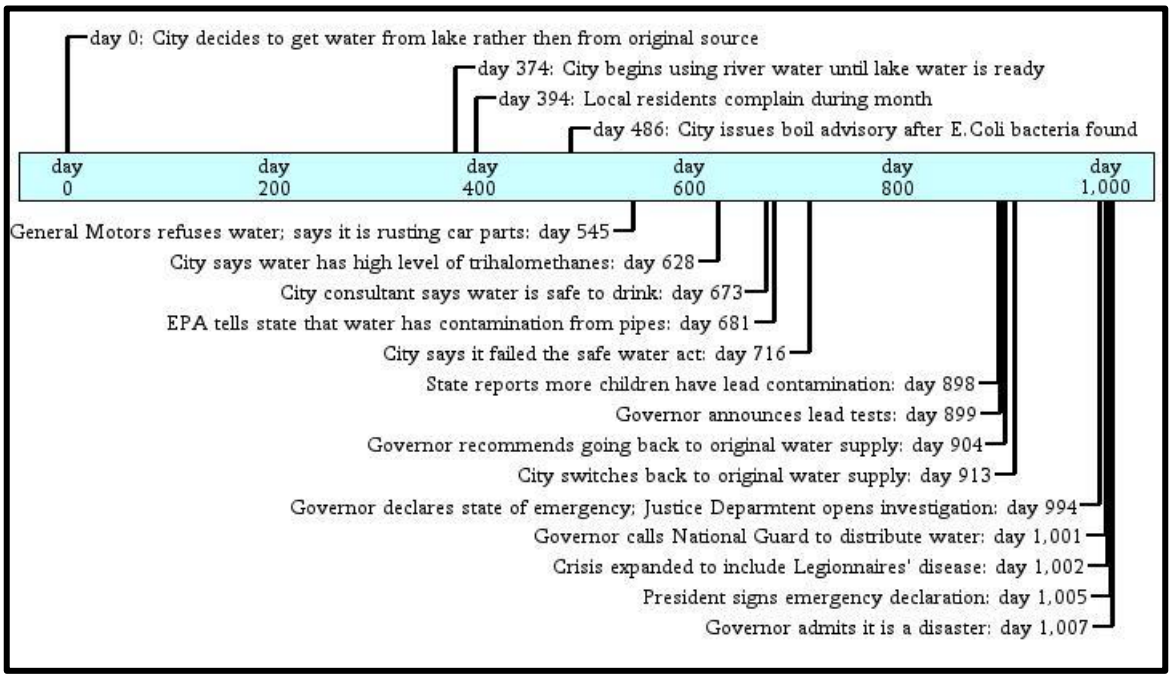
Vulnerable populations, such as infants and children, can be negatively impacted by public health concerns, such as lead poisoning and toxicity. A vulnerable population is defined as persons who have limitations in decision-making capacity, situational circumstances, or because they are at risk for exploitation. According to the World Health Organization [12, para. 1], vulnerability is described as the "degree to which a population, individual or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters", including diseases or public health concerns. Children may share a significant disease burden, and may be permanently impacted by public health concerns. The recent water contamination crisis in Flint, Michigan, presents a significant risk to pregnant women, the unborn fetus, infants, and children. Vulnerability is evidenced within these populations with inability to recover from the impact of lead poisoning or toxicity. Among children six years of age and younger, "males, Hispanics, African Americans, and children in households below 200% of the federal poverty line are disproportionately more likely to have higher-than-average lead exposures" [5, p. 1162-3]. This public health concern affects the health care system, with potential long-term or permanent sequelae. This paper describes the public health concern of lead exposure in the vulnerable population of infants and children, with impact on the health care system, highlighting the case study of Flint, Michigan.

The word cloud depicts words related to the crisis in the outline of water coming out of a water faucet; word size is proportionate to the number of times each word appeared in a text describing the crisis with common words programmatically omitted.

FLINT, MICHIGAN WATER CONTAMINATION TIMELINE OF EVENTS

The community of Flint, Michigan recently experienced a water contamination event leading to lead exposure for numerous community residents. Flint, Michigan has community demographics of 57% black residents, with 42% of community residents living below the poverty level [4]. In an effort to save money for the city, a state-appointed emergency manager determined the water supply from Lake Huron was too costly, and authorized the water supply to be switched to draw from the Flint River, while a new water supply system was developed from the lake. Although the Flint River water supply was deemed safe for consumption, it was not treated with an anti-corrosive agent, leading to lead within the water supply. The incidence of elevated lead levels in children under the age of five years doubled from 2.4% to 4.9%, with some communities reporting lead levels as high as a 6.6% increase over previous levels. No changes in lead levels were reported outside the city [8].

The following depicts a time line of events with specific proper names (e.g. "Flint", "Michigan", "Snyder") replaced with generic names (e.g., "city", "state", "governor") [7]. From the time line, one can visualize significant time lapse between the original event, recognition and detection of the problem, press coverage, and solution implementation (which continue in part to the present time).



LEAD EXPOSURE IN INFANTS AND CHILDREN

Lead exposure in children is a serious public health condition, with more than 4 million households in the U.S. with children who are exposed to elevated lead levels. According to the Centers for Disease Control and Prevention (CDC) [10], no safe levels of lead within the body have been identified, and lead exposure can negatively affect all body systems. Initiation of public health actions is recommended for blood lead levels above the reference range of 5 mcg per deciliter in children ages one to five years, in accordance with the Healthy People 2020 goal of elimination of blood lead levels greater than or equal to 10 mcg/dL, at the national, state, and local levels, and elimination of racial and social class public health concerns

related to blood lead levels [10]. Primary prevention to eliminate or reduce lead exposure is the goal for addressing this public health hazard. Minimization of lead exposure with removal of lead from paint and gasoline began in the 1970s; however, elevated lead levels remain a public health concern. Children may be exposed to lead in older homes, and within the community, with exposure to lead in the soil, through the water supply of leaded pipes, or as an emission from industrial sites. Lead is used as a component in ceramics, pipes and plumbing materials, solders, batteries, ammunition, and cosmetics [11]. In light of the Flint, Michigan water contamination crisis, renewed efforts to reduce and eliminate lead exposure, lead poisoning, and toxicity are needed.

Consequences of Lead Poisoning and Toxicity

Lead is dangerous to children's growing bodies, and even low levels of lead can be harmful with potential lifelong ramifications; the developing brain and nervous system are particularly sensitive to lead exposure [6] [8]. Pre-natal lead exposure can cause irreversible brain damage in the developing fetus. During pregnancy, lead is released from the bones of the mother in lieu of calcium and is used as a building block for fetal bone structure, interrupting the normal bone growth patterns [11]. Lead can enter the body through inhalation, ingestion, or skin absorption, and is harmful to the human body despite the mode of entry; lead becomes distributed throughout the body much like other minerals, such as iron, calcium or zinc. Detrimental effects of lead poisoning are evident within the blood cells and bone tissues. Lead acts by interfering with red blood cell production and calcium absorption within the bones, affecting healthy growth, and causes permanent cognitive decline with accumulation within the brain and central nervous system tissues. Lead exposure and toxicity can cause the following symptoms: developmental delay with altered cognitive development, failure to thrive, learning difficulties, irritability, loss of appetite, weight loss, and growth retardation in the developing fetus, with increased risk of premature birth [2]. These symptoms may be mild or even absent, and diagnosis of lead toxicity if often difficult to make due to the nebulous nature of the symptoms.

Treatment of Lead Toxicity

The best treatment for lead toxicity is primary prevention by reduction or elimination of lead exposure of children and pregnant women within the community. Although complete prevention of exposure to lead may not be possible, early identification and treatment of affected individuals is needed. The American Academy of Pediatrics (AAP) [1] recommendation for risk assessment for lead exposure, and lead testing by finger stick capillary blood draw is done at well child visits at 6-, 9-, 12-, 18-, and 24-months, and 3, 4, 5, and 6 years for those children with increased risk, with confirmation by venous blood specimen for any positive results on screening. Children living in lower socio-economic areas are at higher risk, and routine screening at 12- and 24-months is conducted universally for Medicaid-eligible children regardless of risk assessment screening. Lead exposure effects cannot be reversed, and damage to the body may be permanent. Lead accumulation within the bones replaces healthy bone structure. In cases of severe lead toxicity, greater than 45 mcg/dL, chelation therapy is used to bind the lead to enhance excretion from the body via the urinary system [10].

Long-tern Sequelae of Lead Poisoning and Toxicity

No lead levels are acceptable in children, and even small levels of lead can be toxic, causing lifelong sequelae. Low circulating levels of lead can adversely affect IQ, attention ability, and academic achievement. Learning difficulties may require special education, or adaptations within the school system to enhance learning potential. Devastating effects of irreversible brain damage, kidney damage, nervous system damage, and seizures may be associated with lead poisoning and toxicity, and in the most severe form, lead toxicity is fatal [6].

IMPACT OF LEAD POISONING AND TOXICITY ON HEALTH AND HEALTH CARE

Lead poisoning and toxicity impact the health care system by need for increased access to health care services, economic impact of treatment and prevention efforts, education of the public on the health hazards of lead exposure, and advocacy of governmental officials for primary prevention of lead exposure.

Health Impact

The effects of lead poisoning or toxicity are often permanent, and cannot be reversed. The focus on primary prevention of exposure is paramount to address this serious public health concern. Early identification and detection of lead exposure within the home and/or environment can be accomplished through blood testing by the primary health care provider. Those children under the age of six are particularly vulnerable to negative health consequences, with significant lifelong consequences, necessitating access to the health care system and services. Later effects of lead poisoning into the adult period include neurological disorders, cardiovascular disorders (such as hypertension, heart disease, and stroke), kidney disorders, and osteoporosis [5]. A chronic condition, such as lead poisoning or toxicity, results in increased uptake of long-term health care services; health care services may include early intervention, therapy services, and developmental specialists to maximize achievement of cognitive and developmental milestones, more frequent hospitalizations and use of ambulatory care services, increased medication use into the adult period, and home health care services.

Economic Impact

The economic impact of lead exposure is far-reaching, with associated costs in the areas of health care, loss of lifetime earnings potential as a result of loss of IQ, social and behavioral costs, special education for affected children, and associations between violent behaviors and criminal activity [3][5]. Costs for medical treatment include screening and treatment, physician and nurse visits, investigation of the environment and removal of lead hazards, medications, such as chelation therapy (either oral or intravenous, dependent upon the severity of lead poisoning) or cardiovascular pharmaceutical agents, and life-long medical surveillance. Social and behavior costs are incurred with need for early intervention services, special education, and vocational training, as compensation for decrements in IQ, resulting in the loss of lifetime earnings potential. An association has been established between lead exposure and violent behavior and crime, and increase in risk taking behaviors among individuals with increased lead levels in childhood, incurring additional financial burden to individuals, families, and society [3][4]. Estimated economic costs of childhood lead exposure in the United States top $50 billion according to Attina and Trasande [3]. CDC [10] estimates of medical and special education costs for each child with severe lead poisoning can exceed $5000. Efforts aimed at prevention or reduction in lead exposure can minimize the economic cost to society.

Education and Advocacy

Education of the public regarding the public health concern of lead exposure, with resultant negative consequences is imperative in the battle to protect the nation's vulnerable populations. Primary care providers, nurses, and public health departments are strategically placed to educate parents and the public on the negative consequences of lead exposure, and to support prevention activities. Education of individuals and the public on environmental testing of water, paint, or dust to identify potential sources of lead exposure. Establishing partnerships with local, state and federal agencies to minimize lead exposure, identify lead hazards, and protect vulnerable individuals is imperative. Advocacy for creation and enforcement of policy to prevent or reduce lead exposure on local, state and federal levels, with safe housing, water, and soil, can protect the nation's children from lead exposure [9][10].

CONCLUSIONS

The public health issue of lead exposure, poisoning, and toxicity can have devastating consequences to the vulnerable populations of pregnant women, infants, and children, as evidenced by the chronic nature of the condition. More frequent access to the health care system results in additional cost and burden to individuals, families and the health care system. Lead poisoning is a preventable condition. Prevention, detection, education, and advocacy are important goals to address this public health problem. The residents of the Flint, Michigan community experienced this phenomenon firsthand, with nearly three years of lead exposure within the water system, and are suffering negative health consequences as a result. Increased detection of elevated lead levels in children, combined with poor water quality reports spurred investigation of the event. Delays in recognition and acceptance of lead contamination within the water system by government officials resulted in toxic exposure of countless women and children. Unfortunately the effects of lead exposure to the Flint community are permanent, necessitating life-long interface with the health care system. This case study reinforces the need for continued vigilance of the public health concern of lead exposure.

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The Role of Colleges and Universities in Students' Financial Well-Being

MICHELLE B. HAGADORN
Roanoke College

Introduction

Many adults in the United States exhibit problematic financial behaviors in key areas of personal financial management including budgeting, savings, and the use of credit (Hilgert, Hogarth, & Beverly, 2003; Hira, 2009). This is an area of national concern due to the responsibility of individuals for their own financial wellbeing (Rappaport, 2012) and the impact of uninformed consumers on the economy (Hilgert, Hogarth, & Beverly, 2003; Hira, 2012; "President's Advisory", 2013). In addition, personal financial management is becoming more of a challenge due to the increasing complexity and seemingly limitless choices among products, such as loans, investments, and retirement plans in the financial market (Mandell & Klein, 2009). The need for consumers to utilize sound financial decision making by developing positive behaviors is important in order for the economy to function effectively and efficiently. The benefits of desirable financial behaviors are two-fold when consumers make decisions that ensure their own financial security, society also benefits from them being more productive community members (Hilgert, Hogarth, & Beverly, 2003).

The college years are an especially important time, as young adults gain newfound independence from their parents, which is often accompanied by increased responsibility for their personal financial decisions (Gutter & Copur, 2011; Xiao, Tang, & Shim, 2009).

Furthermore, college students face potential long-term negative consequences due to undesirable financial behaviors, such as damage to their credit history, and increased stress and anxiety, which have been linked to lower academic performance and higher dropout rates (Field, 2010; Kettley, Whitehead & Raffan, 2008; Pleskac, Keeney, Merritt, Schmitt, & Oswald, 2011; Sages, Britt, & Cumbie, 2013). Thus, the college environment provides an excellent opportunity to develop educational strategies to establish favorable financial behaviors before problems develop and become a habit (Shim, Barber, Card, Xiao, & Serido, 2009). College students are at a crucial transitional point in in their life, with the impact of financial decisions having a far reaching influence by affecting their long-term financial wellbeing (Hira, 2012).

Although the benefits of a college education have been documented, the development of financial autonomy during the college years has received limited attention (Shim, Barber, Card, Xiao, & Serido, 2009). Young adults could even be considered a vulnerable group due to the instability of their financial situation (Lokken Worthy, Jonkman, & Blinn-Pike, 2010), with research indicating their increased likelihood of engaging in risky financial behaviors (NFCC, 2012). College students are particularly susceptible to accruing high amounts of debt from both educational loans and credit card use. According to a *USA Today* article (Malcolm, 2014) ensuring that students have basic financial skills, such as, budgeting and how to manage debt are critical as student loan debt continues to increase and "finances remain the number one reason students drop out of school". Sages, Britt, and Cumbie (2013) found that college students reported increased anxiety due to difficulty paying bills, spending more than earned, and reaching the maximum limit on credit cards. The impact of poor financial behavior can have a long-term impact, such as, damage to their credit history, which jeopardizes eligibility for loans

to buy a car or home and even may have consequences for renting an apartment or securing a job (Field, 2010). Mary Johnson, director of financial literacy for Higher One, hopes that colleges and universities will incorporate financial literacy into their mission (Malcolm, 2014).

The rest of this paper has been organized into the following sections: definition of key terms, background on the financial literacy problem and financial education, common financial literacy program models, leaders in financial literacy education and conclusion. A primary goal of this paper is to motivate faculty to become involved in addressing the nationwide problem of financial illiteracy.

Definition of Key Terms

Financial Behavior. According to consumer economists, financial behaviors are positive or desirable behaviors that can be used to improve financial security (Xiao et al., 2009). Four commonly cited domains of financial behaviors include managing cash, credit, savings, investments, and insurance (Dew & Xiao, 2011). According to the Securities and Exchange Commission's (SEC) Office of Investor Education and Advocacy, the roadmap to financial security includes creating a financial plan, paying off high interest debt, and then starting to save and invest ("Securities and Exchange", 2010). Examples of positive financial behaviors include saving regularly, managing spending with a budget, and using credit in a responsible manner by paying off credit card balances in full each month, making payments on time, and refraining from maxing out credit limits (Gutter, Garrison, & Copur, 2010).

Financial Literacy. Generally financial literacy is viewed as a comprehensive term, which includes both knowledge and behaviors related to personal financial issues. According to Gene Dodaro, Comptroller General of the United States, financial literacy is "the ability to make informed judgments and to take effective actions regarding current and future use and

management of money" ("Financial Literacy: The Federal", 2011, p.2). Common conceptual components of financial literacy include: "(1) knowledge of financial concepts, (2) ability to communicate about financial concepts, (3) aptitude in managing personal finances, (4) skill in making appropriate financial decisions and (5) confidence in planning effectively for future financial needs" (Remund, 2010, p. 279). Common topics included in operational definitions of financial literacy include budgeting, saving, borrowing, and investing (Remund, 2010).

Financial Well-Being. According to the Consumer Financial Protection Bureau (CFPB) (2016) financial well-being is a "highly personal state, not fully described by objective financial measures. Instead, well-being is defined as having financial security and financial freedom of choice, in the present and in the future". Financial security includes control over daily and monthly finances and the capacity to absorb a financial shock in the future. Financial well-being also includes the financial freedom to make choices to enjoy life and meet future financial goals.

Financial literacy problem

Numerous statistics based on observable behaviors highlight the struggles that many individuals living in the United States have with personal financial management including the use of debt, saving for the future, budgeting, and cash management (Bricker, Kennickell, Moore, & Sabelhaus, 2012; Jacobe, 2013; "June 2011 Financial", 2011). Budgets serve as an important planning tool in managing cash inflows and outflows, however a recent Gallop annual Economy and Personal Finance survey (Jacobe, 2013) found that two-thirds of individuals reported not preparing a budget and a 2010 Survey of Consumer Finances indicated that 10.8 % of families reported having at least one payment in the last year that was 60 or more days late (Bricker, Kennickell, Moore, & Sabelhaus, 2012). Consumers rely heavily on credit cards with balances averaging $7,219

per household, which is the third largest source of indebtedness only behind mortgages and student loan debt ("American Household", n.d.). In addition 1.4 million personal bankruptcy cases were filed for the 12 month period ending in March of

2012 ("United States Courts", n.d.). Therefore, it is not surprising that Global Finance magazine reported individual savings rates in the United States are among the lowest in the industrialized world based on data from the last 20 years (Pasquali & Aridas, n.d.). Many Americans are not adequately protected in the case of unexpected events; a recent survey by Bankrate.com indicated that 24% of all respondents reported having no emergency savings ("June 2011 Financial", 2011). Younger adults are even less prepared with 35% of respondents 18 to 29 years old having no savings and 28% had less than three months' worth of expenses saved ("Financial Security", 2011). Hira (2009) highlights the prevailing concern that adults of all ages "lack a working knowledge of financial concepts and do not have the tools they need to make decisions most advantageous to their economic wellbeing" (Hira, 2009, p.2).

High debt and low savings rates are an indicator of a potential problem, therefore, survey results of adults and youth in the United States that highlight a lack of basic financial knowledge are not surprising. Almost half of adults in the United States, rated their personal financial knowledge as a C or worse, according to a survey by the National Foundation for Credit Counseling (NFCC) (2012). Also results from the 2012 National Financial Capability study, a comprehensive survey of over 25,000 adults (18+) across the United States, indicate the lack of basic financial knowledge among adults with only 39% of the respondents answering the majority of the questions related to everyday financial matters correctly. The survey was a joint effort of several governmental entities, including the U.S. Department of the Treasury and the

President's Advisory Council on Financial Capability ("Financial Capability", 2012).

In addition, research indicates that high school and college students are not knowledgeable about personal financial issues (Agarwal, Amromin, Ben-David, Chomsisengphet, & Evanoff, 2010, Mandell, 2008). Many studies have used a survey tool developed by Dr. Lewis Mandell for the JumpStart Coalition, a nonprofit organization formed in 1995. "Jump$tart is a coalition of diverse financial education stakeholders. These organizations work together to educate and prepare our nation's youth for life-long financial success" ("About the Jump$tart Coalition", 2016). The survey, which eventually evolved into National Standards in K-12 Personal Finance Education, was first administered in 1997 to a random sample of high school seniors across the country and then repeated biennially between 2000 and 2008. College students were surveyed for the first time in 2008. The survey consists of 31 multiple choice questions that cover four key areas of personal finance (1) income, (2) money management, (3) saving and investing, and (4) spending and credit (Mandell, 2008).

Unfortunately, the JumpStart survey paints the same picture regarding the financial knowledge of high school and college students, as the surveys of adults previously mentioned, with scores actually getting worse over time. The first survey resulted in an average grade of a 57.3% of the questions correct with results declining in 2000 and 2002, bumping upward in 2004 and 2006 and then reaching an all-time low in 2008, which was the last year the survey was administered (Mandell, 2008). Agarwal, Amromin, Ben-David, Chomsisengphet, & Evanoff (2010) note that although surveys of financial knowledge may vary in content and sample populations, several common themes can be found: "a large proportion of consumers are not financially literate, even among the wealthiest and most educated population segments… and financial illiteracy leads to welfare-reducing financial behavior and outcomes" (p.3). Personal

finance is an important topic due to the increasing complexity of the United States financial system and low levels of financial knowledge.

Recent statistics indicate record high levels of educational debt with the average student owing $25,000 in student loans upon graduation (Ellis, 2011). The default rate on student loans is at an all-time high with one in every five government loans that entered repayment in 1995 in default, which has resulted in $50.8 billion of loans in default at the end of 2009 (Field, 2010). In addition to the burden on the economy, with taxpayers absorbing almost 100% of the cost of the defaulted loans, the students face significant personal and financial burdens. Many young adults, between the ages of 22 and 29, reported delaying or deciding against furthering their education because of the debt they owed (NEFE, 2006). The financial stress is compounded by limited job prospects with a 13% unemployment rate of recent college graduates with bachelor's degree according to a 2013 report by the U.S. Department of Labor. Also surveys indicate that students report feeling pressured to take a job they would not have otherwise accepted due to high levels of debt (NEFE, 2006). The risk of bankruptcy is an additional concern related to high levels of debt, with approximately 110,000 young adults under the age of 25 filing for bankruptcy in 2011 (Valenti, 2012). A report by the Institute for Financial Literacy (2011) indicated that college graduates are the fastest growing age group that filed for bankruptcy in the past five years.

As these students move into the workforce, money-related issues are one of the leading causes of absenteeism and lower productivity due to the inability to focus (Davis & Carnes, 2005). Sages, Britt, and Cumbie (2013) found that college students reported increased anxiety due to difficulty paying bills, spending more than earned, and reaching the maximum limit on credit cards. Also research by Klontz and Klontz (2009) found that when individuals feel

stressed or anxious this creates an imbalance in the brain, which is often dealt with by seeking out substances, such as food, nicotine or alcohol, or various human behaviors, such as spending money.

Also poor financial behavior can lead to additional negative consequences, such as damage to credit history, which limits future eligibility for federal aid and the ability to obtain car loans, mortgages and even apartments or jobs (Field, 2010). According to a recent survey by the National Association of Consumer Bankruptcy Attorneys (NACBA) many young people are delaying important life cycle decisions, such as, purchasing a home or getting married due to large amounts of debt (Nance-Nash, 2012). Higher education is an investment in the future, however, the large amounts of debt that many students are faced with paying off after graduation jeopardizes their long-term financial security.

Financial education

Education is often seen as the solution to low financial knowledge and problematic financial behaviors (Hilgert, Hogarth, & Beverly, 2003) with vast amounts of resources being directed to educational programs. A myriad of organizations support efforts to improve financial literacy including private employers such as commercial banks; government agencies; consumer groups; community service organizations; and religious organizations (Gale, Harris, & Levine, 2012). Several private sector nonprofit organizations, such as the National Council on Economic Education (NCEE), the JumpStart Coalition, and the National Endowment for Financial Education (NEFE) have been instrumental in developing voluntary standards, curricula for educational programs, and survey instruments that assess financial literacy (Mandell, 2008; NCEE, 2012; NEFE, 2006).

Also the low knowledge and problematic financial behaviors of Americans has received attention at the national level and resulted in two legislative acts. In 2003 Congress created the Financial Literacy and Education Commission to develop a national strategy in recognition of the fact that Americans could benefit from a better understanding of financial matters. The Department of Treasury's Office of Financial Education coordinates the commission and is charged with developing resources for the American public, such as a national website (MyMoney.gov) to provide financial education materials and a toll-free hotline (1-888-My Money). Also the commission conducts regional meetings and conferences to increase public awareness and foster partnerships with private organizations to improve Americans' financial literacy ("Financial Literacy Education", 2013). The second example of regulatory reform, initiated in response to the 2008 financial crisis in the United States, was the Dodd-Frank Act which established the Office of Financial Education within the Consumer Financial Protection Bureau and was charged with developing and implementing a strategy to improve the financial literacy of consumers (Dodd-Frank Act, Title X, Section 1013).

At the state level, the primary focus has been on the development of policies related to requiring personal finance as part of students' high school education. Almost all states have standards related to personal finance education with some states requiring a class in economics or personal finance in order for students to graduate from high school (*Financial Literacy: The Federal*, 2011). According to the National Council on Economic Education's (NCEE) 2011 report

- 50 states require Economics or Personal Finance to be included in the state standards,
- 40 states require the standards to be implemented,

- 25 states require a high school course in Economics or Personal Finance to be offered,
- 22 states require a high school course in Economics or Personal Finance be taken and,
- only 16 states actually require testing of student knowledge in Economics or Personal Finance (NCEE, 2012).

Due to the large amount of resources dedicated to educational initiatives to improve financial literacy, a logical question is whether the programs are effective in accomplishing their goal. However, widely accepted standards of excellence for financial education are lacking, therefore answering this question is not as simple as it might appear. Several studies have attempted to evaluate the effectiveness of education provided in high school or college on financial knowledge and behaviors (Bell, Gorin, & Hogarth, 2009; Bernheim, Garret, and Maki, 2001; Cole, Paulson, & Shastry, 2013; Lusardi & Mitchell, 2006; Tennyson & Nguyen, 2001). Tennyson and Nguyen (2001) found a significant and positive association between state mandates to take a high school personal finance course and students' financial knowledge scores. Also, the results indicate that students' taking mandated courses knowledge are significantly greater in the topic areas of savings/investing and income, however, no significant relationship was found in the areas of money management and spending/debt. Bell, Gorin, and Hogarth (2009) found that taking a high school financial education course had a positive influence on the financial behaviors of saving and credit management. This study found that individuals who have taken a financial management course were more likely to have a savings account for short term goals, save on a regular basis, and have an emergency fund.

Also positive behaviors related to credit management were found, which included having fewer overdraft fees in the past six months and a decreased likelihood of never paying off their credit card balances. Bernheim, Garret, and Maki (2001) investigated the impact of state financial education requirements later in life by surveying individuals aged 30 to 49. Survey respondents provided the state and years they attended high school, which was then matched with the historical record of when states adopted financial education requirements. Results showed that individuals who attended high school in a state with a mandated personal finance curriculum reported higher savings rates than those who did not. However recently Cole, Paulson and Shastry (2013) replicated the Bernheim, Garret and Maki (2001) study and found conflicting results after accommodating for state-fixed effects. Perhaps states with mandated personal finance education requirements are somehow different from those states without such mandates. Also evidence was found that during the time when these curricula mandates were imposed was a period of economic growth for the country, which may have independently influenced savings behavior.

Even though several studies (Bell, Gorin, & Hogarth, 2009; Bernheim, Garret, and Maki, 2001; Lusardi & Mitchell, 2007; Tennyson & Nguyen, 2001) have found positive effects of financial management courses, due to conflicting results debate still continues regarding the best place for education and the overall effectiveness. For example, Peng, Bartholomae, Fox and Cravener (2007) found that taking a personal finance course in college enhanced financial knowledge more than taking a high school personal finance course. However interestingly, individuals that had a personal finance course in both high school and college did not perform better on the financial literacy test (Peng et al., 2007). Another study by Mandell and Klein (2009) examined the impact of a personal financial management course completed at one of three

high schools within a single school system from 2001 to 2004 and found no significant positive impact for the students who took the personal finance course compared to the students not taking the course. In another study of student perceptions of high school financial literacy courses, over half of the respondents indicated that important financial management topics, such as auto or home loans, renting or buying a house, and retirement planning were covered in their high school class with budgeting being covered the most frequently *(*Miller, Hite, Slocombe, & Railsback, 2010). Due to conflicting results on the effectiveness of personal financial education offered in high school, a few studies (Peng et al., 2007; Yates & Ward, 2011) have questioned if high school is the best place to offer education on financial literacy.

Several studies have found more short-term strategies, such as seminars, or focused educational programs to be effective. Harter and Harter (2009) found that high school students who participated in a Financial Fitness for Life curriculum, which is published by the Council for Economic Education, knowledge improved on post-test comparisons. Also Borden, Lee, Serido, and Collins (2008) found positive improvements in college students' knowledge and attitudes towards credit after participating in a seminar-based financial education program. For example, after participating in the seminar, students reported more responsible attitudes towards credit and decreases in avoidant attitudes towards credit. The effectiveness of providing education for targeted behaviors on a just-in-time basis as teachable moments arise has been documented in multiple studies of financial counseling for adults. These research findings can be used to inform educators of high school and college students as they develop educational strategies (Agarwal, Amromin, Ben-David, Chomsisengphet, & Evanoff, 2010; Collin & O'Rourke, 2010; Hathaway & Khatiwada, 2008).

Certainly the goal of providing information through courses or seminars is a worthy endeavor, however due to the lack of a standard curriculum widely accepted standards to evaluate program effectiveness do not exist. Nonetheless, eight elements are recommended by the Treasury's Office of Financial Education for a successful financial education program, which focus on program content, delivery, impact and sustainability ("Treasury launches", 2004). The first two elements relate to program content, which should be tailored to the target audience and focus on basic savings, credit management, home ownership and retirement planning. The third and fourth elements relate to the recommended delivery of the program content through local distribution channels to make use of community resources and contacts. Follow-up with participants is also important for an effective program to reinforce the message. The fifth and sixth elements note that successful financial education programs measure their impact by establishing specific goals and tracking progress towards the goals. Also the positive impact of programs can be demonstrated by objective evaluation through testing or surveys. The final element of a successful program relates to sustainability, which can be demonstrated if the program is easily replicated on a local, regional or national basis and continues to receive financial or legislative support. The intent of these standards is to guide organizations as they develop programs or strategies for financial education ("Treasury launches", 2004).

Financial Literacy Program Models

So clearly the evidence supports the lack of positive financial behaviors and overall financial literacy of both adults and youth in the U.S. The question then becomes "Where is the best place to teach financial literacy and whose responsibility is it?". As noted previously, research is conflicting on the effectiveness of high school financial literacy (Peng et al., 2007; Yates & Ward, 2011) and debate continues whether the responsibility for educating youth on

important money management topics rests with parents or educators. Among educators there is debate as well, whether primary, secondary or higher education should take the lead in addressing this problem. According to Rose (2015), the assistant director of financial literacy and education programs at Syracuse University, "with the passing of the "buck", our new college graduates are no further along with financial knowledge than their parents before them".

College administrators should feel confident that students are leaving their institutions with basic knowledge on how to manage their finances as they begin their careers. However as colleges and universities across the country are faced with reduced budgets, lower student enrollments, and staff already stretched thin with perhaps little or no formal financial literacy training starting a new program can be a challenge.

According to research by Coalition of Higher Education Assistance Organizations (COHEAO) there is no perfect operational model for a campus financial literacy program however four common approaches have emerged: 1) financial education/counseling centers, 2) peer-to-peer programs, 3) programs delivered by financial professionals, and 4) distance learning programs (Federal Reserve Bank of New York, n.d.). These models are managed by a wide variety of campus departments most often within academic affairs or student affairs (Grable, Law, & Kaus, 2012).

Regardless of approach, it is crucial for colleges and universities to spend time up front becoming familiar with issues important to students on their campuses before developing a plan. A first step is to talk with faculty and staff across campus to understand current trends, such as, how frequently emergency loans are requested, timeliness of payment for student bills, prevalence of financial holds on student accounts and default rates for graduates (COHEAO,

2014). This information can often be obtained from offices, such as, Financial Aid, Business Office and Institutional Research. In addition to financial information, data on student characteristics such as demographics, work obligations, course load and mental health/wellness could be helpful in developing a financial literacy plan.

Research (Mandell & Klein, 2007; McCormick, 2009) has documented the success of four specific approaches: 1) interactive online programs, 2) classroom-based programs, 3) gamebased education, 4) event-based programs, and 5) individual counseling. Interactive online programs are popular at larger institutions since they are cost efficient and allow students to learn at their own pace on their own schedule. The main downside is the lack of human interaction, which can be offset by incorporating multimedia videos to increase student engagement (COHEAO, 2014). Another option is classroom-based programs, such as, semester length courses or guest lectures in certain classes. Again this approach is relatively low cost since large numbers of students can be reached at one time; however the ability to tailor the education and counseling to individuals within the class is somewhat limited. Also the use of financial games, which can include simulations, contests, board games, card games, or electronic games, increases the "fun factor" which can create a collaborative learning environment. Special events are the fourth method often used to help programs gain visibility on campus, create buy-in and deliver program content. The final approach is individual counseling, which can be provided by professional staff members or student peers (Grable et al., 2012). Regardless of who is providing the counseling the format can be face-to-face, over the phone or web-based. The counseling services provided can range of services from providing assistance when dealing with financial problems to more preventive assistance, such as, goal setting, establishing a budget which can include managing cash and credit.

Leaders in Financial Literacy Education

According to a survey conducted by Student Lending Analytics, more colleges are offering or planning to offer financial literacy education (Alban, 2012). Several colleges have emerged as leaders in financial literacy education and their programs provide great ideas and advice for organizations interested in starting their own programs. The good news is that college and university faculty and staff do not have to design a program from scratch to start addressing the need for financial literacy on their campuses. The two programs that will be reviewed in this paper are Syracuse University and the University of Arizona.

At the University of Arizona, Take Charge America Institute (TCAI) was created in 2004 by an endowment with a mission of improving the money management skills, economic reasoning and financial capabilities of youth under 25. TCAI uses a variety of approaches to achieve it's mission. For example the school offers a three-credit elective course, which is offerred on-line and in person, that focuses on personal finance and American culture; since it draws on economics, sociology and psychology the course satisfies a general education requirement. Another very successful program is Credit-Wise Cats which "trains and supports a group of student financial education ambassadors who conduct workshops and seminars for college students on campus and for students in grades 7-12 in the greater Tucson area schools" (Eades, 2012, p. 192). Also in 2011 TCAI launched a youth-oriented website "to facilitate independent, experimental learning with the belief that financial capability is built over time and largely outside the classroom. Students don't learn personal finance, but rather they develop financial decision-making skills by repeatedly making choices, observing outcomes, weighting new options and making more choices" (Eades, 2012, p. 192). Many of the programs are

directly replicable on other college campuses or free resources are available that college faculty and staff can tailor to local needs.

At Syracuse University, the goal is for financial education to be a parallel education to their academic education and be the norm. Rebecca Rose (2015), assistant director of financial literacy and education programs at Syracuse, uses the F.O.C.U.S. Model to guide their program. F stands for the Foundation of the program and involves ensuring that the program matches the institutions values and defining the message and learning goals for participants. Next determining the order of the program is important and could ultimately impact the overall success. C stands for cultivating a network across campus to identify who will deliver the program content and if education is needed or perhaps new hires are required. The following step of utilizing resources is about networking with other areas on campus to effectively use the financial and human resources available. Finally the last phase is starting the program and remembering to refer to the F.O.C.U.S. model as problems are encountered.

Syracuse University launched their financial literacy program entitled "I Otto Know This!" in April of 2010. The program has two core goals: 1) the program includes all students at Syracuase including undergraduate, graduate, part-time students and the Law School 2) the program information is current, relevant and easy to obtain. The program is marketed through the college newspapers and campus listservs. Federal work study students are frequently enlisted to develop or provide feedback on ideas. The current financial literacy program has multiple levels, which includes online self-directed modules, Money Awareness Program for targeted student populations, e-news, and college-wide financial literacy presentations. Future plans include developing peer-to-peer counseling, a video series, and increased presence in campus classrooms (Alban, 2012).

Conclusion

The 2008 financial crisis highlighted the shared responsibility of individuals who voluntarily added unmanageable levels of debt to their personal balance sheets. The ability of individuals to make prudent credit and other financial decisions would appear to be teachable skills with the education industry seeming to have partial responsibility for this. Statistics based on observable behaviors indicate this is not as easy as expected with record low savings rates and increased utilization of debt. However even prior to the financial crisis of 2008, American households were faced with increasingly sophisticated and complicated financial products and increased responsibility for their own financial well-being as employers shifted more health insurance costs to employees, as well as, funding and decision making related to retirement plans. In addition, increases in tuition costs grew faster than income raiseing the question of whether to invest in higher education. All of these factors combined test the financial decision making skills of households across the U.S.

The college years are an influential period in many young adults' lives as they transition from the supervision of their parents to overseeing their finances independently, often for the first time, by using a budget, paying bills and accessing credit (Gutter & Copur, 2011; Xiao, Tang, & Shim, 2009). Research indicates that financial habits, both positive and negative, that develop during this period are likely to persist to adulthood (Xiao, et al., 2009). In addition, the impact of poor financial behavior can have a far reaching influence on students' long-term financial wellbeing, such as damage to their credit history, which jeopardizes eligibility for loans to buy a car or home and even may have consequences for renting an apartment or securing a job (Field, 2010). Due to the responsibility of individuals for their own financial security and the impact of uniformed consumers on the economy, colleges and universities are in the unique

position of having a captive audience. Although results have been somewhat mixed regarding the most effective approach to financial education many resources, often free are available to colleges and universities. In addition, as institutions strive to increase student retention and graduation rates, offering financial education programs may bolster their public image and mission. The goal of this paper is to motivate faculty to become involved in their local community and on their college campuses to do our part in addressing the nationwide problem of financial illiteracy.

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THE ROLE OF TECHNOLOGY, INFRASTRUCTURE AND CULTURE (TIC) IN THE USE OF AUTONOMOUS VEHICLES IN SUPPLY CHAINS

William "Rick" Crandall, School of Business, Post Office Box 1510, University of North Carolina at Pembroke, Pembroke, NC 28372, rick.crandall@uncp.edu

Richard E. Crandall, Appalachian State University, John A. Walker College of Business
CIS & SCM Dept., Peacock Hall, Boone, NC 28608, crandllre@appstate.edu

ABSTRACT

The use of autonomous vehicles, especially driverless trucks, in supply chains, is a popular topic in today's literature, especially in trade publications. Although there are numerous obstacles to overcome, it appears inevitable that we will see this disruptive innovation become a reality within the next decade. This paper will examine some of the changes needed in technologies, infrastructures and cultures to make the current vision a tangible achievement.

INTRODUCTION

The use of autonomous vehicles, especially driverless trucks, in supply chains, is a popular topic in today's literature, especially in trade publications. Although there are numerous obstacles to overcome, it appears inevitable that we will see this disruptive innovation become a reality within the next decade. This paper will examine some of the changes needed in technologies, infrastructures and cultures to make the current vision a tangible achievement.

There are several benefits expected from the use of driverless trucks in supply chains. While the major long-term benefit will be the reduced need for drivers, this may not be realized in the short-term because of complex driving environments and the public's and regulators' concerns about safety. However, there can be short-term benefits from reduced fuel consumption, reduced accidents, and increased utilization of assets (Crandall and Formby, 2016 Industrial Engineer).

The National Highway Traffic Safety Administration (NHTSA) defines vehicle automation as having five levels:

No-Automation (Level 0): The driver is in complete and sole control of the primary vehicle controls – brake, steering, throttle, and motive power – at all times.

Function-specific Automation (Level 1): Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alone.

Combined Function Automation (Level 2): This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a Level 2 system is adaptive cruise control in combination with lane centering.

Limited Self-Driving Automation (Level 3): Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in

those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The Google car is an example of limited self-driving automation.

Full Self-Driving Automation (Level 4): The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles. (NHTSA, 2013)

Most of the trucks demonstrated or tested so far have been at Level 3, where a driver is present and available to take control if and when needed. However, Level 4 unmanned trucks are in operation in a few mining and port operations (Crandall, 2016). This paper will focus primarily on the proposed use of driverless trucks on the open highway. It is a preliminary exploration of some of the issues that need to be addressed in this new disruptive technology. There is a need for more scholarly articles on the subject.

Behrmann and Behrmann (2016) set the stage with the following description. Although driverless cars grab headlines, it may take decades before truly autonomous vehicles rule the road. In the meantime, semi-automated convoys can help manufacturers hone the technology while cutting emissions and fuel consumption, Platooning is one of the first steps toward automated driving. The technology is mature. Drivers will still be needed—by law they have to keep their hands on the wheel. But letting the rig do some of the work will result in less passing, quicker braking, and fuel savings of about 10 percent for the following trucks and a smaller gain for the lead vehicle, according to Daimler. And it will help reduce congestion. When a human is at the wheel, a truck in some countries must maintain a distance of about half a football field from the vehicle in front of it to stop safely in an emergency. With automation, that distance shrinks to about 50 feet.

CONDITIONS TO CONSIDER

The primary objective in today's supply chains is how to deliver an increasing number of packages, the result of increased online ordering. At the same time, customers want faster delivery and suppliers are competing to figure out how to do this at a lower cost. While there is increasing interest in unmanned aircraft, it is not likely this means of transportation will become commonplace as fast as the use of driverless trucks. Driverless cars are also included under the umbrella of autonomous vehicles; however, they will not be considered because of their limited role in supply chains.

We will use Figure 1 as a basis for the discussion of this topic. Figure 1 shows how technology, infrastructure and cultures could interact during the implementation of a disruptive innovation. Technology can be a leading driver of change, but without the development of a supporting infrastructure and the realignment of cultures, the innovation will never be successful. (Crandall and Crandall, Vanishing Boundaries).

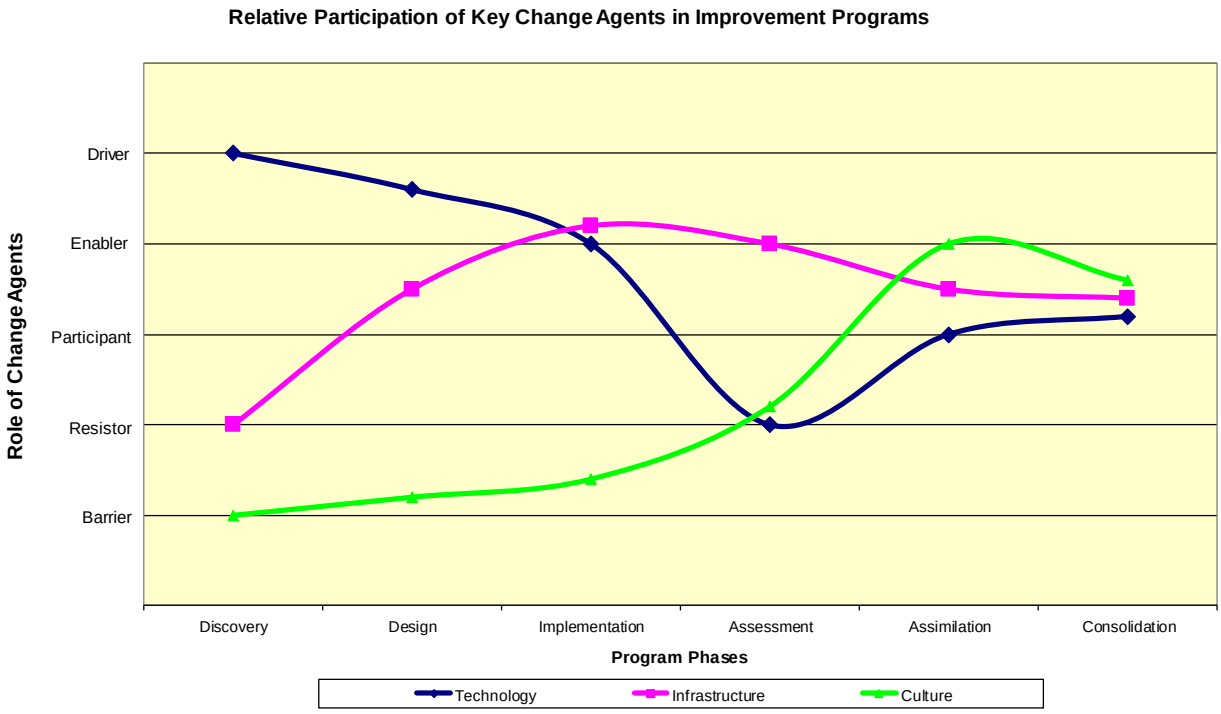

Figure 1. Technology, Infrastructure and Culture as Change Agents (from *Vanishing Boundaries*, Crandall and Crandall, CRC Press, 2013.

TECHNOLOGY

Technology will be discussed in three broad categories: (1) Technology needed on the individual trucks, (2) Technology needed on the highways and other driving areas, and (3) the software needed to integrate all of the data collected into an active system.

Technology on Trucks

The technology on the trucks is designed to enable the truck to navigate to its designated destination, avoid accidents and obey traffic signals during transit, and record data related to its performance during the trip. In navigating, the technology must continually monitor such questions as: Where are we? Where is our destination? How do we best get there?

Early stages of adding technology to trucks included active safety systems such as stability control and automatic braking systems (ABS), considered Level 1 automation. Adaptive cruise control and lane centering were added at Level 2. Collision mitigation and other technologies that considered what is happening outside the truck – its environment – began to involve systems that could integrate a number of variables and move to a Level 3 classification. Most tests are being done at Level 3. (Mele, 2015)

GPS systems are commonplace for most drivers today, using either systems installed in the vehicle or remote systems that can be plugged in. However, the GPS information must be transmitted to the control mechanism of the truck rather than to the human driver.

In addition to knowing where it is supposed to go, the truck must also see where it is as it navigates its way along the highway. One of the technologies being tested is the use of cameras to "see" what is in the road ahead. Among the existing technologies utilized by the vehicle are: Radar-based adaptive cruise control (ACC) that automatically accelerates and decelerates to maintain safe following distances; and Lane departure warning (LDWS) systems that use cameras to detect lane edges and striping and alerts the driver if the vehicle is drifting outside of its lane. Kahn said the performance of these technologies is

boosted by giving the LDWS the ability to self-correct the vehicle through integration with the electronically controlled steering system and the ACC the ability to use the cameras to bring the vehicle to a complete stop (Peterbilt, 2014). Sensors will be an essential component of driverless trucks. In 2007, there were about 10 million devices embedded with sensors. In 2030, there will be about 10 trillion. (Hitch, 2016). For more about the Internet of Things, see Crandall (2014).

Mercedes-Benz recently debuted its Future Truck 2025 in Germany. The technology is a combination of radar sensors at the front and sides, a stereo camera behind the windshield and precise three-dimensional maps. The truck is partnered with vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) networking in order to exchange information between the truck and other vehicles on the highway. Instead of a conventional instrument cluster, it has a high-resolution graphic color display. The developers no longer refer to the interface between the driver and truck as instruments, but as the Human Machine Interface (HMI) (Anon, 2014).

In lieu of cameras, some researchers believe that lidar – for light detection and ranging -- will be a requirement. ASC's sensor has no moving parts, a feature car makers prefer to avoid breakdowns. It blasts beams of light that reflect back to the sensor and provide data on the distance to objects in its field of view. Unlike cameras, which rely on image-recognition algorithms, a lidar's calculations are based on simple geometry, which computers can interpret with speed and accuracy. Nissan Motor Co.'s autonomous Leaf electric car uses several ASC's sensors located around a vehicle, to construct a nearly 360-degree field of vision (Ramsey, 2015).

Volvo Trucks of North America has also been active in the design of autonomous trucks. They also believe that platooning whereby a series of two or more trailers would be wirelessly connected to a lead truck would have the ability to disconnect from the platoon in order to make deliveries and then reconnect to the platoon at some point. It is recognized that on-road platooning would require more enhancements to be workable (Birkland, 2015).

Peterbilt showcased advanced technologies capable of autonomous driving to complement vehicle operators during the ITS World Congress in Detroit. The system was demonstrated on a Peterbilt Model 579 concept truck. The autonomous truck of the future is an extension of existing, individual systems already available for today’s commercial vehicles and the automation technologies are not driver replacement tools but rather complement the truck operator. Improving safety, efficiency and performance are top priorities for the entire transportation industry. (Peterbilt, 2014)

Technology is also needed to avoid collisions. Vehicle-to-vehicle (V2V) communication systems are being developed to assure that trucks maintain a safe distance from vehicles ahead of them. This will be especially important when trucks travel in platoons so that trucks brake and accelerate in response to the lead truck. According to one report, the planned distance between the vehicles is slated for 0.5 seconds - which, when traveling at 80 kph (50 mph), translates to a distance of only 10 meters (30 feet). The responsiveness of the trailing truck within the platoon is estimated at 25 times faster than the average human reaction time of one second - saving critical time in case of emergency braking (NASDAQ CMXm, 2016).

Driverless trucks could also reduce accidents caused by drivers who go to sleep while driving or are slow to react because of fatigue. Truck braking capability can be a factor in truck crashes. Loaded tractor-trailers take 20-40 percent farther than cars to stop, and the discrepancy is greater on wet and slippery roads or with poorly maintained brakes. Truck driver fatigue also is a known crash risk. Drivers of large trucks are allowed by federal hours-of-service regulations to drive up to 11 hours at a stretch and up to 77 hours over a seven-day period. Surveys indicate that many drivers violate the regulations and work longer than permitted (IIHS, 2016).

With all of this new technology, how about the trucks already in operation? Should they be upgraded by adding the new technology, or should the technology be introduced as new trucks are added to the fleet? In the face of technology, this is an old-fashioned return on investment analysis for trucking companies.

Technology on Highways

Highway systems, especially those on Interstate or other open high-speed highways, will also require some upgrades in technology. Something as simple as lane dividers will have to be clear so that driverless trucks can sense them and avoid crossing over into another lane. There will need to be some way to signal driverless trucks of unusual conditions such as snow, ice, rain, accidents or road construction. While GPS systems rely on satellites, driverless trucks may also need some more local signals to avoid problems, especially during adverse weather conditions.

Software to Integrate the Hardware

Bill Kahn, Peterbilt principal engineer and manager of advanced concepts says: "The vehicle we demonstrated during the ITS World Congress showcases how these technologies can integrate to provide the next generation of advanced cruise control and automation features. Heavy-duty trucks are an ideal platform for automated operation because, compared to motorists, commercial vehicles travel a majority of their miles on modern highways, at constant speeds and for extended periods of time." (Peterbilt, 2014)

Wilfried Achenbach, senior vice president, engineering and technology for Daimler Trucks North America, says "It's amazing what our human brain and eyes can handle. When you drive, about 10 times a second you get input from your surroundings, primarily through your eyes. A driver must process that information and make the right decision 10 times a second. Software is far from being able to handle that. That's why current autonomous-technology programs focus on less-complex on-highway operations, or pre-programmed routes, with the driver 'on-call' to take over when necessary." (Lockridge, 2015)

Jim Szudy, engineering manager for vehicle systems at Bendix, also recognizes the complexity of combining high-speed information from other vehicles on the road and the road infrastructure itself poses "what is probably the biggest challenge in terms of decision making for an autonomous vehicle – being able to gather and meld all that data." (Mele, 2015)

INFRASTRUCTURE

For this discussion, infrastructure will be considered to be all of the supporting elements necessary to create the environment in which the technology can be successfully employed. These will include not only the tangibles such as highways, city streets, and parking and storage areas, but also the intangibles such as regulations, policies and procedures, and education and retraining programs.

Highways

On the open highways, it will be important to have clearly designated lanes so that the sensors on driverless trucks can maintain their alignment within the lanes, especially if the lanes are open to manned vehicles. As an interim measure, it is feasible to use dedicated lanes solely for driverless trucks. For example, on an Interstate highway with three lanes going in the same direction, the right lane could be designated as a driverless truck lane with the remaining two lanes open to general traffic.

In some countries, the current highway structure may be an obstacle. For example, Graham Jarvis (2016) suggests that problems could arise with large truck platoons on the UK motorway network because it is most intensively used and has many more junctions than much of the rest of the world.

City streets

City streets will be much more difficult for driverless trucks to navigate because of their variety in size, number of lanes, turn limitations and the like. It appears likely that human drivers will be required for some years to navigate through today's urban configurations. As cities grow, it will become even more

difficult for large trucks that are now used for cross-country movement of goods to navigate city streets and it may be necessary to use smaller trucks or vans to make the final-mile deliveries.

Parking and storage areas

As a way of coping with the transition from open highway driving to city driving, parking and storage areas could be created on the outskirts of the city, much like the rest areas or truck inspection areas in use today. The platoon of trucks, or future driverless trucks, could move into the parking area where human drivers could take over to move the truck into more congested areas.

Regulations

Regulations of all types will be required. State and federal agencies will have to coordinate their efforts to assure complete coverage without excessive duplication. In the United States, government agencies will need to coordinate/collaborate with Canada and Mexico to pave the way for cross-border movement of driverless trucks. In other continents, there will be an equal, if not even greater, need for governments to work together to gain the benefits offered by this new technology.

In Brussels, lawmakers are considering Europewide regulations for things such as the minimum legal distance between vehicles and adopting standard rules about dissolving platoons at busy highway junctions. Transport ministers, the European Commission, and industry representatives have agreed to cooperate on connected and automated driving, focusing on traffic rules and making testing easier. Close cooperation "is needed if we want a widescale introduction of platooning," says Harrie Schippers, who heads DAF Trucks, the European unit of Paccar, a manufacturer based near Seattle. (Behrmann and Behrmann, 2016)

Policies and procedures

Companies operating driverless trucks will also have to carefully define how their vehicles are to be operated. If there is a human driver available, such as in the lead truck of a platoon, what are their duties and responsibilities? Will they be asked to perform related duties, such as scheduling, communication with next stop recipients, evaluation of truck performance, or other tasks related to their work? Will they be allowed to sleep during the trip or must they remain close to the truck controls in case of emergency? Will there be a remote controller of the truck who also has a responsibility, much like drone pilots do now?

Education and retraining programs

Educational requirements abound. Lead drivers in truck platoons will have to be trained in onboard adjustments to the truck or with communication systems connecting with trailing trucks, remote controllers, customers or other agencies. Educational programs may be useful for governmental agencies, such as police for day-to-day considerations, or city planners for long-term planning purposes.

CULTURE

Cultures will need changing for participants within the supply chains and also the non-participants who will be exposed to the changes in their surroundings as they become aware of the driverless trucks they encounter.

Drivers in autonomous trucks

Human drivers will become a different breed. Instead of being concerned with the physical needs of driving "big rigs," they will become the pilot of a sophisticated mover of goods and will be more concerned with the hardware and software systems they control. Consequently, it will require a different type of employee to be the lead driver in a driverless truck platoon, or convoy. Even the drivers who move the truck from the open highway to the city will be faced with the need to complement the truck's technology in the most effective way. While many of today's drivers will be required to adjust, it is likely that future drivers will enter their jobs with a different skill set and attitude.

Drivers in regular cars and trucks

Drivers of cars and trucks operating on the open highway with driverless trucks will also have to adjust. The sheer sight of a truck moving along at 60 mph without a visible driver will be an adjustment for most human drivers. It will also be an adjustment for today's drivers who like to pass on the right; they will not be able to squeeze into a platoon of trucks, or at least they should not try to make that maneuver. Other drivers who like to move to the right-most lane of the Interstate and travel in a lower stress mode will have to rethink their predilections and stick to the center lane for their own good and the safety of the driverless trucks.

Pedestrians

Although there won't be many pedestrians on the open highways, the use of driverless trucks on city streets will introduce a new consideration. Perhaps driverless trucks should have a large sign or flashing light to warn pedestrians not to test the stopping capabilities of driverless trucks when they sense an obstacle in front of them.

Police

Police will also have to adjust. While, in theory, driverless trucks will always obey the laws, a malfunction or adjustment by a controller may cause the driverless truck to operate in such a way to attract the attention of a law enforcement officer. How does the officer get the truck to "pull over?" Who does he/she talk to? Will there be a communication device on the truck or a number for the police to call to talk with a human? Or will the police just have to paste the ticket on the side of the truck in the hopes that some human will eventually see it? How does the officer get the truck to start again? No doubt, the police and truck operators have some things to work out.

General public

The general public will probably be the last group to grasp the concept of driverless trucks. It will probably all seem unreal to many who instinctively distrust automation or any form of technology advancements. Perhaps the reports of fewer accidents with trucks will sound like some fabrication of the press; on the other hand, it could be the beginning of a realization that automation in another form is rapidly becoming a reality. Some early studies have found that members of the general public aren't quite ready for driverless trucks and truck platoons (Jarvis, 2016)

CONCLUSIONS

As evidence that the business community is serious about driverless trucks, a recent experiment in platooning was carried out in Europe. A caravan of a dozen self-driving, semi-trailer trucks for the first time completed a trip across parts of Europe. The autonomous truck challenge was organized by the Dutch Ministry of Infrastructure and the Environment and included rigs from six manufacturers, including Volvo, Daimler and Volkswagen subsidiary Scania. The convoy journeyed from manufacturing facilities in

Belgium, Denmark, Germany and Sweden to the port of Rotterdam in the Netherlands. A Scania semi-trailer traveled the longest distance -- more than 2,000 miles and across four national borders. The network of authorities involved in the pilot project included federal governments, roadway authorities and consumer groups from six nations (Mearian, 2016).

One authority is optimistic about the future of autonomous trucks. "We're on a steady technology course that sooner rather than later will bring us a self-driving truck. Tut the true sweet spot for truck fleets may be stopping short of NHTSA's Level 4 full autonomy and instead give us trucks with self-driving attributes that complement rather than replace drivers." (Mele, 2015)

Kuehn and Reiner (2015) sum up the situation as follows: "Driverfree trucks and locomotives will soon become an economic imperative for freight railroads and motor carriers, changing the economics of

shipping. As technology companies develop driverless cars, the freight industry is working on the equivalent for trucks and trains. Shifting to driverless freight could resolve the longstanding problems of truck driver shortages in the U.S., significantly cutting costs for freight companies. The technology also could be more fuel efficient than human drivers and safer in terms of accidents. Research and development is much further along in the automation of trucking than in freight rail because trucking is more labor intensive and the economic benefits of automation greater. The compelling economics of autonomous trucking may change the transportation landscape so radically, however, that railroads will have no choice but to respond in kind. To manage this transition safely, all parts of society – government, the private sector, and the public – will need to work in concert, with freight railroads and motor carriers leading the way."

Petersen (2016) also believes that driverless trucks are close to being available. He views the remaining barriers as regulatory, not technology. He also believes that regulators will be understandably reluctant to allow technology with the potential to eliminate so many jobs. He also believes that the potential benefits, which he compares to the mechanization of agriculture, are so great that governmental agencies will be forced to adapt to this new reality.

Driverless trucks will be a disruptive technology that will take years to successfully implement. The management of supply chains is headed for a significant change as driverless trucks become a reality. While their coming is not imminent, it is inevitable. Both the companies directly involved and the general public should get ready.

As shown in Figure 1, often the technology precedes the infrastructure and culture changes. In some cases, the technology falters or is not all that it is expected to be. At this time, if the infrastructure and culture modifications are not adequate to carry the project through the technology adaptations needed, the entire project could be in trouble. While it appears that driverless trucks are a certainty, their implementation will be successful only if the infrastructure is compatible and the cultures change to capitalize on this disruptive innovation.

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TURNOVER AND TURNAWAY OF INFORMATION SYSTEMS/TECHNOLOGY PROFESSIONALS DURING A NATIONAL CRISIS AND ACROSS AGE GROUPS

Carlo Gabriel Porto Bellini, University of North Carolina Greensboro, USA
Valter de Assis Moreno Jr., Universidade do Estado do Rio de Janeiro, Brazil
Alexandre Reis Graeml, Universidade Tecnológica Federal do Paraná, Brazil
Prashant Palvia, University of North Carolina Greensboro, USA
Tim Jacks, Southern Illinois University Edwardsville, USA

ABSTRACT

We studied how the perception of job insecurity (JI) along with the perceptions of job satisfaction (JS) and professional self-efficacy (PSE) of information systems/technology (IST) professionals influence their intentions to leave their organizations (ILO), leave the profession (ILP), or remain in the same job. We analyzed survey data from IST professionals in different work positions in several different organizations and economic sectors in Brazil during a national crisis. The main findings are that JS mediates the influence of PSE on both ILO and ILP, and JI mediates the influence of PSE on ILO. Also, we found that a professional's age and the economic environment may be important intervening factors to be considered in job-related research. Our study contributes by calling attention to JI as a key factor in the job-related mindset of IST professionals, by proposing a parsimonious model to study the reasons for ILO and ILP, and by suggesting that certain control variables such as age and the economic environment may have to be studied in greater depth.

INTRODUCTION

Although the relationship between turnover intention (ILO) and job insecurity (JI) has been a concern in the management literature (e.g., Ashford et al., 1989, and Staufenbiel & König, 2010), it does not seem to be an interest of the information systems/technology (IST) literature. A recent bibliographical search revealed that only a few studies about JI were published in reputed IST journals. This may be related to the facts that the IST profession is highly demanded worldwide and that IST professionals are able to negotiate more convenient employment contracts – so, JI does not seem to be an issue. Also, a substantial part of the IST workforce is composed of self-employed professionals who are more independent in terms of work arrangements. On the other hand, the IST profession is embedded in the broader economic environment, and thereby may be influenced by economic cycles and contingencies, and also by the level of maturity of national and regional institutions.

Brazil is a country that has received considerable attention from scholars, practitioners, and governments in the last decade due to an alleged improvement of social indicators. However, recent anti-corruption investigations headed by the Brazilian Federal Police and other institutions unveiled a variety of schemes involving business and political leaders, shedding serious doubts about the country's recent socioeconomic achievements and prospects. In fact, since 2014, Brazil has witnessed a decline in its economic indicators, including the employment rates and the rising inflation. The state of the Brazilian economy and labor market represents an opportunity to study IST professionals' JI and related constructs according to their influence on ILO and turnaway intention (ILP) in a socioeconomic context that is radically unique.

In the following sections, we provide a brief view of this study's theoretical background, methodological procedures, statistical results, and conclusions. Further details of each section, as well as the discussion of results, will be available elsewhere.

LITERATURE REVIEW

The demand for IST professionals exceeds the supply, and the supply is declining while the demand is rising (Armstrong et al., 2015). In this scenario, worker shortage (Freeman et al., 1999; Moore et al., 2001; Guzman & Stanton, 2009) and the retention of staff (Agarwal et al., 2006; Ghapanchi & Aurum, 2011; Dinger et al., 2015) are enduring concerns particularly in the USA. But keeping the supply-demand equilibrium and retaining IST professionals in the company or in the profession are two different concerns. There are four broad ways in which a professional may develop his/her IST career: he/she may (1) remain in the organization and remain in the profession; (2) leave the organization, but remain in the profession; (3) remain in the organization, but leave the profession; or (4) leave the organization and leave the profession. Following Joseph et al. (2012, 2015), turnover refers to when a worker leaves the organization and remains in the IST profession; and turnaway refers to when a worker leaves the IST profession by moving to another field of expertise, either inside the organization or across organizational boundaries. In our study, we exclude the cases in which a worker (1) decides to stop working at all, (2) compulsorily retires (such as when following a country's particular legislation), or (3) is laid off.

IST professionals are known to have high job mobility (Moore & Love, 2005; Fallick et al., 2006). Reasons for the mobility are manifold, including the very nature of the IST professional, who is eager to develop new knowledge and face new challenges (Jacks & Palvia, 2014), the project-oriented nature of IST work (Agarwal et al., 2006), and the competitive and highly demanding labor market that offers alternative work opportunities (Armstrong et al., 2015). The IST labor market has been consistently reported as one of the most complex regarding turnover, thus challenging the management of human resources in organizations (Bernthal & Wellins, 2001). But as a knowledge worker (Scarbrough, 1999) who performs rather autonomous work (Moore & Love, 2005) and whose work routines are difficult to supervise (Dinger et al., 2015), the IST professional is also highly skilled and interested in an environment that promotes continuous learning and technical competence, creativity, and self-management opportunities in order to keep motivated (Ferratt & Short, 1986; Ramakrishna & Potosky, 2003). If management does not address such issues, the IST professional may consider to quit by either manifesting ILO or ILP.

In search for the reasons for ILO and ILP among IST professionals, we assumed that JI would be an important factor. JI is "perceived powerlessness to maintain desired continuity in a threatened job situation" (Greenhalgh & Rosenblatt, 1984, p. 438). We surveyed all published material available in Web of Science about JI in the IST field in order to see how central this topic is in that literature. Having identified only 15 articles that address JI to some degree in the IST field, we concluded that the field's academic interest on JI is low. It is our guess that prior to the first published studies on JI in the IST profession, the profession was enshrined as the redoubt of untouchable employees – for the highly skilled and organizationally critical routines its practitioners performed. But after the dotcom bubble burst in the first years of the 2000s (Hirschheim & Klein, 2003), the alleged commoditization of the information technologies (Carr, 2003) and the important U.S. financial crisis of 2007-2008, which led to an 8.9% unemployment rate in that country (Murphy et al., 2013), the IST profession may have started to be seen as just another organizational function, and, as such, threatened by the risk of unemployment. That is, it is possible that perceptions of JI emerged as a topic in the field, especially during the occurrence of crises. Therefore, the lack of studies on JI in the IST literature may not be due to a lack of interest, but to the perception of JI being a new phenomenon.

Starting with JI, we then searched for other key constructs that might interact with JI and help explain ILO and ILP among IST professionals. Our final model and hypotheses included only a few constructs that were expected to explain to a good degree the occurrence of ILO and ILP. But even if the model ended up being parsimonious, it included two constructs that are unusual in related literature – JI, and professional self-efficacy (PSE). Also, the model included two constructs that are theoretically expected to be shaped by the professionals' background context – JI and job satisfaction (JS). This was an important modeling decision, since we were about to test the model in a setting marked by

economic recession. Below, we define our additional constructs and the hypotheses. The full rationale for the hypotheses will be available elsewhere.

If PSE is the perception an individual has about his/her own efficacy in the profession (this definition is ours), and if JS is "an accumulation of sentiments related to the job being performed" (Kianto et al., 2016, p. 623), we have the following hypotheses:

H1) PSE negatively influences JI.
H2) PSE positively influences JS.
H3) JI negatively influences ILO.
H4) JI positively influences ILP.
H5) JS negatively influences ILO.
H6) JS negatively influences ILP.

METHOD

This study is part of a larger project (World Information Technology Project, WITP, http://worlditproject.com), which has been gathering data about the IST profession in 47 countries since 2013. According to Palvia (2013), the WITP is motivated by the fact that most IST research is dominated by the perspective of a few countries, and researchers in other countries – mainly the less developed ones – inadvertently adopt theoretical models and empirical findings that are exotic to their realities. At the same time, the international IST community does not have access to potentially useful perspectives and cases that remain isolated within the geographical boundaries. The problematic development of true global knowledge about the IST field worldwide is certainly due to a variety of reasons, among which the language barrier, the irregular access to mainstream literature in many parts of the world, and the lack of initiative by both the local researchers and the global community towards a richer, shared frame of reference. Such a more diverse approach to IST interests is expected to enable greater effectiveness of local practices for both the demand and the supply sides of IST applications, services, and public policies.

The WITP recruited researchers throughout the world who could interact with their local IST realities and make bridges with the global IST community. The focus was on the IST workforce in each participating country. A standard data collection instrument was shared with all research teams that joined the project, and the teams were expected to translate the instrument to their regional languages, apply the instrument to a statistically significant sample of IST professionals in their countries, and apply local knowledge to interpret the results. Besides collecting a series of demographic variables about the respondents and their organizations, the data collection instrument measured items on (1) the respondents' personality, friendship circle, IST-related competencies, and job-related perceptions and intentions; (2) their organizations' culture, IST maturity, business strategy, and competitive environment; (3) the IST occupational culture; and (4) the local national culture.

Our study is part of the WITP's Brazilian chapter. During the collection of data in Brazil, we realized that we had quality data to study the hypotheses mentioned before. IST is not recognized as a true profession in Brazil (it is sometimes referred to as an occupation instead – Joia & Mangia, in press), but it is responsible for a great deal of the Brazilian economy, as part of the services sector – which corresponds to nearly 70% of the Brazilian GDP and also nearly 70% of the total job positions in the country. The IST sector employs 1.3 million workers in Brazil, and another 750 thousand are expected to be demanded until 2020 (Garbin, 2016), but the shortage of qualified professionals is an enduring issue in the country (Joia & Mangia, in press). The public interest, non-governmental organization that promotes the Brazilian software worldwide estimates a deficit of 408 thousand professionals by 2022 and a corresponding loss in business opportunities (Softex, 2015).

All constructs included in our model were operationalized and measured with previously validated five-point Likert scales that were included in the standard WITP data collection instrument. We also included several control variables in the model, namely: the respondents' age, education and gender,

their organizational hierarchical level, their organization's type (whether public, private, or mixed), and crisis (whether the respondents answered the questionnaire early in 2016, or early in 2015). We were primarily interested in addressing IST professionals who had an organizational life, that is, those who were employed by organizations. A few self-employed professionals and owners of IST organizations also answered the questionnaire. We decided to keep them in the dataset since our constructs are somewhat meaningful for self-employed IST professionals and owners of IST organizations as well. Also, we wanted to include all professionals that make the IST profession, thus leaving for future research the interest for more particular analyses. After screening out anomalous cases and outliers from an initial set of 385 cases, our final dataset consisted of 291 cases collected during 23 months during which an important economic crisis in Brazil took shape.

RESULTS

Our model explained a considerable proportion of the variance of ILO (R^2 = 0.44). Although the corresponding values for the remaining exogenous latent variables were lower (R^2 = from 0.13 to 0.18), the hypotheses in our study obtained empirical support with the exception of H3.

PSE had significant influence on both JS and JI. The corresponding path loading estimates were statistically significant and similar in magnitude, although with opposite signs (0.33 and -0.27, respectively; $p < 0.001$). Hence, as proposed in the theoretical review, IST professionals who have higher PSE tend to report higher JS and lower JI. Therefore, hypotheses H1 and H2 were supported.

JI had significant influence on ILP (0.17; $p < 0.05$), that is, IST professionals who have stronger concerns about the possibility of losing their jobs (higher JI) are more likely to take steps to leave the profession. In our study, JI refers to one's concerns about his/her job being eliminated or outsourced soon. On the other hand, contrary to what was expected, JI had no effect on ILO. Therefore, hypothesis H4 was supported, while hypothesis H3 was not.

JS was the foremost predictor of ILO and ILP, with statistically significant effects of -0.59 and -0.33, respectively ($p < 0.001$). These results support hypotheses H5 and H6, that is, IST professionals who have higher JS are less likely to report ILO or ILP.

PSE had a statistically significant negative effect on ILO through JS. On the other hand, the effect of PSE on ILP is mediated by both JS and JI. The estimated total effect of PSE on ILP was -0.15 ($p < 0.001$). Thus, the stronger the beliefs of IST professionals that they are able to properly perform their tasks, the less they intend to leave the IST profession.

Some control variables had statistically significant effects on the endogenous latent variables. The more educated an individual is, the less he/she reports JI (-0.23; $p < 0.01$). And both age and hierarchical level seem to negatively influence ILO (-0.12 and -0.11, respectively; $p < 0.05$), that is, older IST professionals and those who have higher positions in the organizational hierarchy seem to be less likely to intend to cross the organizational boundaries. On the other hand, older professionals tend to report higher ILP (0.2; $p < 0.001$). This result is not supported by another study done in a similar setting, which did not confirm age as an antecedent of ILP (Joia & Mangia, in press). The intention to leave the IST profession seems to be also more in the mind of professionals who answered the questionnaire later when compared to those who answered it earlier (0.11; $p < 0.05$). It is therefore possible to think that the increasing awareness about the economic crisis affected ILP, but not ILO.

DISCUSSION AND IMPLICATIONS

The theoretical and applied discussion of results will be available elsewhere.

CONCLUSIONS

Our study was motivated by known idiosyncrasies of the IST field – such as the unbalance between the supply and demand of IST professionals worldwide, the struggle of organizations to retain their IST human resources, the IST occupational culture, and the phenomena of turnover and turnaway in the IST profession. We then contributed to the literature by introducing JI as an important concern in the IST field, although still largely absent in the field's research. We found that JI is part of a network of constructs that also includes JS and PSE as direct or indirect antecedents of ILO and ILP. This means that a small set of key perceptions of IST professionals about their relationship with their jobs explains to a good degree their intentions regarding job continuance. However, the perspective of IST professionals about their jobs may be influenced by their broader context, including their own individual ages and the background economic environment. This is left open for future studies.

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Acknowledgement: We thank Administradores (www.administradores.com.br) and its CEO, Leandro Vieira, for promoting our online questionnaire, thus helping us to collect most of the data. Administradores is the most popular web portal for the Brazilian management and business community. And we are most thankful to all respondents who kindly agreed to provide the empirical data.

USING THE SAMR MODEL TO CREATE A TRANSFORMATIONAL LEARNING INITIATIVE AT THE UNIVERSITY LEVEL

Jerry D. Neal, University of Central Missouri

ABSTRACT

The SAMR Model conceptualizes how technology has evolved in such a manner that educators must now look at a continuum of options when selecting what type of technology best fits the task at hand. The paper provides specific details regarding the logistics of replicating this effort at other universities, how it may impact K-12 learning, and how the Transformational Learning Initiative (TLI) is an on-going learning experience at the university level.

Introduction

The use of technology in America's public school classrooms has grown at an exponential rate over the last 20 years. The advent of the computer was a landmark in how educators could apply new resources to their teaching toolboxes. Who can forget the first Apple computers, replete with floppy disks and 64 K memories? And then the "mouse" came along and made navigation even easier for novice computer users. Finally, the Internet opened an entire new world of learning for students and teachers alike. The use of the classroom black board and chalk disappeared while online learning skyrocketed in the late 1990s. Everything changed, and many educators believed that everything that could be developed for classroom innovation had, in fact, been developed. And then the Apple iPad and other mobile learning devices started making their way into the classroom. Mobile learning, or mLearning, had begun, and education took notice.

It did not take long before technologically-astute teachers were putting the iPad and mLearning into regular use. Numerous studies and testimonials have touted the use of iPads and other mLearning devices as the latest revolution in educational technology (Ferenstein, 2011;McNaughton & Light, 2013; Rossing, Miller, Cecil, &Stamper, 2012). Some scholars and researchers eventually recognized that the iPad, and mLearning in general, were so revolutionary that they had, indeed, transformed the way teachers will teach and students will learn in the 21st Century. Most notable of these innovators was Reuben Puentedura (2016). Puentedura termed this rethinking of technology the SAMR Model.

The SAMR Model

The SAMR model of viewing teaching and learning has been in existence for a number of years, but is just now becoming widely used in higher education. The acronym SAMR stands for Substitution, Augmentation, Modification, and Redefinition. The SAMR Model conceptualizes how technology has evolved in such a manner that educators must now look at a continuum of options when selecting what type of technology best fits the task at hand.

Transforming learning with the SAMR model views the use of technology as a hierarchy that requires more and more dynamic involvement and adaptation as one proceeds upward in that hierarchy. The internet is replete with numerous examples of how the SAMR Model is conceptualized. For example, at the lowest level, Substitution, students would use a typewriter instead of an ink pen for written communication. At the Augmentation level, we are able to see a significant improvement in technology for writing, such as using a word processor instead of a typewriter, thus allowing one to correct and edit a written document in progress rather than completely retyping a completed work. Technology at the

Modification level would have the student not only use a word processor/computer, but also have the assignment completed by using Google Docs so that partners/collaborators could edit, critique and share writing responsibilities online. At the apex of the SAMR model is Redefinition. Redefinition has the student conceptualize tasks that had previously been inconceivable. The writing assignment could now be turned into a video presentation through various "apps" such as iMovies or other multi-media productions.

The Initiative Conceived

As the use of all technology in public schools expands exponentially, the leadership of the College of Education (COE) at the author's university determined that there was an urgent need to implement a program that would rapidly provide faculty members with the tools and the training to make them proficient not only in the use of mobile learning devices, but also in teaching their students how to use the devices and the software associated with them. The university began efforts to adopt a mobile learning model in spring 2014. The project was based on the use of mobile devices in order to enhance the teaching effectiveness of not only the university instructors, but also enable teacher education students to become acclimated to how these devices can be used in their classrooms once they graduate and take control of their own classrooms. The SAMR Model was the centerpiece and guiding force in this effort which was termed the Transformational Learning Initiative (TLI).

Much of the idea behind the TLI, in addition to the SAMR Model, was the notion or practice of mLearning. Based somewhat on the work of Romrell, Kidder, and Wood (2014), the TLI combined the best features of the SAMR and mLearning models for teaching and learning. As Romrell, et al note, while there is a mobile device at the heart of mLearning, it is what the devices enable teachers and learners to do that truly define mLearning. In particular, mobile devices are personal and personalized. They are situated across contexts and time. And they are connected to information, people, and practices. These three characteristics of mobile devices make mLearning unique and different from other types of eLearning (p. 2). The TLI was thus conceived and the decision to implement it was made with the College of Education (COE) leading the way for the rest of the university.

Implementation of the Initiative

The Transformational Learning Initiative, was an ambitious, intense instructor training program which formally began in the summer of 2014 and continues to the present. Much of the impetus for the TLI project was based on data collected from the follow-up surveys completed by school district administrators who hired the university's graduates. Over several years, the surveys had consistently indicated the need for greater knowledge and skill of our graduates in the use of technology with students in the public school classroom. The central focus of the TLI project was the effective use of mobile learning devices such as iPads, iPhones, tablet computers, Apple TV technology, and the myriad applications (Apps) and online technologies that are readily available, and affordable, for most school districts. The administration and faculty leadership of the COE were acutely aware that mobile learning devices and their associated technologies were already in wide use in public schools where most of the COE's graduates will eventually obtain employment. The next challenge was then to induce, coerce, or otherwise goad instructors and faculty members to willingly acknowledge the need for this transformation to take place, and for them to start incorporating these technologies into their own teaching repertoires.

The inducement to gain faculty participation in the TLI was an offer of a free iPad to anyone willing to take part in a week-long intensive training workshop, and a commitment to attend regularly-scheduled training/learning updates for the 2014-2015 academic year. There were two initial cohorts of 20 faculty members for training workshops, and a third cohort was trained at a later time. The first cohort was from the College of Education only, and the second involved faculty from across the university. An Apple Consultant was retained for the training sessions, which lasted for 7-8 hours each day for 4 days. Many participants had never handled an iPad prior to the workshops, and it was a unique learning experience,

especially for those who were PC users and were unacquainted with Apple products and user systems. A variety of learning experiences was developed and collegiality, peer teaching, and collaboration were the hallmarks of these sessions.

The Apple facilitator was extremely knowledgeable about the features, capacities, and limitations of iPad and similar products. There was no lecture involved: One hundred percent of instruction was hands-on either individually or in small groups. Participants were required to download the various apps on the spot, and each app was explained and immediately put into use. This massive use of university server bandwidth centered in one classroom periodically created some minor technology problems. Downloading of apps often took a considerable amount of time, and in some instances, the iPad would "time out" before the app could be successfully downloaded necessitating accessing the App Store once more to attempt to load an app into the device. Patience was needed by both facilitator and participants.

TLI in Practice

Beginning with the fall 2014 academic year, participants put what they had learned during the TLI training session in summer into actual practice. The College of Education had previously been awarded a technology grant, and with the finds from that grant, 500 iPads were purchased. The iPads were dispensed to education majors who were allowed to keep the iPads as long as they are enrolled in courses at the university. The iPads provided the necessary platform for the TLI to be put into practice. Faculty members were encouraged to begin using the iPads and the apps that had been downloaded into them for day-to-day instruction as much as possible. A number of apps were immediately useful for such mundane tasks as taking attendance, obtaining viewpoints, polling students about lecture content, and exchanging information between students via the Airdrop feature on iPads. Students were able to see very quickly how they could apply these tools in their own classrooms. Every classroom in the main College of Education building was equipped with an Apple TV projector by the spring of 2016, thus enhancing the capabilities of the iPads and the teaching-learning experience. Additionally, combined with interactive Smartboards and other devices such as Prometheus, the classrooms truly became state-of-the-art learning labs.

The central goal of the TLI, at least for the faculty and students who were part of the College of Education, was to make the leap from merely using an iPad or other mLearning device for personal use or obtaining information to employing the devices as teaching/learning tools in K-12 classrooms. This meant that faculty members had to systematically begin requiring education majors to develop lesson plans and long-term learning experiences that incorporated those technologies whenever possible. It was important for our students to understand that one of the central reasons why the TLI was implemented in the first place was to address the shortcomings of novice teachers from our programs in the effective use of technology once they became certificated teachers. The aim was to make the use of mLearning technology so pervasive that the education majors automatically would consider which application (app) or iPad feature could most readily teach young students a skill or concept in the most effective or efficient manner. As such, students were expected to teach lessons to peers in small groups, large groups, or individually using their iPads, Smartboards, or other technologies available to them. Practicum students were encouraged to use the iPad technologies during their field experiences in area school districts and to report back to their university instructors as to the results of those lessons.

On-Going Professional Development

Recognizing the need for systematic, continued professional development in the use of mLearning technologies, a lead facilitator was appointed by the dean of the College of Education. The facilitator was a full-time instructor in the College of Education who had extensive expertise and skill in a wide variety of educational technologies and was also an extremely adept teacher with an extraordinary acumen to motivate a diverse group of teacher preparation faculty members. Beginning in the Fall 2014 semester,

weekly "Appy Hours" were conducted with a mix of university technology facilitators leading most sessions. These sessions eventually included students as well as teaching faculty, and outside tech support people who provided insights on new innovations and products. These were nearly all hands-on learning opportunities for participants. Some of the Appy Hour sessions included:

- Making iMovies with student groups
- Use of QR Codes for instructional purposes
- Socrative
- Developing blogs, wikis, and using Skype for distance learning
- Effective use of Google Docs and Google Drive
- Cloud technologies
- Developing assessments with online technologies

Many of the Appy Hours were 'Strategy Swaps" in which faculty and students would share with the faculty members present new apps or innovative approaches to teaching and learning. The Appy Hours now include faculty members from across the campus, thus bringing diverse perspectives on how mLearning is being applied in various academic disciplines. One faculty member even developed a TLI blogspot .

Assessment of the Project

Assessments were conducted to determine the extent to which the devices and learning approaches were actually incorporated into faculty's teaching practices, and how the TLI impacted student learning. Each semester, students were asked to respond to an online survey regarding the extent to which they were using their iPads, educational apps or other technologies and where in the SAMR continuum their use occurs. Faculty members completed a similar survey and were encouraged to provide suggestions or ideas as to how the TLI could be improved. The most recent student survey revealed the following results:

- 84.69% felt they had experienced transformed learning this semester.

- There were still some comments about instructors not using the iPads. However, 75% said they used iPads for class time activities often or very often. And, 85% agreed or strongly agreed that their teachers were modeling engaging instructional technology which increased learning.

- 80% agreed or strongly agreed that teachers who use current instructional technology have more interesting classes.

- 82% agreed or strongly agreed that courses with instructional technology provided ls for their career.

- There were also comments about offering instruction on how to use the iPads. This was corrected by offering to students "iPad 101" courses to students upon being issued one of the devices.

Because one of the main reasons for starting the Transformational Learning Initiative in the first place was to address the perceived shortcomings of our students in the use of technologies in the classroom once they are certificated educators, the ultimate assessment will be the next round of follow-up surveys completed by our graduates' immediate supervisors in the K-12 schools in our state. Informal conversations by the author with school leaders and classroom teachers now indicates that, while the iPad devices are still being used extensively in K-12 classrooms, new technologies, such as Google Chrome

Books and their capacities to utilize cloud technologies, are becoming the learning/teaching platform of choice in many public schools. Universities will be expected to keep up with these ever-changing, quickly-evolving technologies to ensure that novice teachers are prepared to use state-of-the-art tools as soon as they enter the classroom. That will be a great challenge to those in the teacher preparation business. But it will be an exciting challenge.

Suggestions for Implementing a TLI at the University Level

The following suggestions are gleaned from personal experience with the implementation of a Transformational Learning Initiative at one university.

- Have a good reason for starting an initiative such as the one described in this paper. In our case, the TLI was started due to an ongoing perceived deficit in our graduates' ability to use technology at acceptable levels in K-12 classrooms. Accreditation agencies such as the Council for Accreditation of Educator Preparation (CAEP) and The Higher Learning Commission (HLC) pointed out this shortcoming to the university faculty and college leadership. The TLI was intended to improve the abilities of our students to use technology effectively and thus satisfy the area for improvement noted by the accreditation teams. If a goal is in mind prior to the adoption of such an initiative, planning will be much easier as there will be specific outcomes to be attained by the initiative.

- Plan, plan, plan. This cannot be overstated. Doing a "one shot" in-service will never be sufficient. Success will depend on a well-conceived initial training period (at least one solid week of from 5-8 hour days), followed by on-going, consistent training sessions where faculty and students are motivated and involved personally. People must WANT to pursue learning about technology and see how it directly will improve both their teaching and learning skills.

- Procure the services of an expert in the area of mLearning to serve as a facilitator/trainer for the initial TLI training sessions. This can be an individual or small group of people from within the existing ranks of the university's faculty or an outside consultant contracted for this purpose. The author's university opted for the outside consultant model who was a faculty member from another university and also happened to be an Apple Corporation product consultant. Because the mLearning platform chosen was the Apple iPad, this made a lot of practical sense.

- Enlist the services of a faculty member or members who will serve as facilitators for the continuous training sessions that will take place throughout an entire academic year or beyond. This person will not only coordinate the several professional development training sessions, but should also be available on an as-needed basis when faculty or students have questions or need in-depth training with a device or an application. Ideally, this person should receive release time in order to plan training sessions, communicate to faculty and student participants, and conduct follow-up assessment of the project to determine future needs and fine tune the project as needed.

- If large numbers of mLearning devices (e.g. iPads) are purchased for student and/or faculty use, a secure storage area will need to be obtained where the devices can be kept charged and a process for dispensing and returning the devices will have to be implemented. These are expensive learning tools costing several hundred dollars each, and you must protect the investment in them. Students and faculty must be made aware at the outset that they are responsible for the devices and if one of them is lost, stolen, or damaged, the university will expect the recipient of the device to make restitution.

Conclusion

The Transformational Learning Initiative has proven to be a great success for everyone concerned. Students are gaining the skills and expertise to use educational technologies that they will be expected to incorporate into the teaching once they enter their own classrooms. University faculty are becoming more adept and creative in using these technologies such that they replacing themselves as the "guide on the side" rather than the "sage on the stage." The TLI has been an exciting learning project since its inception, and new roads are yet to be travelled. It is hoped that the TLI at this university will serve as a model for others who are interested in developing a similar project on their own campuses.

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VISUALIZING SIMPSON'S STATISTICAL PARADOX

Robin M Snyder, robin@robinsnyder.com, http://www.robinsnyder.com

ABSTRACT

Simpson's Paradox is a statistical paradox that arises from time to time in working with ratios or proportions. Data visualization can be defined as visualizing data in ways that can help one find what one is looking for. Information visualization can be defined as visualizing data in ways that can help others understand a certain point of view. Previous work by the author looked at finding minimal instances of Simpson's Paradox and in using data visualization to visualize and investigate the asymptotic behavior of Simpson's Paradox. This paper looks at using information visualization techniques to make Simpson's Paradox more understandable.

INTRODUCTION

Simpson's paradox appears from time to time in actual, and sometimes important, circumstances. Such examples are omitted but the reader can do an Internet search search for "**Simpson's Paradox examples**" to find many examples.

Recent and related work by the author involved finding minimal instances of Simpson's Paradox through simple code prototyping [6], developing a simple technique to use data clusters for distributed computation [7], and investigating the asymptotic behavior of Simpson's Paradox using data visualization and cluster computing techniques [8].

This paper looks at using information visualization techniques to make Simpson's Paradox more understandable. A primary objective in the visualization is that the visualization should allow the reader to check individual parts of the visualization that lead to the overall result.

VISUALIZATION

Visualization can be used to both find something of value in data (thus extracting useful information from data) and to convey something of value as information. See, for example, [10], [3], [2], [9].

Thus, visualizations (the author's idea) can be divided into two categories.

1. Data visualization is where one does not know what one is looking for, such as trends, etc., and the visualizations allow one to explore and look for things of interest. For example, an airline can display a graphic of the airplane and allow the user to select a seat. A sports team can display a graphic of the stadium/area, with dynamic views, etc., and allow the user to select a seat.

2. Information visualization is where one knows what one wants to convey and needs a way to effectively communicate that idea.

In a legal analogy, custom scripts and code can be used to explore ideas using data visualization. Once one has found the important ideas, one then uses information visualization to effectively convey that idea to the jury.

Larry Page, co-founder of Google, came from a user interface point of view and has a saying that, in terms of the user interface, the user is always right. Thus, Google attempts to create the user interface such that the user can easily do what the user wants to do - all to Google's advantage, of course.

BACKGROUND

In his book Probabilistic reasoning in intelligent systems, Judea Pearl, winner of the 2011 ACM Turing Award for "**For fundamental contributions to artificial intelligence through the development of a calculus for probabilistic and causal reasoning** ", makes the following observation in reference to Simpson's paradox.

> *Imagine your family physician saying, "This drug seems to work on the population as a whole, but it has an adverse effect on males ... and an adverse effect on females." Only when you look at the numbers and agree to interpret the phrase "seems to have an effect" as a statement about a change in proportions do you begin to see that the calculus of proportions clashes with our intuitive predictions.* [4, p. 496]

Pearl say this about human intuition for such problems.

> *It appears that the machinery invoked by people for such tasks amounts to approximating the calculus of proportions by some expedient abstraction. The machinery may be adequate for an idealized model of these proportions but would not respond to all their fine details.* [4, p. 405]

Pearl has done important work in the related field of causality [5]which sometimes has to deal with paradoxes such as Simpson's paradox.

THE PARADOX

The paradox is best understood (and visualized) with a simple example. Although the paradox is often presented in terms of floating point approximations to rational number ratios, here, nonnegative integer counts are used to get the ratios. A minimal instance of the paradox is used in the example and visualizations.

In simple form, if there are `n` balls to be distributed between red and blue balls and then distributed between `4` jars (e.g., left pair and right pair) that each have at least one color of each ball in them (a previous paper allows no balls of one color), then there are `8` degrees of freedom which requires `8` simple nested loop bodies (i.e., and outer loop and `7` inner loops). The nested loops make the problem intractable in general.

PROBLEM VISUALIZATION

Simpson's Paradox is here presented using a visualization of Simpson's Paradox, created by the author, and whose details and alternatives will be discussed here.

The famous/infamous computer scientist Edsger Dijkstra once made the following comment about computer programming and software development.

> *The moral of the story can only be that a nontrivial algorithm is just nontrivial, and that its final description in a programming language is highly compact compared to the considerations that justify its design.* [1, p. xv]

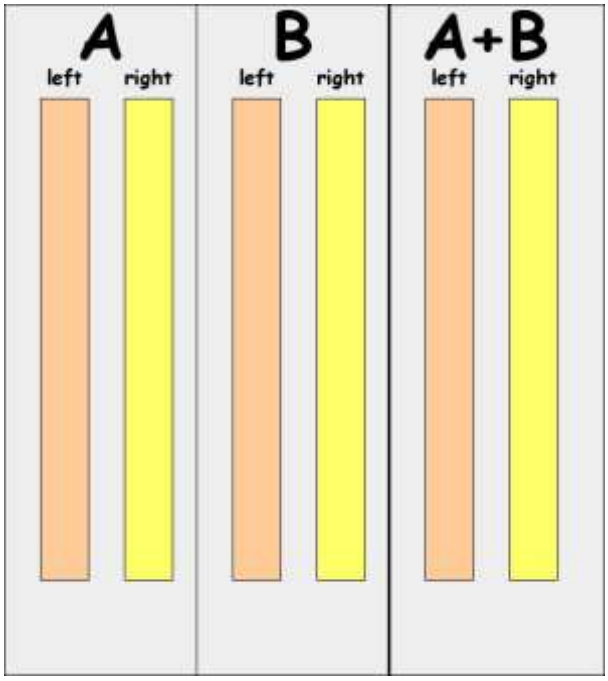
One can make the following claim about information visualization development, as in the following.

> The moral of the story can only be that a nontrivial data visualization problem is just nontrivial, and that its final description as a data visualization graphic is highly compact compared to the considerations that justify its design.

The visualization presented uses a minimal instance of Simpson's Paradox, using **19** balls, as investigated in previous work by the author.

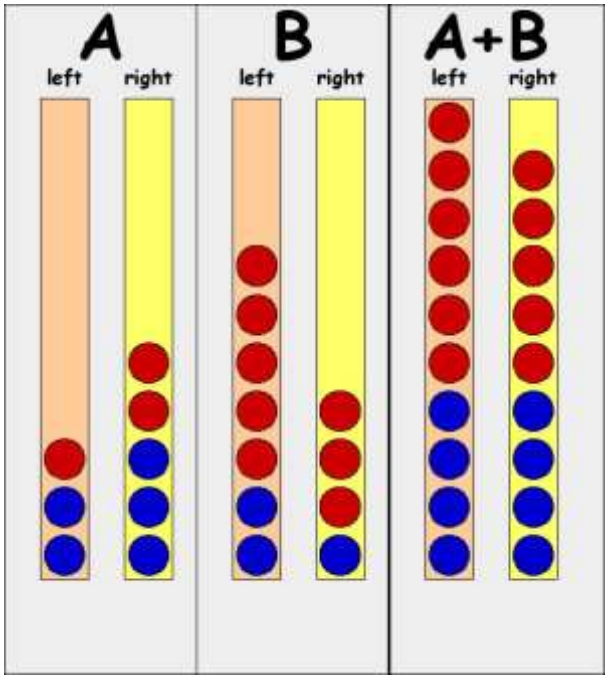
EMPTY PAIRS OF TUBES

The kinesthetic example used by the author uses actual clear tubes containing balls of red and blue color. For visualization, three pairs of tubes are needed, called here set "**A**", "**B**", and "**A+B**". Each pair is divided into a "**left**" and "**right**" pair.



PUT BALLS INTO EACH TUBE

The next step is to place the red and blue balls into the tubes, using a minimal example of Simpson's Paradox, as follows.

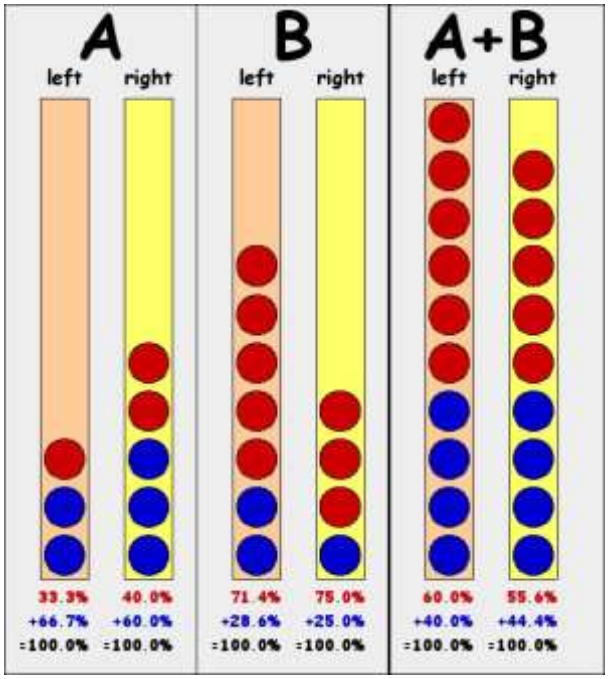


Note that the left and right tubes of pair "**A+B**" have the same number and color of balls as the corresponding balls in the left and right tubes of pair "**A**" and pair "**B**" combined.

The next step is for the reader to decide, for each pair of tubes, the best probability of picking a blue (or red) ball out of the tubes - where the balls in each tube are put into a jar (or bag) and one must pick a ball out of the jar (or bag) without knowing which color of ball will be chosen. To do this, one must calculate percentages.

SHOW THE PERCENTAGES

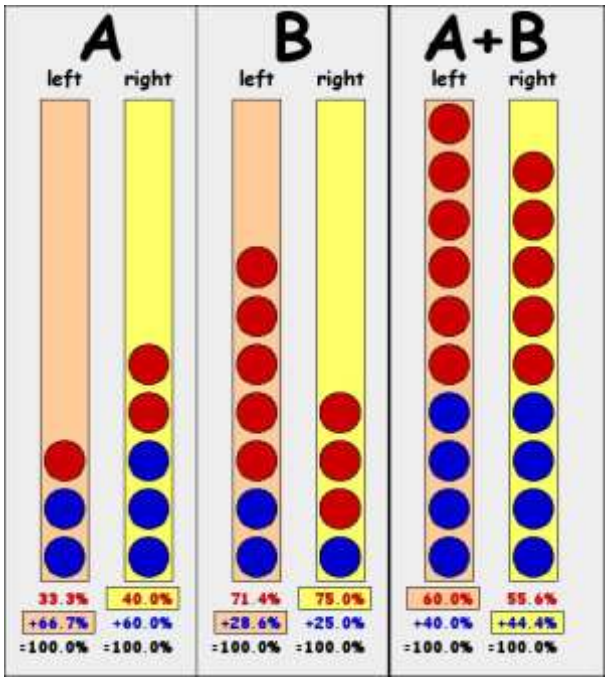
It can help the reader to provide the percentages, since it is easier to verify percentages rather than calculate them. Here is the result.



The percentages are color coded to the color of the balls, using black for the "**100.0**" percent.

SHOW THE BEST CHOICES

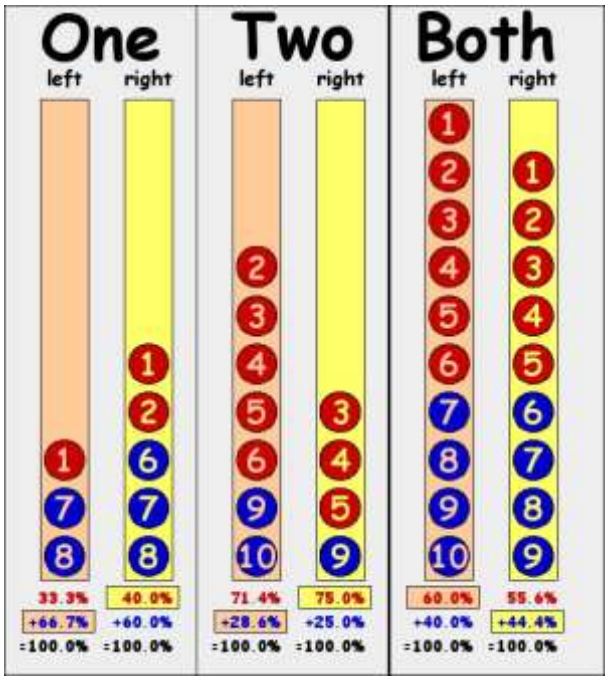
For each pair of tubes, it can help to show the best choices, left or right, for each pair.



This is done with a color-coded box around the percentage, "**left**" or "**right**", that provides the best chance of picking that color ball.

IDENTIFY EACH BALL

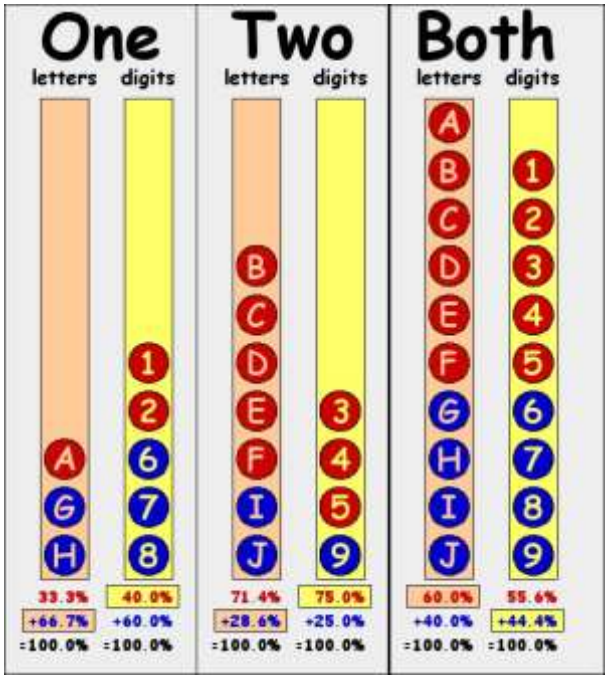
To help show that the "**left**" and "**right**" balls in pair "**A+B**" are a summation of the "**left**" and "**right**" balls in pair "**A**" and the "**left**" and "**right**" balls in pair "**B**", respectively, it can help to identify each ball uniquely, as follows.



In doing this, the naming of "**A**", "**B**", and "**A+B**" is changed, for better or worse, respectively, to "**One**", "**Two**", and "**Both**".

DISTINGUISH BALLS

To help distinguish balls between the "**left**" and "**right**" tubes, the "**left**" tubes can use letters while the right tubes can use digits, as follows.



In doing this, the naming of "**left**" and "**right**" is changed, for better or worse, to "**letters**" and "**digits**", respectively.

This, then, is the final result. A primary objective in the visualization is that the visualization should allow the reader to check individual parts of the visualization that lead to the overall result.

SUMMARY

This paper has looked at using information visualization techniques to make Simpson's Paradox more understandable.

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WHAT A TIME-SERIES MODEL IMPLIES ABOUT TRADING STRATEGIES

Joshua A. Brooks, Lander University, jbrooks@lander.edu
Lili Chen, Lander University, lchen@lander.edu
Michael Mlinar

ABSTRACT

The purpose of this paper is to put forward basic trading strategies that are the product of econometric modelling. We develop two basic divisions of these trading strategies: first order and higher order. First-order trading strategies are applicable for situations where simply going long or short is an appropriate response to a given financial instrument's data generating process. Higher-order trading strategies move beyond trading short and long with market orders. This paper adds to the body of work that connects trading strategies to econometric modelling.

"We know that you can't trade profitably on the… so we know that it contains a unit root." This was overheard at a recent conference in reference to one of the many financial instruments that are often studied as part of investments and risk management research. Many who have worked in the time series space, particularly in the area of finance, have likely heard something similar. There is always a certain feedback between what we observe in markets and how data is tested. In this paper we seek to link the econometric testing of a financial data series with practical trading rules. We do not focus on the use of unit root tests but instead focus on the implications of a particular data generating process, DGP (for a thorough analysis of this area we would refer you to Campbell and Perron [1991] along with Cochrane's comments [1991]). The purpose of this paper is to explain the error contained in the above statement and to add to the literature on time-series methodologies.

The remainder of the paper is organized as follows. Section I gives some selections from the relevant literature. In Section II, we discuss the trading rules implied by time series models. Section III reports the primary implications for researchers and practitioners. Section IV discusses several extensions, and Section V presents our conclusions.

LITERATURE REVIEW

We are seeking to merge two veins of research: time-series econometrics and trading strategies. A search of time-series on SSRN gives over 11,000 results; a search of trading yields over 19,000 results. Even with this wide variety of papers that use time series models for trading purposes ours is the first to our knowledge that presents a robust framework for whether or not a time series implies trading strategies. We begin with two of the most foundational papers for the underlying assumptions of financial research.

Harrison & Kreps (1979) build on the Black-Scholes ideas by giving a theoretical framework for them. Black and Scholes assume that the price dynamics of securities are known. From these (generally stocks and bonds), one tries to determine the prices of other contingent claims (such as options) through the no arbitrage constraint. Harrison and Kreps' research has laid the foundation for the vast majority of later derivatives pricing research. Harrison and Pliska (1981) develop a general stochastic model of a frictionless (no transaction cost, no restriction of selling short) market with continuous trading. Black and Scholes' option pricing formula originally motivated their study. In Black and Scholes' option pricing formula, all changes in the value of portfolio are due to capital gains rather than withdraw of cash or infusion of new funds, which is called self-financing strategy by Harrison and Kreps. This paper focused on the isolated market where only stocks and bonds are traded, assuming no arbitrage opportunities exist within the market. No outside market is considered at all. Outside of these papers there are a large number of important papers that need mentioning. We now move to some selected papers that give indications of how time-series econometrics are being used to advance our knowledge of forecasting and developing efficient trading strategies.

Kissell (2012) incorporates both previous prices and forward-looking implied volatilities to forecast intraday changes in volatility. Davies (2004) uses regime switching models along with cointegration to model changing credit conditions. Zakamulin (2014) builds a covariance matrix in order to develop more appropriate GARCH models for portfolio formation. Li (2002) models volatility through an autoregressive fractionally integrated moving average model. He also notes that in financial markets the assumption of constant volatility is flawed and advocates for the use of GARCH-type models. Christoffersen, et al. (2013) survey the options pricing literature and a number of empirical papers to show the importance of modeling the volatility's time series process in developing option prices. Xu and Wirjanto (2010) advance GARCH models by proposing a mixing model that introduces fat-tailed distributions to the time-series space. Sum (2014) uses the time-series concepts of Granger-Causality to show the causal relationship between stock returns and liquidity measures. Satish, et al., (2014) use forecasting models to estimate intraday volume. They note that adding this dimension of trade data improves model predictions. Moving beyond our discrete time model admits the possibility of any number of alternative order submission strategies.

A number of papers expand on dynamic order submission strategies. Harris (1997) notes that under a number of assumptions traders may optimally submit limit orders near the market in order to "pick up" a portion of the bid-ask spread. Peterson and Sirri (2002) give some empirical evidence for the use of marketable limit orders and show that the conditional costs of trading often drive order submission through different channels. Hollifield, et al. (2004) use data from the Stockholm Stock Exchange to show a number of empirical boundaries on the use of limit orders. Beber and Caglio (2005) use data from the NYSE to show that the impact of asymmetric information is largely depended on the depth of the order book and momentum. Buti and Rindi (2009) presents the idea that traders can strategically use electronic limit orders to create an order submission routine that is dependent on the execution of a previous order. They note a number of empirical correlations with book characteristics and note that these hidden orders are helpful in stabilizing orders during market stress. While these papers show a number of advanced applications of time series and strategic order submission, to our knowledge no paper has been written that shows exactly which time-series models imply a trading strategy.

MODELLING

Time-series modelling can be used for hypothesis testing and forecasting. In the first section we will focus on one-step-ahead forecasts and their usefulness in developing trading rules. Going forward we define "first" order trading rules as those that are based on one-step-ahead forecasts. This is in contrast to trading rules that are based on supplying liquidity or trading on movements in volatility. The second section looks at higher order trading rules that deal with trading on higher order moments of a process. We will begin by assuming that there are no costs to trading, and the stochastic reaction time problem is solved by assuming that our agent has enough time to place a trade at the current observed price in anticipation of the next observed price.

Each period our agent observes the current price (P_{t-1}) and previous prices as well as the stable price process. After observing the current price our agent enters a trade. The market is competitive so that our agent's purchasing activity does not change the data generating process or move prices[1]. Each trade involves taking a position in the underlying (short or long) at one point in time then unwinding it at another point in time. Although we begin with market-order oriented strategies, our conclusions can be readily expanded to alternative order strategies.

A. "First" Order Trading Rules

We begin with the simple mean-reverting[2] data generating process, DGP, for a financial instrument's price shown below:

$$P_t = c_0 + c_1 P_{t-1} + \tilde{e}_t \qquad (1)$$

Here P_t is the variable being modeled (the price denoted P can be thought of as stock for convenience) with t representing the point in time that an observation occurs. The regression variables c_0 and c_1 are such that there is not a unit-root, and e_t represents the error term. Here the trading rule is defined as follows:

Buy if $E[P_t] > P_{t-1}$
Hold if $E[P_t] = P_{t-1}$
Sell if $E[P_t] < P_{t-1}$

Here $E[\cdot]$ denotes the expected value. In the case of our simple mean-reverting model this can also be defined as follows:

Long if $P_{t-1} < E[P]$
Unwind if $P_{t-1} < E[P]$
Short if $P_{t-1} < E[P]$

Here *E[P]* denotes the long-run mean operation based on the regression of c_0 and c_1. These one-stepahead trading rules are easily generalized for any ARMA DGP and non-linear DGPs. Any mean-reverting

[1] In practice trading a particular strategy decreases its profitability over time. This loss is profitability is also common when increasing the scale of a strategy.

[2] Here we define mean-reversion not as regression to the mean, but in the time-series sense that data can be modelled in a reduced form by covariance-stationary process that has a finite long-run mean.

variable will give similar trading rules under the most general first set of rules which include the one-stepahead forecasts. This same methodology can be extended to an I(1) variable (and correspondingly any ARIMA process).

Suppose that we begin our econometric analysis of the time-series *P* and further testing indicates the presence of a unit root. After repeating unit root tests we settle on an order of integration of 1 for our variable of interest. If in first differences there is some ARMA process then we will once again have an implied set of trading rules. Returning to our previous simple example we have the following:

$$\Delta P_t = b_0 + b_1 \Delta P_{t-1} + \tilde{e}_t \qquad (2)$$

Here we use the first differences in order to regress with I(0) variables. The first difference is as follows:

$$\Delta P_t = P_t - P_{t-1} \qquad (3)$$

This I(1) variable can be used to give the following trading rules:

Long if $E[\Delta P_t] > 0$
Unwind if $E[\Delta P_t] = 0$
Short if $E[\Delta P_t] < 0$

The trading rules could be further rearranged because ΔP_t contains the known variable P_t. The key insight here is that the presence of a unit root does not mean that a time series model does not imply a trading rule. Just as in the case that dealt with levels, instead of a mean-reverting AR(1) any ARMA model gives trading rules. Since these trading rules are not limited to levels, we can say that any ARIMA model gives some trading rules and nonlinear models are certainly not precluded by our analysis. To further illustrate the generality of our model we present a "knife's-edge" case in which no trading rule is generated.

For pure white noise we would obtain the following DGP:

$$P_t = \tilde{e}_t \qquad (4)$$

This configuration will allow the formation of trading rules because if there is a non-zero mean then regressions will indicate a trading rule that buys below the mean and sells above the mean. If there is only a unit root, with only white noise in first differences then we would arrive at the model below.

$$\Delta P_t = \tilde{e}_t \quad (5)$$

This DGP is closely related to what we know about the movement of equity securities, but it ignores a number of well-known patterns in equities (i.e. momentum, GARCH process, yield curve exposure, Fama-French Factors, etc.). Here any non-I(0) variable that ends with a purely white-noise process, will admit only the hold step in our general trading rule because the expected value of the next term can only be zero. This is illustrated below. If $\Delta_i P_t = \tilde{e}_t$ and $i \geq 1$ and lower order unit-root tests have rejected the presence of a unit root, then no implied trading rule exists. Here *i* is defined as the order of integration. Any other deterministic trends or exogenous variables will permit a trading rule to be developed under our assumption of no trading costs. Since we have addressed difference stationary series, we now take note of trend stationary series.

A trend stationary series is one that has some deterministic trend such that any long-run mean will be infinite in absolute value[3]. Suppose the following model:

$$P_t = b_0 + b_1 P_{t-1} + a_1 t + \tilde{e}_t \quad (6)$$

The presence of the drift term, $a_1 t$, will cause this DGP to have an infinite long-run mean. Removing the trend will yield a stationary process that has the same trading rules as shown above.

Buy if $E[P_t] > P_{t-1}$
Hold if $E[P_t] = P_{t-1}$
Sell if $E[P_t] < P_{t-1}$

For a DGP with a positive drift the buy rule will occur more frequently because the process will be moving towards an increasing mean. We now move to nonlinear models.

The above arguments have focused almost exclusively on linear models. Moving beyond linear models, a DGP will imply trading rules as long as there is a region where the expected value of the next step is not zero (or undefined in the case of an exponential smooth threshold autoregressive model where there are two unequal roots and the internal region contains another unit root). Pereiro and González-Rozada (2015) propose just such a model in their use of a self-exciting threshold autoregressive, SETAR, to model the behavior of global equity markets. To illustrate this consider the following exponential smoothtransition autoregressive model:

$$P_t = \alpha_0 + \alpha_1 P_{t-1} + \theta[\beta_0 + \beta_1 P_{t-1}] \quad (7)$$

Where,

$$\theta = 1 - exp[-\gamma(P_{t-1} - c)^2] \quad (8)$$

Here α and β are normal regression parameters. The function θ is a transition function between 0 and 1 so that the function for P_t smoothly goes from depending on just α to depending on both α and β. The function θ depends on γ a parameter for the speed of change and c a parameter for the center of the middle region. This parameterization describes a middle region and an outer region with different levels of mean reversion. To further illustrate the generalizations of our trading rules suppose that α_0 and β_0 are equal to zero, α_1 is equal to 1, and β_1 is equal to -0.9. Here this function describes a process that behaves like a unit root near zero but is highly mean reverting when far from zero. The previous trading rules easily generalize to nonlinear situation. When the most recent realization is far from its long-run mean, the trade is to buy or sell based on its mean reversion. When the most recent realization is near zero then the appropriate trade is to close out your exposure. Similar rules are possible for heteroscedasticity.

B. "Higher" Order Trading Rules

This section puts forward "higher" order trading—a category contains any trading strategy that uses order outside market orders or any derivative security written on the underlying. We begin with trading on the second-moment functions followed by additional derivative strategies.

[3] Although generally economic DGP will not move towards negative infinity we allow this possibility for completeness.

There are a number of well-known econometric phenomenon that move beyond the first moment of data, and a large number of econometric models include a stochastic process for the variance as well as the levels of a variable of interest. In the options valuation space see Christoffersen, et al. (2013) for a comprehensive review. Let's begin with the simple GARCH model shown below:

$$P_t = a_0 + a_1 P_{t-1} + \varepsilon_t \quad (9)$$

Where,

$$\varepsilon_t = v_t \sqrt{h_t} \quad (10)$$

Where $\sigma_v^2 = 1$, and

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t2-1} + \beta_1 h_{t-1} \quad (11)$$

Here P_t follows a basic AR(1) process with its error term taking the form of a GARCH(1,1) process. The variable v_t is a white noise process.

Since the DGP of the variance is mean-reverting, trading rules are readily available for trading on the variance. The presence of options will make this much easier. When the goal is to trade on the volatility the following rules can be used:

Straddle if $E[h_t] > E[h_t]$
Unwind if $E[h_t] = E[h_t]$
Reverse Straddle if $E[h_t] < E[h_t]$

The straddle used in the above trading rules is interchangeable with other volatility trading strategies that are commonly known and traded (iron butterfly, iron condor, strangle, etc.). The key insight here is that even a unit-root DGP admits trading strategies if it contains a volatility process or even a higher-moment process than volatility. This basic approach generalizes even to the discretized forms of higher-order stochastic differential equation models like those of Chen (1996). Some recent ideas in trading and acadmic research show the use of options to invest in skewness and kurtosis. It is well known that stock returns are negatively skewed and leptokurtic. These effects can have a significant impact on trading strategies particularly those in the higher order category. Carr and Wu (2004) is one example of a model of stochastic skewness in currency options. These higher order moments can be traded as these models also typically incorporate some mean-reversion. In addition to the presence of higher-order moment effects it is important to note the possibility of alternative error-term distributions.

A growing body of literature and investment capital has been moving to models and funds that incorporate alternative distributions and functional forms (see Taleb, 2009; Taleb and Goldstein, 2011). As long as the conditional expectation of the next time step is defined these trading rules work. Some notable issues are "pathological" distributions like the Cauchy distribution, some forms of symmetrical power distributions (that have an undefined mean or standard deviation), and Lévy distributions. It is worth noting that although many of these have some application in finance and economics their properties exclude them from traditional time-series econometrics.

Any covariance stationary DGP that can be accurately modelled as a time-series process implies some profitable trading strategy except for those processes that have the following: an order of integration

greater than or equal to 1, a difference stationary process that is just white noise, and no higher moment effects.

IMPLICATIONS

While our findings seem to open the doors for a large number of profitable trading ventures it is important to note that in practice this is not the case. The factors that generally cause time-series models to not be economically significant are as follows: trading costs, liquidity, and structural breaks.

There are a number of well-known pricing phenomenon that are not viable due to trading costs. One such example is the "January Effect." The January Effect is the phenomenon where stock prices seem to consistently rise during the beginning of January. Although this effect is commonly observed, the magnitude of the increase is too small to allow profitable trading once the execution costs are considered. This is not the only trading strategy that disappears when trading costs are considered. Many technical analysis strategies disappear when trading costs are added. Correspondingly, in thinly traded markets like those of exotics almost all trading strategies disappear when trading costs are measured (this can be seen in nearly any binary option chain; see Chaudhury, 2015 for additional evidence of the wide heterogeneity in these markets). Malkiel (2003) has argued that the January effect has totally disappeared from markets. In addition to this seasonality effect there are many others. For instance the lunar cycle effects (see Dichev and Janes, 2003; Herbst, 2007; and many others). There are many biological processes that are attributed to the lunar cycle. Dichev and Janes (2003), among others, put forward evidence that the lunar cycle's effects are seen in stock prices. If consistently observed this pattern fits within our model of DGPimplied trading rules. However, Herbst (2007) finds no consistent evidence for this pattern. His findings are consistent with the Efficient Market Hypothesis which deserves some mention.

The Efficient Market Hypothesis, EMH, states that it is impossible to consistently earn higher economic returns that those warranted by the risk that you are taking in a particular investment. In the academic space this idea is taken as irrefutable fact, but in the practitioner arena it is often ignored. Large portions of the stock market use technical analysis to generate consistent returns. There are even notable exceptions to this idea like Warren Buffet's firm. If markets are even weak-form efficient then on the surface it would appear that none of our trading rules are appropriate (recall that the weak-form EMH states that all previous price and volume patterns are incorporated in to the current stock price). Even if we limit our DGP to processes that contain only the previous price there is still an extraordinary variety of autoregressive, nonlinear, higher-order moment, and higher orders of integration processes that will generate these trading rules within an efficient market paradigm. Another common issue with the deployment of these strategies is a liquidity constraint.

Many mutual and hedge funds have found that they are more able to compete and attract new capital if they use leverage to multiply their returns. Often it is this additional leverage that causes these funds to fail (see Mitchell and Pulvino, 2012). In many of the DGPs considered in this paper there is some, albeit small, probability that the investment can go to zero. If the investment becomes worthless then even an unleveraged firm becomes worthless. The primary effect of leverage in this sense is that it increases the threshold below which the investor has exhausted his capital. One other profound error is in how the DGP is described.

There is a wide variety of financial models that are reliant on first taking the natural log of the time-series observations before fitting them with a parsimonious model. This common practice in time-series econometrics has a hidden side effect in that the fitted model implies that the process cannot go to zero.

Computing a value-at-risk with these models in the absence of leverage would lead a trader to assume that the strategy has a zero chance of bankruptcy. Interestingly, the discretized stochastic process used in the Black-Scholes-Merton option pricing model has this zero chance of bankruptcy. Although there are some portions of the commodities and volatilities markets where this assumption is reasonable, the vast majority of equity and interest rate markets there is a chance of zero. For equities the clear event is bankruptcy. In the fixed income markets there are a number of models used for interest rate processes and very few of them allow a negative rate. As of the writing of this article several countries have negative rates and the Federal Reserve has even broached this possibility. The presence of negative rates shows one of the most important components of any trading strategy—change.

Once an appropriate time-series model has been found and a trading strategy deployed it becomes important to monitor the day-to-day trades in order to know when the underlying market behavior has changed. In 5000 years of recorded history there is no record of negative interest rates until very recently. This is a profound change in financial markets. In deploying a trading strategy based on time-series econometrics a strategy needs to be developed to monitor when market behavior has changed (see Cooper and Van Vilet (2012) for additional information on how statistical process control can be applied even to high frequency data). It is well-known that economics as a social science admits the possibility of performativity and counter-performativity. If for no other reason this is cause for continual monitoring.

EXTENSIONS

There are several important areas for extension in this space. The application of time-series econometric tools to the realm of finance presents a rich territory for research and trading opportunities. One extension of this work is to further develop, in a mathematical sense, these rules in the same way that Harrison and Kreps (1979) and Harrison and Pliska (1981) codified the foundational assumptions of finance. Their assumptions are built on continuous time, continuous state-space models. Our assumptions are built on the discrete time, continuous state-space models of time-series econometrics. Another extension is to give further examples of these strategies under vector autoregressive models like those mentioned in Cochrane's 2008 address. Many of the factor models used in frameworks like the Arbitrage Pricing Theory are based on these multifactor models (see Chen, et al., 1986). In this paper we have looked at the trading strategies implied by a particular time-series model, but it would also be important to see how these implied strategies relate to our understanding of the underlying data. The strategies put forward in this paper are inductive, but a companion piece could be written on the deductive portion of this exploratory cycle.

CONCLUSIONS

We have put forward a novel approach for linking statistically derived time-series econometric models with practical trading strategies. We have also shown that nearly all time-series models imply trading strategies, but also note that execution costs can devour any the profits even if the underlying strategy is sound. In searching for the most appropriate DGP this methodology gives additional insight into the underlying behavior of a particular process. It is important to note that just because trading strategies are not readily available does not mean that the DGP does not imply profitable trading strategies in the absence of execution costs.

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WHICH IS THE BETTER EXCEPTION FOR A HIGH-INCOME TAXPAYER TO AVOID THE SUSPENSION OF BUSINESS LOSSES – TREATED AS PASSIVE ACTIVITY LOSSES – (1) THE "EXTRAORDINARY PERSONAL SERVICES" EXCEPTION OR (2) THE "REAL ESTATE PROFESSIONAL" EXCEPTION TO THE PASSIVE ACTIVITY LOSS RULES UNDER I.R.C. § 469?

Kay M. Poston, Francis Marion University, Florence, SC 29502
Brad Johnson, Francis Marion University, Florence, SC 29502

ABSTRACT

The purpose of this article is to enhance the awareness of the high-income taxpayer as to how to avoid the suspension of rental real estate business losses under I.R.C. § 469—treated as passive activity losses—by satisfying either (1) Treas. Reg. § 1.469-1T(e)(3)(ii)(C), i.e., the "extraordinary personal services" exception to the passive activity loss (PAL) rules under I.R.C. § 469, or (2) I.R.C. § 469(c)(7), i.e., the "real estate professional" exception to those PAL rules. Specifically, under either Treas. Reg. § 1.469-1T(e)(3)(ii)(C) or I.R.C. § 469(c)(7), if the particular requirements are met, the *per se* "passive activity" rule for rental real estate activities under I.R.C. § 469(c)(2) does not apply.

To qualify for the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C), under a two-pronged test, the taxpayer must be able to offer competent evidence that the taxpayer provided personal services to renters of tangible property (e.g., real estate) "in connection with making such property available for use." Also, from the perspective of the renter of real estate (a s**ubjective** determination), the taxpayer must be able to show that the use by the renter of the real estate was incidental to the renter's receipt the personal services provided by the taxpayer. In other words, the taxpayer must show that the renter was motivated to rent the real estate to receive the personal services provided by the taxpayer, e.g., that the use of the real estate by the renter was just an "incidental" benefit to the receipt of the personal services provided to the renter by the taxpayer "in connection with making such property available for use" to the renter.

In contrast, under the "real estate professional" exception of I.R.C. § 469(c)(7), the *per se* "passive activity" rule for rental real estate activities under I.R.C. § 469(c)(2) does not apply to a rental real estate activity of a "real estate professional" for any tax year within which such person satisfies the real estate business participation requirements of I.R.C. § 469(c)(7)(A)(i)—an **objective** test. A person meets these requirements if such person performs:

(1) more than 750 hours of personal service during the tax year in designated real property trades or businesses in which the person materially participates (a "750-Hour Personal Service Test"), where

(2) more than one-half of the personal services performed in all trades or businesses during the tax year were performed in designated real property trades or businesses in which the person materially participates (a "50% Personal Service Test") [I.R.C. § 469(c)(7)(B)].

Within this context, a person who participates in at least one rental real estate activity and who meets the above real estate business participation requirements is a qualifying "real estate professional" within the meaning of I.R.C. § 469(c)(7) [Treas. Reg § 1.469-9(b)(6)].

Under either of the above exceptions [Treas. Reg. § 1.469-1T(e)(3)(ii)(C) or I.R.C. § 469(c)(7)], I.R.C. § 469(c)(2) does not apply. Instead, I.R.C. § 469(c)(1) applies. If I.R.C. § 469(c)(1) applies to a taxpayer's rental real estate business under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) for a particular tax year, said business is a non-passive activity for such tax year (i.e., rental real estate business losses are fully deductible against non-passive income), but only if the taxpayer materially participates in the rental real estate business for that year. On the other hand, if I.R.C. § 469(c)(1) applies to a rental real estate activity of a qualifying "real estate professional" under I.R.C. § 469(c)(7), said activity of a qualifying "real estate professional" is a non-passive activity for such tax year (i.e., rental real estate losses are fully deductible against non-passive income), but only if said "real estate professional" materially participates in such real estate activity for that year (e.g., participation in the activity for more than 500 hours) [Treas. Reg. § 1.469-9(e)(1)].

In a case study approach, the three primary objectives of this article are:

(1) To establish the factual background surrounding the case study;

(2) To establish the law at issue; and

(3) To apply the law at issue to the factual background for the purpose of identifying implications for the high-income taxpayer in avoiding the suspension of rental real estate business losses – treated as passive activity losses—under the PAL rules of I.R.C. § 469.

This article argues that if these objectives are met, the high-income taxpayer will have a greater understanding of the intricacies of I.R.C. § 469 and be in a better position to choose the best exception alternative to avoid the suspension of rental real estate business losses under I.R.C. § 469—treated as passive activity losses—by satisfying either (1) Treas. Reg. § 1.469-1T(e)(3)(ii)(C), i.e., the "extraordinary personal services" exception to the PAL rules under I.R.C. § 469, or (2) I.R.C. § 469(c)(7), i.e., the "real estate professional" exception to the PAL rules.

In a case study approach, this article accomplishes its purpose and objectives in a stepwise fashion as follows.

- In Part I, the factual background surrounding the case study is established.
- In Part II, the federal tax law concerning the PAL rules under I.R.C. § 469 is identified.
- In Part III, the federal tax law concerning the "extraordinary personal services" exception to the PAL rules under I.R.C. § 469 is identified (Subpart A) and the federal tax law concerning the "real estate professional" exception to the PAL rules under I.R.C. § 469 is identified (Subpart B).
- In Part IV, the law at issue under I.R.C. § 469 is applied to the factual background for the purpose of establishing particular legal conclusions about the federal income tax consequences of the application of I.R.C. § 469.
- In Part V, implications of the findings in Part IV for the avoidance by the high-income taxpayer of the suspension of business losses—treated as passive activity losses—by satisfying either (1) Treas. Reg. § 1.469-1T(e)(3)(ii)(C), i.e., the "extraordinary personal services" exception to the PAL rules under I.R.C. § 469, or (2) I.R.C. § 469(c)(7), i.e., the "real estate professional" exception to the PAL loss rules under I.R.C. § 469, are presented.

I. THE FACTUAL BACKGROUND SURROUNDING THE CASE STUDY

1. In 1998, Taxpayer (TP) established a Rooming/Boarding Business Activity with his principal place of business located at 935 S. Wildwood Avenue in Kankakee, Illinois 60901 (hereinafter "C2 Business Activity") within which TP provided the occupant/resident of the home with:

   a. the non-exclusive right to occupy a room and

   b. the following services in attending to the needs of all of the occupants/residents of the home.

      (1) **Counseling** in multiple areas, e.g., financial, tax, legal, family, and general psychological.
      (2) **Living Options**, i.e., the option to occupy another room.
      (3) **Recreational Activities**, e.g., various board games all year round inside and outside on patio and tennis in the park during spring, summer and fall.
      (4) **Directv**, i.e., purchase, operation and maintenance of Directv.
      (5) **Communication Systems**, e.g., (1) operation, maintenance and payment of communications systems, including a telephone in every room and a desktop computer with internet access and Microsoft Office, and (2) tutoring with respect to the components of said communication systems.
      (6) **Kitchen Facilities**, i.e., purchase, operation and maintenance of kitchen dishes, utensils and appliances.
      (7) **Fully Furnished Housing**, i.e., purchase, operation and maintenance of furniture, including a television in every bedroom and in the living area.
      (8) **Laundry Facilities**, purchase, operation and maintenance of laundry facilities.
      (9) **Household Supplies and Cleaning**, i.e., provision of household cleaning supplies and periodic household cleaning of the common areas, including kitchen and bathroom cleaning.
      (10) **Landscaping and Garbage Pickup**.
      (11) **Bathroom Toiletries**, i.e., provision of bathroom toiletries.
      (12) **Continental Breakfast Items**, i.e., provision of continental breakfast items, including coffee, juice bread/bagels, and jelly.
      (13) **General Repairs**.

2. With respect to the C2 Business Activity referenced in Paragraph #1:

   a. TP was the sole owner of the C2 Business Activity and conducted said activity in his own name as a sole proprietor.

   b. TP conducted the C2 Business Activity during calendar years 1998-2007, inclusive, and reported income and deductions associated with said business activity on Schedule C of his Federal Income Tax Return (Form 1040) for calendar/tax years 1998-2007, inclusive. However, in January 2005, TP was forced to legally reside in Myrtle Beach, SC. Accordingly, the services referenced in Paragraph #1(b) that TP rendered in 2005 and 2006 were significantly curtailed in terms of frequency, but not in terms of their nature. Then, in February 2007, the Kankakee, IL home suffered a casualty (severe water damage inside) requiring that the 2 residents/occupants move out until repairs could be completed (at the end of 2009).

   c. TP's participation in the C2 Business Activity for each taxable year during calendar years 1998-2007, inclusive, constituted substantially all of the participation in such activity of all individuals (including individuals who were not owners of interests in the activity) for each of such years.

d. During calendar years 1998-2006, inclusive, TP marketed and advertised the C2 Business Activity as a sharing arrangement, where TP informed each prospective occupant/resident of the home of the services referenced in Paragraph #1(b) that TP would provide, in exchange for his/her verbal agreement to pay $250 per month plus a ¼ share of the utilities for the non-exclusive right to occupy a room. Specifically, TP informed each prospective occupant/resident of the home that he/she would be giving up his/her privacy in a communal living arrangement, but would be receiving significant personal services in exchange, i.e., each prospective occupant/resident of the home verbally agreed to the communal living arrangement to obtain the services referenced in Paragraph #1(b) that TP would provide, in exchange for his/her payment of $250 per month plus a ¼ share of the utilities for the non-exclusive right to occupy a room.

3. In 2004, TP purchased 2 homes in the Laurel Woods Subdivision in Myrtle Beach, SC 29588.

4. In 2005, TP extended his C2 Business Activity by establishing a Rooming/Boarding Business Activity with his principal place of business located at 8669 Laurel Woods Drive in Myrtle Beach, SC 28465 (hereinafter "C3 Business Activity") within which TP provided the occupants/residents of the homes within the Laurel Woods Subdivision with:

   a. the non-exclusive right to occupy a room and

   b. the following services in attending to the needs of the occupants/residents of said homes.

      (1) **Counseling** in multiple areas, e.g., financial, tax, legal, family, and general psychological.
      (2) **Living Options**, i.e., the option to occupy another room in any one of the two homes in the Laurel Woods Subdivision in Myrtle Beach, SC 29588.
      (3) **Recreational Activities**, e.g., (a) various board games all year round inside and outside on one of 2 huge patios, (b) croquet, badminton, and horse shoes during spring, summer and fall, and (c) campfires during fall, winter and spring.
      (4) **Directv**, i.e., purchase, operation and maintenance of Directv.
      (5) **Communication Systems**, e.g., (1) operation, maintenance and payment of communications systems, including a telephone in each room and a desktop computer with internet access and Microsoft Office, and (2) tutoring with respect to the components of said communication systems.
      (6) **Kitchen Facilities**, i.e., purchase, operation and maintenance of kitchen dishes, utensils and appliances.
      (7) **Fully Furnished Housing**, i.e., purchase, operation and maintenance of furniture, including a television in every bedroom and in the living area.
      (8) **Laundry Facilities**, purchase, operation and maintenance of laundry facilities, including occasional laundry cleaning.
      (9) **Household Supplies and Cleaning**, i.e., provision of household cleaning supplies and periodic household cleaning of the common areas, including kitchen and bathroom cleaning.
      (10) **Landscaping and Garbage Pickup**.
      (11) **Bathroom Toiletries**, i.e., provision of bathroom toiletries.
      (12) **Continental Breakfast Items**, i.e., provision of continental breakfast items, including coffee, juice bread/bagels, and jelly and occasional meals.
      (13) **General Repairs**.

5. With respect to the C3 Business Activity referenced in Paragraph #4:

   a. TP was the sole owner of the C3 Business Activity and conducted said activity in his own name as a sole proprietor. TP obtained a Horry County Business License (License # 81219) for 2005, which he has maintained through 2015.

   b. TP conducted the C3 Business Activity during calendar years 2005-2007, inclusive, and reported income and deductions associated with said business activity on Schedule C of his Federal Income Tax Return (Form 1040) for calendar/tax years 2005-2007, inclusive.

   c. TP's participation in the C3 Business Activity for each taxable year during calendar years 2005-2007, inclusive, constituted substantially all of the participation in such activity of all individuals (including individuals who were not owners of interests in the activity) for each of such years.

   d. During calendar years 2005-2007, inclusive, TP marketed and advertised the C3 Business Activity as a sharing arrangement, where TP informed each prospective occupant/resident of the home of the services referenced in Paragraph #4(b) that he would provide, in exchange for his/her verbal agreement to pay $250 per month plus a ¼ share of the utilities for the non-exclusive right to occupy a room. Specifically, TP informed each prospective occupant/resident of the home that he/she would be giving up his/her privacy in a communal living arrangement, but would be receiving significant services in exchange, i.e., each prospective occupant/resident of the home verbally agreed to the communal living arrangement to obtain the services referenced in Paragraph #4(b) that TP would provide, in exchange for his/her payment of $250 per month plus a ¼ share of the utilities for the non-exclusive right to occupy a room.

6. During calendar/tax year 2006, with respect to the combined activities, TP spent an aggregate amount of 969 service hours rendering services described in Paragraph #4(b) and Paragraph #1(b), where 892 service hours were spent rendering services to the occupants/residents of the C3 Business Activity and 77 service hours were spent rendering services to the occupants/residents of the C2 Business Activity. Of the 892 service hours that were spent rendering services to the occupants/residents of the C3 Business Activity, 700 service hours were performed rendering services described in Paragraph #4(b)(1)-(9),(11)-(12) and 192 service hours were performed rendering services described in Paragraph #4(b)(10),(13).

7. During calendar/tax year 2007, with respect to the combined activities, TP spent an aggregate amount of 813 service hours rendering services described in Paragraph #4(b) and Paragraph #1(b), where 813 service hours were spent rendering services to the occupants/residents of the C3 Business Activity and 0 service hours were spent rendering services to the occupants/residents of the C2 Business Activity, because of the casualty (severe water damage inside) that occurred, requiring that the 2 residents/occupants move out until repairs could be completed (at the end of 2009). Of the 813 service hours that were spent rendering services to the occupants/residents of the C3 Business Activity, 651 service hours were performed rendering services described in Paragraph #7(b)(1)-(9),(11)-(12) and 162 service hours were performed rendering services described in Paragraph #7(b)(10),(13).

8. For the calendar/tax years 2006-2007, inclusive, the nature and type of the C3 Business Activity and the C2 Business Activity are similar. Furthermore, the C3 Business Activity and the C2 Business Activity have common control and common ownership. Upon this basis, pursuant to Treas. Reg. 1.469-4 (grouping of activities) for calendar/tax years 2006-2007, inclusive, TP combined these activities into one Combined Activity for the sole purpose of applying the PAL rules under I.R.C. § 469.

9. Specifically, for calendar/tax year 2006 (2007), the C2 Business Activity had a recognized loss of $18,286 ($25,173) and the C3 Business Activity had a recognized loss of $19,148 ($19,999) for a TOTAL LOSS of $37,434 ($45,172). Accordingly, for calendar/tax year 2006 (2007), the TOTAL LOSS of $37,434 ($45,172) was carried over to Form 1040, p. 1, Line #12, where such TOTAL LOSS of $37,434 ($45,172) offset other income.

10. During each of the calendar/tax years 2006 and 2007, TP was employed as an accounting professor (a non-passive activity) with an annual salary of $150,000. During each of those years, in connection with such employment, TP performed personal services for a total of 750 hours.

11. Finally, in 2005, TP made an election to treat all of her rental real estate activities as a single, aggregated activity. Specifically, TP filed a statement with the his original income tax return for the tax year 2005, declaring that she was a qualifying "real estate professional" and was making the election under Code Sec. 469(c)(7)(A) to treat all of her rental real estate activities as a single, aggregated activity.

II. THE FEDERAL TAX LAW CONCERNING THE PASSIVE ACTIVITY LOSS RULES UNDER I.R.C. § 469

A. The Federal Tax Law Concerning the Deductibility of Expenses In Connection with an Activity Engaged in for Profit

A(1) Non-Deductibility of Certain Expenses

The Internal Revenue Code (I.R.C.) generally disallows:

- the deduction of personal, living, or family expenses [I.R.C. § 262(a)] and
- the deduction for expenses incurred in a hobby, i.e., an "activity not engaged in for profit" [I.R.C. § 183].

A(2) Deductibility of Certain Expenses

In contrast, the I.R.C. generally allows taxpayers to deduct all of the "ordinary" and "necessary" expenses, which are "paid or incurred" during the taxable year in carrying on a trade or business. I.R.C. § 162. In order to qualify as a "trade or business" for purposes of deducting any "ordinary" and "necessary" expenses under I.R.C. § 162, the activity must be engaged in for profit, i.e., it must not be a hobby under I.R.C. § 183 [*Faulconer v. Commissioner,* 748 F.2d 890, 892 (4th Cir. 1984)].

Also, I.R.C. § 212 generally allows taxpayers to deduct all of the "ordinary" and "necessary" expenses, which are "paid or incurred" for:

- the production or collection of income and
- the management, conservation, or maintenance of property held for the production of income.

Accordingly, under I.R.C. § 162 and I.R.C. § 212, a deduction is generally allowed for any "ordinary" and "necessary" expense, which is "paid or incurred" during the taxable year in connection with an activity engaged in for profit [*Meinhardt v.Commissioner,* 766 F.3d 917, 919 (8th Cir. 2014)].

An "ordinary" expense is one that commonly or frequently occurs in the taxpayer's business, and a "necessary" expense is one that is appropriate and helpful in carrying on the taxpayer's business. *See Deputy v. Du Pont,*

308 U.S. 488, 495 (1940); *Welch v. Helvering*, 290 U.S. 111, 113 (1933). In other words, to be deductible, an expense must directly connect with or pertain to the taxpayer's trade or business [Treas. Reg. § 1.162-1(a)].

B. Limitations on the Deductibility of Losses Under the Passive Activity Loss Rules of I.R.C. § 469

In general, a "passive activity" is "any activity (A) which involves the conduct of any trade or business, and (B) in which the taxpayer does not materially participate" [I.R.C. § 469(c)(1)]. Furthermore, "any rental activity" is generally considered to be passive *per se* [I.R.C. § 469(c)(2)]. Within this latter (rental activity) context, it is immaterial whether the taxpayer materially participates in the activity [I.R.C. § 469(c)(4)]. A "rental activity" includes "any activity where payments are principally for the use of tangible property" [I.R.C. § 469(j)(8)]. Also, *see* Treas. Reg. § 1.469-1T(e)(3).

> **Temp. Treas. Reg.** § **1.469-1T(e)(3)** *Rental activity.*
> (i) In general. Except as otherwise provided in this paragraph (e)(3), an activity is a rental activity for a taxable year if—
>
> > (A) During such taxable year, tangible property held in connection with the activity is used by customers or held for use by customers; and
> >
> > (B) The gross income attributable to the conduct of the activity during such taxable year represents (or, in the case of an activity in which property is held for use by customers, the expected gross income from the conduct of the activity will represent) amounts paid or to be paid principally for the use of such tangible property (without regard to whether the use of the property by customers is pursuant to a lease or pursuant to a service contract or other arrangement that is not denominated a lease).

For purposes of the PAL rules of I.R.C. § 469, the taxpayer may group or combine activities into one activity under the *facts and circumstances test* or as an *appropriate economic unit* [Treas. Reg. § 1.469-4(c)].

In contrast to the disallowance of deductions with regard to personal expenses and hobby expenses under I.R.C. § 262(a) and I.R.C. § 183 (*see* above), respectively, I.R.C. § 469 generally *limits* the deduction of losses from "passive activities" in any particular tax year, at least to the extent those losses exceed the aggregated net income from other "passive activities" in said year [I.R.C. § 469(a)]. The purpose of the "passive activity" loss rules under I.R.C. § 469 is to prevent the tax sheltering of "active" income through the netting of "passive activity" losses against such "active" income. *See Schwalbach v. Commissioner*, 111 T.C. 215, 223 (1998); *Schaeffer v. Commissioner*, 105 T.C. 227, 230 (1995). To the extent such limitation applies, any loss from a particular "passive activity," which is not offset by the aggregated net income from other "passive activities," is deferred to a later year [I.R.C. § 469(b)]. In such later year, the taxpayer is able to recognize the deferred loss, but only if the taxpayer has either:

- an excess of aggregated income from all "passive activities" over aggregated deductions from those "passive activities" or
- disposed of her entire interest in the particular "passive activity" to an unrelated party [I.R.C. § 469(g)]. Also, *see Hillman v. Commissioner*, 263 F.3d 338, 340-41 94th Cir. 20010.

III. EXCEPTIONS TO THE RULE UNDER I.R.C. § 469(c)(2) WITHIN WHICH "ANY RENTAL ACTIVITY" IS CONSIDERED TO BE PASSIVE *PER SE*

Exceptions to the general rule under I.R.C. § 469(c)(2), within which "any rental activity" is considered to be a *per se* "passive activity," are found under I.R.C. § 469(c)(7) and in regulations promulgated by the Treasury. In particular, Treas. Reg. § 1.469-1T(e)(3)(ii) contains a variety of exceptions to this *per se* rule of any "rental activity" being considered as a "passive activity." See Subpart A, below, for an explanation of the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C).

In addition, under I.R.C. § 469(c)(7), the *per se* "passive activity" rule under I.R.C. § 469(c)(2) does not apply to a rental real estate activity of a "real estate professional" for the tax year within which such person satisfies the real estate business participation requirements of I.R.C. § 469(c)(7)(B). In this case, the rental real estate activity of a qualifying "real estate professional" is a non-passive activity for such tax year, if said "real estate professional" materially participates in such real estate activity for that year [Treas. Reg. § 1.469-9(e)(1)]. See Subpart B, below.

A. The Extraordinary Personal Services Exception Under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) To the Passive Activity Loss Rules of I.R.C. § 469

Under the "extraordinary personal services" exception of Treas. Reg. § 1.469-1T(e)(3)(ii)(C) to the PAL rules of I.R.C. § 469, "an activity involving the use of tangible property is not a rental activity for a taxable year" [and therefore exempted from being a *per se* "passive activity" under I.R.C. § 469(c)(2)] "if . . . [e]xtraordinary personal services . . . are provided by or on behalf of the owner of the property in connection with making such property available for use by customers (without regard to the average period of customer use)" [Treas. Reg. § 1.469-1T(e)(3)(ii)(C)]. Under Treas. Reg. § 1.469-1T(e)(3):

> "**Extraordinary personal services are provided** in connection with making property available for use by **customers only if the services provided in connection with the use of the property are performed by individuals**, and **the use by customers of the property is incidental to their receipt of such services**" [Bold added; Treas. Reg. § 1.469-1T(e)(3)(v)].

Accordingly, based upon Treas. Reg. § 1.469-1T(e)(3)(v), personal services provided (1) by (or on behalf of) the owner of property and (2) "in connection with making such property available for use by customers" are "extraordinary personal services" only if:

(a) such services are performed by individuals (i.e., the personal service component) and

(b) from the perspective of the customer receiving the services, "the use by customers of the property is incidental to their receipt of such services" (a **subjective** judgment).

A(1) Treasury Regulations Examples of the Extraordinary Personal Services Exception of Treas. Reg. § 1.469-1T(e)(3)(ii)(C)to the Passive Activity Loss Rules of I.R.C. § 469

The Treasury Regulations under I.R.C. § 469 provide six illustrations of the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) to the PAL rules of I.R.C. § 469.

a. A hospital's boarding facilities; a school's boarding facilities.

Brief illustrations of the "extraordinary personal services" exception to the passive activity loss rules of I.R.C. § 469 are provided within Treas. Reg. § 1.469-1T(e)(3)(ii)(C), as follows.

> "For example, the use by patients of a hospital's boarding facilities generally is incidental to their receipt of the personal services provided by the hospital's medical and nursing staff.
> Similarly, the use by students of a boarding school's dormitories generally is incidental to their receipt of the personal services provided by the school's teaching staff" [Treas. Reg. § 1.469-1T(e)(3)(v)].

b. A business leasing photocopying equipment; a business transporting goods; a lease of a taxicab; a residential apartment hotel.

More detailed illustrations of the "extraordinary personal services" exception to the PAL rules of I.R.C. § 469 under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) are provided in the "Examples" section of Treas. Reg. § 1.469-1T(e)(3)(viii), as follows.

In "Example 1," the taxpayer owns and operates a business leasing photocopying equipment to customers and repairing the equipment [*Id*]. In the example, skilled technicians maintain and service malfunctioning equipment for no additional charge. Service calls occur three times per week on average and require substantial labor. Further, the value of maintenance and repair services exceeds 50% of the amount charged. Notwithstanding the foregoing, the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) to the PAL rules of I.R.C. § 469 does not apply because customers' use of the photocopying equipment is not incidental to their receipt of the repair services [*Id*].

In "Example 3," the taxpayer owns and operates a business engaged in transporting goods for the taxpayer's customers. The taxpayer also provides the tractor-trailers to transport such goods for the taxpayer's customers [*Id*]. "[T]he tractor-trailers are selected by the taxpayer, may be replaced at the sole option of the taxpayer, and are operated and maintained by drivers and mechanics employed by the taxpayer" [*Id*]. In this case, the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) applies, because "[t]he use of the tractor-trailers by taxpayer's customers is incidental to their receipt of personal services provided by the taxpayer" [*Id*].

In "Example 9," the taxpayer owns a taxicab that he operates during the day, but leases to another driver at ight under a one-year lease [*Id*].The "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) does not apply because the taxpayer does not provide personal services in connection with making the taxicab available to the other driver [*Id*].

Finally, in "Example 4," the taxpayer owns and operates a residential apartment hotel [*Id*]. "In addition to cleaning public entrances, exits, stairways, and lobbies, and collecting and removing trash, the taxpayer provides a daily maid and linen service at no additional charge" [*Id*]. The "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) does not apply, because no services are provided in connection with making apartments available for use by customers [*Id*].

c. Three other examples worth noting.

In addition, there are three other examples worth noting. First, in I.R.S. PLR 9247003, a taxpayer's activities with respect to a retirement center that he managed and operated fell outside of the scope of the basic definition of a rental activity. In this case, the gross income attributable to the operation of the center represented amounts paid principally for the extensive services provided to the residents of the center, rather than for the use of the

tangible property. Those services included meals, room service, maid service, laundry, recreational activities, and transportation. As a result, the taxpayer's gross income from the activity was not principally for the use of property. In other words, the activity did not fall within the scope of the definition of a rental activity.

Second, in I.R.S. PLR 9842001, a taxpayer's ownership and operation of a continuing care retirement facility again fell outside of the scope of the basic definition of a rental activity. In this case, a taxpayer's gross income from the activity was derived from payments principally for the services provided at the retirement facility. These services included meals, housekeeping and linen service, on-site and off-site recreational activities, all utilities, assistance with bathing, dressing and medication, and the right to transfer to an adjacent nursing home facility.

Finally, in *Assaf, Assaf F. Al*, TC Memo 2005-14 (2005), the taxpayer, a limited liability company (LLC), was the owner of an office building that provided substantial support services to its attorney-tenants. In this case, attorney-tenants leased the space so that they would receive the benefit of such support services. As a result, the Tax Court held that the LLC provided extraordinary personal services in connection with its leasing activity. In particular, the LLC provided its attorney-tenants with a legal support staff (e.g., paralegal, intern, and clerk), an up-to-date law library and computer, and conference rooms. In addition, LLC employees performed various clerical tasks for the attorney-tenants.

A(2) In Welch, the Tax Court (in a Memorandum Case) Has Significantly Narrowed the Kind of Personal Services That Must be Provided by the Owner of Property in Connection with Making such Property Available for Use by Customers

Within the context of the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) to the PAL rules of I.R.C. § 469, in a Tax Court Memorandum Decision, the Tax Court has significantly narrowed the kind of personal services that must be provided by the owner of property in connection with making such property available for use by customers to satisfy the personal service component of the exception. Specifically, in *Welch v. Commissioner, Michael D.*, 76 T.C.M. (CCH) 354 (1998), the Tax Court held that services are "extraordinary personal services" for purposes of the above rules if:

(1) the services are "significant personal services" as defined in Treas. Reg. § 1.469-1T(e)(3)(ii)(B) under a different exception to the PAL rules of I.R.C. § 469, wherein the average period of customer use is 30 days or less, and

(2) the rental of the tangible property is incidental to the performance of those "significant personal services."

In *Welch*, the Tax Court found that the taxpayer:

- rented tools and equipment to movie production companies that hired the taxpayer as a construction coordinator and

- acquired, transported, maintained, and repaired the tools and equipment rented to the movie production companies.

Based upon these findings, the Tax Court held that:

(1) the personal services provided constituted "significant personal services" in connection with making the tools and equipment available for use and

(2) the rental of the tools and equipment was incidental to the performance of those "significant personal services."

Accordingly, the taxpayer was held (1) to have provided "extraordinary personal services" in connection with the rental of the tool and equipment rentals and (2) not to have engaged in a rental activity subject to the PAL rules of I.R.C. § 469.

Here, it is important to note that the Tax Court in *Welch* held only that the "extraordinary personal services" exception to the PAL rules of I.R.C. § 469 applied, which only meant that the activity was not a *per se* "passive activity." Although the Tax Court concluded that the PAL rules did not apply, because the activity was not a passive activity, the reasoning of the court fell short of a complete analysis under I.R.C. § 469. Presumably, the taxpayer in *Welch* also showed facts supporting the legal conclusion of the taxpayer's material participation in the activity of being a construction coordinator (a trade or business) to have the activity adjudged to be outside the scope of I.R.C. § 469 [I.R.C. § 469(c)(1)(B), (c)(4)]. Also, *see Assaf v. Commissioner*, T.C.M. (RIA) 2005-014, 2005 WL 209726, *5 (2005). In contrast, if the taxpayer in *Welch* failed to show facts supporting the legal conclusion of the taxpayer's material participation in the activity, he would not have been able to avoid the PAL rules of I.R.C. § 469. Accordingly, in this case, the issue of whether the taxpayer in *Welch* materially participated in the activity would be extremely relevant to the ultimate conclusion of the Tax Court. *See* I.R.C. §469(c)(1)(B)—Definition of Passive Activity.

B. Under I.R.C. § 469(c)(7), the "Real Estate Professional" Exception to the Passive Activity Loss Rules of I.R.C. § 469

A taxpayer's rental real estate activity is not treated as a passive activity *per se* under I.R.C. § 469(c)(2), if said taxpayer is a "real estate professional" as defined in I.R.C. § 469(c)(7)(B) [I.R.C. § 469(c)(7)(A)(i)]. In other words, under I.R.C. § 469(c)(7)(A)(i), the *per se* "passive activity" rule under I.R.C. § 469(c)(2) does not apply to a rental real estate activity of a "real estate professional" for the tax year within which such person satisfies the real estate business participation requirements of I.R.C. § 469(c)(7)(B). A person meets these requirements if such person performs:

(1) more than 750 hours of personal service during the tax year in designated real property trades or businesses in which the person materially participates (a "750-Hour Personal Service Test"), where

(2) more than one-half of the personal services performed in all trades or businesses during the tax year were performed in designated real property trades or businesses in which the person materially participates (a "50% Personal Service Test") [I.R.C. § 469(c)(7)(B)].

Within this context, a person who participates in at least one rental real estate activity and who meets the above real estate business participation requirements is a qualifying "real estate professional" within the meaning of I.R.C. § 469(c)(7) [Treas. Reg. § 1.469-9(b)(6)]. Such designation is determined on an annual basis [*Bailey v. Commissioner*, 82 T.C.M. (CCH) 868 (2001)]. Thus, a taxpayer may be a qualifying "real estate professional" in one tax year, but not in another tax year.

Under I.R.C. § 469(c)(7), where I.R.C. § 469(c)(2) does not apply in a particular tax year, I.R.C. § 469(c)(1) applies. In this case, the rental real estate activity of a qualifying "real estate professional" is a non-passive activity (i.e., rental real estate losses are fully deductible against non-passive income) for such tax year, if said "real estate professional" materially participates in such real estate activity for that year (e.g., participation in the activity for more than 500 hours) [Treas. Reg. § 1.469-9(e)(1)]. Within this context, material participation is determined under the general rule of I.R.C. § 469(h)(1) [I.R.C. § 469(c)(7)(B)].

B(1) Real Property Trades or Businesses

To qualify as a "real estate professional" under I.R.C. § 469(c)(7)(B), a taxpayer must meet the "750-Hour Personal Service Test," as stated above. Within this context, a real property trade or business, within which a taxpayer must materially participate, generally involves real estate. Examples include the renting, management, construction, development, and the buying and selling of real estate [I.R.C. § 469(c)(7)(C)]. However, specifically identifying a taxpayer's particular real property trade or business is based on all relevant facts and circumstances [Treas. Reg. § 1.469-9(d)]. Furthermore, if the taxpayer's real property trade or business is the management of rental real estate, in applying the material participation test to such real property trade or business, service hours are limited to only those hours when service is provided in the management of the taxpayer's rental real estate [Treas. Reg. § 1.469-9(e)(3)(ii)]. Within this context, rental real estate is simply defined as real estate that is used by customers (or held for use by customers) in an activity within the meaning of Treas. Reg. § 1.469-1T(e)(3), where the income received is principally for the use of real estate.

B(2) Personal Services Provided Within the Context of a Real Property Trade or Business Must Satisfy a "750-Hour Personal Service Test" and a "50% Personal Service Test"

To be a qualifying "real estate professional" within the meaning of I.R.C. § 469(c)(7), the taxpayer must satisfy a "750-Hour Personal Service Test" and a "50% Personal Service Test" [I.R.C. § 469(c)(7)(B)]. Within this context, it necessarily follows that the taxpayer must establish the number of hours of personal service performed in real property trades or businesses within which she materially participated. Here, acceptable methods of substantiation include appointment books, calendars, or narrative summaries, each of which reveals contemporaneous verification by written record or other similar type of evidence.

But further, the character of the personal services provided, within the context of a real property trade or business, does not have to be of a particular type. Within this context, personal service is defined as service by an individual that is "in connection with" a trade or business. Such service does not have to be of a character that directly relates to real estate [*Stanley v. U.S.*, 116 AFTR 2d (RIA) 2015-6766 (2015)]. Examples within the context of a rental real estate activity include (1) keeping books and records and preparing financial statements, (2) communications with tenants, (3) securing the property, and (4) repairs and maintenance [*Jahina v. Commissioner*, TC Summary Opinion 2002-150 (2002)]. However, such personal services do not include service by an individual, in the individual's capacity as an investor, as defined by Treas. Reg. § 1.469-5T(f)(2)(ii) [Treas. Reg § 1.469-9(b)(4)].

Finally, the taxpayer must also show that she performed more than 750 hours of personal services in real property trades or businesses within which she materially participated (the "750-Hour Personal Service Test"), where her hours of personal service performed in real property trades or businesses exceeded her hours of personal service performed in other trades or businesses (the "50% Personal Service Test").

B(3) The Election to Treat All Rental Real Estate Activities as a Single, Aggregated Activity

Each rental real estate activity of a qualifying "real estate professional" is treated as a separate activity, unless such "real estate professional" makes an election to treat all of her rental real estate activities as a single, aggregated activity. In other words, if a qualifying "real estate professional" is engaged in multiple rental real estate activities, the material participation test (e.g., participation in the activity for more than 500 hours) must be applied separately as to each rental real estate activity in order to treat each of such rental real estate activities as non-passive (i.e., rental real estate losses are fully deductible against non-passive income). This separate activity requirement for the material participation test makes satisfying said test for each activity exceedingly difficult the more activities with which the qualifying "real estate professional" is engaged. The

qualifying "real estate professional" may avoid this pitfall by making an election to treat all of her rental real estate activities as a single, aggregated activity. In this latter case, the qualifying "real estate professional" must simply materially participate in the single, aggregated activity (e.g., participation in the single, aggregated activity for more than 500 hours).

The election by the qualifying "real estate professional" to treat all of her rental real estate activities as a single, aggregated activity may be made in any year within which the taxpayer is a qualifying "real estate professional" [Treas. Reg § 1.469-9(g)(1)]. Said election is made by filing a statement with the taxpayer's original income tax return for the tax year—declaring that the taxpayer is a qualifying "real estate professional" and is making the election under I.R.C. § 469(c)(7)(A) [Treas. Reg § 1.469-9(g)(3)]. Furthermore, the failure by the qualifying "real estate professional" to make the election in any particular year does not prohibit her from making the election in a subsequent year [*Id*]. Finally, the election is effective for the tax year within which it is made and for any subsequent year within which the taxpayer is a qualifying "real estate professional." In other words, the election has no effect in any subsequent tax year within which the taxpayer is not a qualifying "real estate professional." Notwithstanding the foregoing, the election, once made, is in effect for any subsequent tax year within which the taxpayer is a qualifying "real estate professional."

IV. THE LAW AT ISSUE UNDER I.R.C. § 469 IS IDENTIFIED IN PARTS II & III AND IS APPLIED TO THE FACTUAL BACKGROUND FOUND IN PART I

A. Application of Treas. Reg. § 1.469-1T(e)(3)(ii)(C), i.e., the Extraordinary Personal Services Exception to the Passive Activity Loss Rules of I.R.C. § 469, to the Facts in the Instant Case

A(1) The Law

To qualify for the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C), under a two-pronged test, TP must be able to offer competent evidence that**:**

- TP provided personal services to renters of tangible property (e.g., real estate) "in connection with making such property available for use" and

- From the perspective of the renter of real estate (a **subjective** determination), the use by the renter of the real estate was incidental to the renter's receipt of the personal services provided by TP.

If the requirements under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) are satisfied, I.R.C. § 469(c)(2) does not apply. Instead, I.R.C. § 469(c)(1) applies. If I.R.C. § 469(c)(1) applies to TP's rental real estate businesses (C2 & C3) under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) for a particular tax year, said businesses (C2 & C3) are non-passive activities for such tax year (i.e., the rental real estate business losses are fully deductible against non-passive income), but only if TP materially participates in the rental real estate businesses (C2 & C3) for that year (e.g., participation in the activities for more than 500 hours).

A(2) The Facts

In 2006 and 2007, TP engaged in two rental real estate business activities (C2 & C3). During those years, within each of the two rental real estate business activities (C2 & C3), TP informed each prospective occupant/resident of the home that he/she would be giving up his/her privacy in a communal living arrangement, but would be receiving significant personal services in exchange, i.e., each prospective

occupant/resident of the home verbally agreed to the communal living arrangement to obtain the services that TP would provide, in exchange for his/her payment of $250 per month plus a ¼ share of the utilities for the non-exclusive right to occupy a room.

During each of the calendar/tax years 2006 and 2007, TP was employed as an accounting professor (a non-passive activity) with an annual salary of $150,000.

During calendar/tax year 2006, with respect to the combined activities, TP spent an aggregate amount of 969 service hours rendering services, where 892 service hours were spent rendering services to the occupants/residents of the C3 Business Activity and 77 service hours were spent rendering services to the occupants/residents of the C2 Business Activity.

During calendar/tax year 2007, with respect to the combined activities, TP spent an aggregate amount of 813 service hours rendering services, where 813 service hours were spent rendering services to the occupants/residents of the C3 Business Activity and 0 service hours were spent rendering services to the occupants/residents of the C2 Business Activity, because of the casualty (severe water damage inside) that occurred, requiring that the 2 residents/occupants move out until repairs could be completed (at the end of 2009).

A(3) Legal Conclusions

Based upon the facts in the case study for each of the tax years 2006 and 2007, TP satisfied the "extraordinary personal services" exception under Treas. Reg. § 1.469-1T(e)(3)(ii)(C) to the PAL rules of I.R.C. § 469. First, within the context of the two rental real estate business activities (C2 & C3) in tax years 2006 and 2007, TP offered competent evidence that TP provided personal services to renters of tangible property (e.g., real estate) "in connection with making such property available for use" within each of said years.

Second, within the context of the two rental real estate business activities (C2 & C3) in tax years 2006 and 2007, TP offered competent evidence suggesting (a **subjective** determination) that the renters were motivated to rent the real estate to receive the personal services provided by TP, e.g., that the use of the real estate by the renters was just an "incidental" benefit to the receipt of the personal services provided to the renters by TP "in connection with making such property available for use" to the renters.

Accordingly, under Treas. Reg. § 1.469-1T(e)(3)(ii)(C), each the two rental real estate business activities (C2 & C3) in each of the tax years 2006 and 2007 is exempted from being a *per se* "passive activity" under I.R.C. § 469(c)(2)] , since "[e]xtraordinary personal services . . . are provided by or on behalf of the owner of the property in connection with making such property available for use by customers (without regard to the average period of customer use)" [Treas. Reg. § 1.469-1T(e)(3)(ii)(C)].

Furthermore, for each of the tax years 2006 and 2007, TP's combined rental real estate business (C2 & C3) is a non-passive activity (i.e., the rental real estate business losses of C2 & C3 are fully deductible against non-passive income), since TP offered competent evidence that TP has materially participated in the combined rental real estate business (C2 & C3) (e.g., participation in the combined activity for more than 500 hours).

Accordingly, for calendar/tax year 2006 (2007), the C2 Business Activity had a recognized loss of $18,286 ($25,173) and the C3 Business Activity had a recognized loss of $19,148 ($19,999) for a TOTAL LOSS of $37,434 ($45,172). Moreover, for calendar/tax year 2006 (2007), the TOTAL LOSS of $37,434 ($45,172) was carried over to Form 1040, p. 1, Line #12, where such TOTAL LOSS of $37,434 ($45,172) offset other income.

B. Application of I.R.C. § 469(c)(7), i.e., the "Real Estate Professional" Exception to the Passive Activity Loss Rules of I.R.C. § 469, to the Facts in the Instant Case

B(1) The Law

Under the "real estate professional" exception of I.R.C. § 469(c)(7), the *per se* "passive activity" rule for rental real estate activities under I.R.C. § 469(c)(2) does not apply to a rental real estate activity of a "real estate professional" for any tax year within which such person satisfies the real estate business participation requirements of I.R.C. § 469(c)(7)(A)(i)—an **objective** test. TP meets these requirements if TP performs:

(1) more than 750 hours of personal service during the tax year in designated real property trades or businesses in which TP materially participates (a "750-Hour Personal Service Test"), where

(2) more than one-half of the personal services performed in all trades or businesses during the tax year were performed in designated real property trades or businesses in which TP materially participates (a "50% Personal Service Test") [I.R.C. § 469(c)(7)(B)].

Within this context, if TP (1) meets the above real estate business participation requirements and (2) participates in at least one rental real estate activity, TP is a qualifying "real estate professional" within the meaning of I.R.C. § 469(c)(7) [Treas. Reg § 1.469-9(b)(6)].

Under I.R.C. § 469(c)(7), I.R.C. § 469(c)(2) does not apply. Instead, I.R.C. § 469(c)(1) applies. If I.R.C. § 469(c)(1) applies to a rental real estate activity of a qualifying "real estate professional" (e.g., TP) under I.R.C. § 469(c)(7), said activity of a qualifying "real estate professional" (e.g., TP) is a non-passive activity for such tax year (i.e., rental real estate losses are fully deductible against non-passive income), but only if said "real estate professional" (e.g., TP) materially participates in such real estate activity for that year (e.g., participation in the activity for more than 500 hours) [Treas. Reg. § 1.469-9(e)(1)].

B(2) The Facts

In 2005, TP made an election to treat all of her rental real estate activities as a single, aggregated activity. Specifically, TP filed a statement with her original income tax return for the tax year 2005, declaring that she was a qualifying "real estate professional" and was making the election under Code Sec. 469(c)(7)(A) to treat all of her rental real estate activities as a single, aggregated activity.

In 2006 and 2007, TP engaged in 2 rental real estate business activities (C2 & C3).

During each of the calendar/tax years 2006 and 2007, TP was employed as an accounting professor (a non-passive activity) with an annual salary of $150,000. During each of those years, in connection with such employment, TP performed personal services for a total of 750 hours.

During calendar/tax year 2006, with respect to the single, aggregated activity, TP spent an aggregate amount of 969 service hours rendering services, where 892 service hours were spent rendering services to the occupants/residents of the C3 Business Activity and 77 service hours were spent rendering services to the occupants/residents of the C2 Business Activity.

During calendar/tax year 2007, with respect to the single, aggregated activity, TP spent an aggregate amount of 813 service hours rendering services, where 813 service hours were spent rendering services to the

occupants/residents of the C3 Business Activity and 0 service hours were spent rendering services to the occupants/residents of the C2 Business Activity, because of the casualty (severe water damage inside) that occurred, requiring that the 2 residents/occupants move out until repairs could be completed (at the end of 2009).

B(3) Legal Conclusions

Based upon the facts in the case study, for each of the tax years 2006 and 2007, TP satisfied the "real estate professional" exception under I.R.C. § 469(c)(7) to the PAL rules of I.R.C. § 469. First, TP offered competent evidence that TP satisfied the real estate business participation requirements of I.R.C. § 469(c)(7)(A)(i)—an **objective** test, for each of the tax years 2006 and 2007. Specifically, for each of the tax years 2006 and 2007, TP offered competent evidence that TP performed:

(1) more than 750 hours of personal service during each of the tax years 2006 and 2007 in designated real property trades or businesses in which TP materially participated (a "750-Hour Personal Service Test"), where

(2) more than one-half of the personal services performed in all trades or businesses during each of the tax years 2006 and 2007 were performed in designated real property trades or businesses in which TP materially participated (a "50% Personal Service Test") [I.R.C. § 469(c)(7)(B)].

Second, TP offered competent evidence that TP participated in at least one rental real estate activity.

Accordingly, TP is a qualifying "real estate professional" within the meaning of I.R.C. § 469(c)(7) for each of the tax years 2006 and 2007 [Treas. Reg § 1.469-9(b)(6)].

Furthermore, for each of the tax years 2006 and 2007, TP's single, aggregated activity (C2 & C3) is a non-passive activity (i.e., the rental real estate business losses of C2 & C3 are fully deductible against non-passive income), since TP offered competent evidence that TP has materially participated in the single, aggregated activity (C2 & C3) (e.g., participation in the single, aggregated activity (C2 & C3) for more than 500 hours).

Accordingly, for calendar/tax year 2006 (2007), the C2 Business Activity had a recognized loss of $18,286 ($25,173) and the C3 Business Activity had a recognized loss of $19,148 ($19,999) for a TOTAL LOSS of $37,434 ($45,172). Moreover, for calendar/tax year 2006 (2007), the TOTAL LOSS of $37,434 ($45,172) was carried over to Form 1040, p. 1, Line #12, where such TOTAL LOSS of $37,434 ($45,172) offset other income.

V. IMPLICATIONS OF THE FINDINGS IN PART IV FOR THE AVOIDANCE BY THE HIGH-INCOME TAXPAYER OF THE SUSPENSION OF BUSINESS LOSSES—TREATED AS PASSIVE ACTIVITY LOSSES—BY SATISFYING EITHER (1) THE "EXTRAORDINARY PERSONAL SERVICES" EXCEPTION OR (2) THE "REAL ESTATE PROFESSIONAL" EXCEPTION TO THE PASSIVE ACTIVITY LOSS RULES UNDER I.R.C. § 469

Within the context of the "extraordinary personal services" exception of Treas. Reg. § 1.469-1T(e)(3)(ii)(C) to the PAL rules of I.R.C. § 469, there is great uncertainty as to how to satisfy the two-pronged test.

- With respect to the requirement of competent evidence showing that the taxpayer provided personal services to renters of tangible property (e.g., real estate) "in connection with making such property available for use," in a Tax Court Memorandum Decision [*Welch v. Commissioner, Michael D.*, 76 T.C.M. (CCH) 354 (1998)], the Tax Court has significantly narrowed the kind of personal services that must be provided by the owner of property in connection with making such property available for use by customers.

- With respect to the requirement of competent evidence showing that, from the perspective of the renter of real estate, the use by the renter of the real estate was incidental to the renter's receipt of the personal services provided by the taxpayer, such determination is **subjective in nature** and open to criticism.

Accordingly, such exception should be used as a last resort.

Within the context of the "real estate professional" exception of I.R.C. § 469(c)(7) to the PAL rules of I.R.C. § 469:

- Electing to treat all of a taxpayer's rental real estate activities as a single activity may make it easier to meet the material participation requirement (resulting in treatment of the rental real estate activities as non-passive), because all of the taxpayer's "participation" with respect to all of those activities will be taken into account in determining whether the taxpayer materially participated in the aggregated activities.

- The real estate business participation requirements of I.R.C. § 469(c)(7)(A)(i) is an **objective** test and easily met with competent evidence.

Accordingly, such exception is preferable.

You Can Do That in PowerPoint?

Wilma M. Andrews
Virginia Commonwealth University
Department of Information Systems
Richmond, VA. 23284-4000, 804-827-0956, wandrews@vcu.edu

Robert L. Andrews
Virginia Commonwealth University
Retired, Department of Supply Chain Management and Analytics
Richmond, VA. 23284-4000, 804-355-4645, randrews@vcu.edu

ABSTRACT

An emerging trend in presentations is the expectation for interactive nonlinear presentations with vibrant images. Older versions of PowerPoint have options that allow users to add interactivity to presentations but there is a learning curve to using those features. Professional looking slide designs are also possible with older version but few educators take the time to learn the skills needed to create them. New PowerPoint 365 (only) features - **Morph** and **Zoom** – make interactivity much easier. **Designe**r in PowerPoint 365 helps those who are not designers come up with visual slides that look very professional. Another relatively new PowerPoint feature that can be useful to educators is **Office Mix.** The Office Mix download enables users to turn PowerPoint slides into interactive online lessons. This session will review features to make attendees aware of what PowerPoint can do but time limitations will not enable detailed training. Links to online resources will be made available.

OVERVIEW

PowerPoint is blamed for bad presentations. But PowerPoint isn't the problem, users are. Many users prepare their PowerPoint slides just like they were preparing slides for an overhead projector presentation with no interactivity. It is difficult to break old habits. Microsoft continues to evolve PowerPoint to keep up with current presentation trends that go far beyond the normal default features. These updates help them keep up with competitive presentation software. The 2016 version of PowerPoint basically only added more enhancements rather than making major changes from the previous version. But with PowerPoint 365 users have the ability to download new features as they are released, sometimes monthly. However, even earlier versions of PowerPoint have options that allow for more interactivity if users are willing to explore some of those features so they can go beyond the default of linear presentations.

POWERPOINT 365 FEATURES

The newest PowerPoint 365 enhancements use a cloud-powered recommendation engine and smart animation technology to take PowerPoint to a new level. PowerPoint 365 updates are either setup to be downloaded automatically or by clicking on the Update link within the application.

Designer

Visuals are so important in today's presentation world. PowerPoint default slide layouts do not make for vibrant and current looking presentations. **Designer** helps non-designers make their slides look new without having to learn advanced layout techniques. First, an image is selected (from online or a file) and dropped on to a slide. **Designer** then uses that image to display very professional layout options on the right. With a click, the layout option selected is moved to the slide and ready to use.

Morph

Morph is a transition that allows for animation that was never before possible with PowerPoint. **Morph** enables very creative animation between slides that is far easier to create than any of the previous advanced animation techniques. There are numerous online modules to help learn how to use this new feature. It may take some time to learn, but the end result can be very impressive to an audience, which yields a good return on the investment of time.

Zoom

The **Zoom** features enable jumping to and from slides/sections during a presentation rather than being constricted to a linear model. For example, an Agenda or Summary slide can be setup to link to different slides or sections of the presentation. By just clicking on a tile, image or group of words, the presentation can move to areas of interest to the audience. Although this capability was also possible with advanced animation techniques in older versions of PowerPoint, the Zoom feature is much easier to use.

OFFICE MIX

Microsoft's PowerPoint Add-on called **Office Mix** was new in Fall 2014 but is still relatively unknown. It is a **free download** currently available to use with Office 2013, 2016 or Office 365 on PCs. The possibilities for in-class use as well as incorporating Mixes for online training and online courses are exciting. Each slide can basically become a multimedia collection of whatever the "Mix" creator wants to put on it including active websites, screen shots, recorded mouse moves in applications such as Excel, and the presenter can move from one application to another. Mix can also be used for quizzes. Faculty flipping classes can create mixes for students to view prior to class. Whole lectures can be recorded and a link sent to the class for review. Mix does not have any editing capability other truncating the recording at the beginning or end of each slide.

INTERACTIVITY IN OLDER VERSIONS

Hyperlinks and triggers that enable PowerPoint to be more interactive can be used with earlier versions of PowerPoint. These techniques do require exploring and using more advanced features of PowerPoint. Many users never get past basic defaults, but learning how to use hyperlinks and triggers can transition a linear presentation into a more interactive one.

SUMMARY

Presenters need to get onboard the updated design and interactivity trend for presentations at conferences and in the classroom. There are YouTubes and Microsoft online modules to help learn how to use all of the new PowerPoint features. Investing time to learn how to use them, will make presentations far more interesting to the audience and provide a positive role model for students to help them be better prepared for presentation expectations in today's business world.

YOUR ACCOUNTING CAREER PATH: WHAT'S THE RIGHT CHOICE

Dustin M. Grant, Clayton State University, Morrow, GA 30260, micahgrant@clayton.edu

ABSTRACT

As accounting majors near graduation, the all-important question remains, where am I going to work? The students have to make that tough decision, and look for career areas that peak their interest. Accounting offers many different options when it comes to an industry choice, so this paper will explore public, audit, tax, consulting, private, corporate, managerial, governmental and non-profit, and education careers. This paper reviews the benefits and challenges to these industries, and analyses the different accounting career paths that one may pursue. The qualifications of each industry will also be discussed, along with some suggestions that may fit with one's personality. With all the different career path options, what's the right choice?

ACCOUNTING JOB MARKET ADVANTAGES

An article by Allegra Nagler states "It's a good time to be in the accounting and finance professions." In the same article by Nagler, the claim is that starting salaries for accountants and finance positions are expected to rise by 4.7% in 2016 (referencing the Robert Half 2016 Salary Guide). Accounting has a high job growth outlook of 11% based on a report by the Bureau of Labor Statistics, so accounting majors have an advantage when entering the job force. The article from the Bureau of Labor states that "Employment of accountants and auditors is projected to grow 11 percent from 2014 to 2024, faster than the average for all occupations." Compared to many other business majors, accounting yields more opportunities as there are many different industries to choose from, thereby increasing the number of opportunities for landing a job. The *U.S News and World Report* ranks Accounting number three in the best business jobs category and number twenty-four overall for 2016, with the job market ranked ten out of ten based on job opportunities (2016). Tighter regulations and the duty to uphold the public's trust also helps the accounting job market, as those factors require separation of duties to deter fraud and errors. Many jobs require prior accounting experience, therefore making internships invaluable. Internships play an important role while in school, as students gain experience and also get a taste of what specific accounting industries have to offer. By participating in an internship, students gain real-world accounting experience while also determining if that particular accounting industry is of a particular interest. Due to the number of accounting jobs available, students should apply to many different accounting jobs within different accounting industries. Being exposed to multiple areas and going through many interviews will also increase the odds of landing a job, while learning interviewing techniques along the way.

ACCOUNTING JOB MARKET CHALLENGES

Market constraints, job opportunities, and experience may play a significant part of the job hunting process, as many may choose based on available jobs, as opposed to what industry appeals to their qualifications and personality. Job hunting can be a stressful and challenging time, so what obstacles must one overcome to land the perfect job? Some challenges to entering the accounting job market are high numbers of applicants, limited jobs in rural areas, and experience requirements. Finding ways to differentiate in the application process leads to higher success in landing a job. To compete against a high number of applicants, making your resume stand out from the others is vital, as many are similar and blend in with the others. Living in rural areas also pose a significant challenge. In rural areas, there are fewer jobs to choose from, which leads to increased competition due to the lack of job opportunities. Rural areas may also be very limited in their offerings in the applicant's industry expertise or industry choice, therefore limiting the job

opportunities. Prior job experience requirements also pose a threat. Many do not have the opportunity to participate in an internship while in school due to different factors or personal reasons, so they are at a disadvantage when it comes to applying for a job. The number one recommendation when searching for a job is to be patient, assuming that is an option.

ACCOUNTING INDUSTRIES

Accounting offers many career path choices, including but not limited to public, audit, tax, consulting, private, corporate, managerial, governmental and non-profit, and education. Each industry is unique and requires a different set of skills and personality traits. A benefit of obtaining an accounting degree is the flexibility to work in different industries until one finds their niche. Once a particular industry becomes of sincere interest, narrowing the job scope and pursuing a specific career path becomes more clear.

PUBLIC ACCOUNTING

Public accounting is an area that encompasses auditing, tax preparation, consulting, and other similar areas. A public accountant usually specializes in one of those areas, and is usually licensed as a Certified Public Accountant, or a CPA. Audit and tax are probably the most popular types of public accounting, and are the services that the Big Four Accounting firms mainly provide to their clients. The Big Four Accounting firms are the holy grail of public accounting, and is considered to be the best experience that an accountant could have on their resume. However, many medium and small firms provide excellent opportunities for accounting careers.

AUDITING

As described in AU Section 110 paragraph .02, “The auditor has a responsibility to plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether caused by error or fraud.” An auditor is an independent third party that reviews and expresses an opinion on the client’s financial statements. As an auditor, the responsibilities are to analyze records, and look for noncompliance to accounting and auditing rules and standards.

A benefit of auditing is that it is an area of accounting that continues to grow and has a high job growth outlook, so this is a good choice for new graduates as job opportunities are available. Another benefit is that usually auditor’s daily tasks are not repetitive. Each client has their own unique industry and characteristics, so reviewing the information for one client could possibly be totally different from another client. If an accountant likes to dig around and research, then this would be an area of expertise they may want to consider. Audit usually also requires a good amount of travel, so if traveling is of an interest, then audit may be a good choice. There are opportunities for external and internal auditing, so that allows for more job flexibility.

A challenge for auditing is that it sometimes requires long hours and great communication skills. Auditing season can require many overtime hours in order to complete the job, so those extra hours could be a deterrent to some. One complaint about the working at the Big Four Accounting firms is that the hours are brutal. While it is great work experience to have on your resume, it is not uncommon for some to work seventy to eighty plus hours per week during crunch time. Communication is also key to be an auditor. If someone does not like to communicate with others and prefers to work independently, then this may not be the best option for them. A good auditor must ask the right questions to the right people, so communication is vital to completing a successful audit. Stress levels are high during peak season, due to the volume of work and attempting to meet deadlines, so be prepared to eat, sleep, and breathe auditing during peak season.

To become an auditor, a bachelor's degree in accounting is usually required, while a masters in accounting is preferred for higher level positions. Most auditors are licensed as CPA's, so obtaining a CPA license is often required if an accountant wants to move up the ladder within an organization. As obtained from Learn.org, there are many other certifications that auditors can obtain, such as the Certified Internal Auditor (CIA), Certification in Control Self-Assessment (CCSA), Certified Government Auditing Professional (CGAP) and Certified Financial Services Auditor (CFSA) (*www.theiia.org*). You can also earn the Certified Information Systems Auditor (CISA) credential from the ISACA (*www.isaca.org*).

The average salary for those with less than a year of experience ranges based on the size of the firm. According to the *Robert Half 2016 Salary Guide*, auditors working with small firms earn about $48,000 with less than one-year experience, while the average salary for medium and large size firms is $52,000 and $59,000 respectively. The numbers are taken from the low end of the scale, so starting salaries are very good for auditors. As one gains experience and gets promoted, top managers and partners usually make well into the six digits.

TAX

According to an article posted by in the *Washington Examiner* by Jason Russell, the number of pages in the federal tax code is 74,608 (2016). As a tax professional, that is information overload. While a tax professional should stay current with tax laws, it is nearly impossible to know everything on those 74,608 pages. The majority of those tax laws probably do not affect the average American taxpayer, so do not let that be a deterrent to becoming a tax professional. As an entry-level tax accountant, you will work on preparing individual and corporate tax returns. While the busy season for tax is January 1st through April 15th each year, there is work that must be done throughout the year as well. Normally each month, clients will bring in their financial information, which will require the calculation their monthly and quarterly tax payments, estimated taxes, withholdings, sales taxes, and other tax related information.

One benefit of tax is similar to auditing. Each client is unique, so the work is not repetitive. Working with multiple clients keeps variety in the job. The work that is done one day, may be totally different than the next. Tax jobs are abundant, especially during peak season, so this may help a new graduate find work. As tax accountants are sought after during peak season, this offers many possibilities of landing an internship while still in school, which will become a valuable source on a resume once one graduates. Tax professionals are in high demand, so experience and knowledge in the realm of tax is invaluable.

While tax has a great upside, it also has its downside. Like auditing, it has long hours during peak season. Again at the Big Four, seventy to eighty plus hour work weeks are not uncommon. Smaller firms may require less overtime hours, but do expect to stay late and work on some weekends during the tax season of January 1st through April 15th. Communication and building relationships with clients is extremely important to succeed in tax accounting. If someone does not like working with other people, then tax may not be the right choice for a career path. The relationships need to be built and maintained so the clients return next year. Making the customer happy is vital to the firm's success. Relationships with tax clients requires a considerable amount of trust, as they share all of their private information. As with auditing, stress plays a huge factor during tax season.

The education required to be a tax professional is usually a bachelor's in accounting. There may be bookkeepers at the firm that only have an associate's degree, but they usually do not work with clients and on the actual tax returns. In order to be promoted to higher level positions, a master's degree is preferred along with becoming a licensed CPA. Certifications other than the CPA are available for tax accountants. The Internal Revenue Service (IRS) describes a couple of other certifications that have Unlimited Representation Rights, such as Enrolled Agents (EA) and Attorneys. The IRS also names Annual Filing Season Program Participants and PTIN holders as having Limited Representation Rights.

The pay scale for tax accountants is similar to auditors. According to the *Robert Half 2016 Salary Guide*, a tax accountant with less than one-year experience earns on average $49,000, while medium and large scale firms pay $52,250 and $59,000 respectively, again reporting these numbers from the low side of the scale. Like with auditing, tax managers and partners make well over $100,000, depending on the size of the firm.

CONSULTING

Another form of public accounting is consulting. While audit and tax are the most popular types of public accounting, consulting plays a huge role in the public accounting sector. Consulting can be done on many levels about many different topics. Accountants can consult clients on retirement planning, estate planning, accounting systems, tax planning, compliance, training, new business start-ups, etc. There is a long list of items that accountants can consult clients on. Consulting requires broad experience, so being vested in many areas is important. Attending conferences, attending trade shows, researching journal articles, and networking is a must in order to be successful.

Consulting can be a rewarding career. Consultants many times set their own schedule, consultants pick and choose which jobs they want to accept, and have the ability to work on various projects. Many jobs can be completed remotely, so going to the office every day is not always necessary. In an article posted on accountingweb.com titled *Tips for the Would-be Accounting Consultant*, it states to also learn how to play golf. The article goes on to state that "Forty-three percent of the biggest deals start on the golf course, and eighty-one percent of those are finalized within a few days of the game." Consulting also allows for working with a firm, or starting a new consulting business. Starting a new consulting business could be difficult, as finding and building a client list takes time. Consulting, like auditing, usually involves travel. If sitting in the same office every day is not appealing, then consulting would be an option to consider.

One challenge is that consulting requires strong public speaking skills, as usually presentations are made to many officers within an organization. As with all public accounting jobs, a personality that enjoys talking with and working closely with others is key. Consulting may even require more face-to-face time with clients than audit or tax. The clients are paying you to give them advice, so they are going to want to pick your brain and ask many questions, so patience is a good virtue to have as well. Listening is also a valuable skill, as consultants must know exactly what the client is looking to achieve. Another challenge for consulting is that the job market is more competitive with less opportunities than audit and tax. Finding the right job may be fairly difficult. One of the most difficult parts of consulting is being honest with a client. Telling the client what they want to hear is one thing, but telling them what they need to hear is the difficult part, especially when the news is bad.

The education for consulting varies, mainly depending on if one starts their own consulting practice or works for an established firm. Working for an established firm will require a bachelor's degree in accounting, and usually a CPA license. Obtaining a CPA license usually requires additional education beyond the bachelors, so a master's is usually preferred. Starting a new firm does not require any sort of education, but building relationships and finding clients will be challenging without an education, as the clients will want to pay for experience and education. Certifications can be obtained, but will vary based on the type of consulting specialization desired.

Salaries for consultants are often hard to predict, especially for those starting a new consulting firm. According to payscale.com, the low end of the scale shows a salary of $44,000, which would be for new consultants. With consulting, the pay can have a broad range. On the same chart from payscale.com referenced above, the average salary for accounting consultants is $68,000.

PRIVATE ACCOUNTING

While public accounting focuses more on working with multiple clients from various industries, private accounting is more focused on one company within one industry. Private accountants are usually more specialized in one area or industry. Private accounting jobs include working for corporations, and climbing the corporate ladder as experience is gained. Private accountants most likely will start with a Staff Accountant position, then work their way up to Assistant Controller, Controller, Directors, and Chief Financial Officer (CFO). Private accountants are considered internal employees, meaning the work they perform benefits the specific company they work for. Private accounting tends to be the more stable choice for an accounting career. Public accounting deals more with building a client list, while corporate accounting is more reporting business transactions.

CORPORATE ACCOUNTING

Corporate accounting deals with the recording and reporting of financial information of an individual company. Corporate accounting is more representative of what is learned from a Principles of Accounting textbook. Examples of corporate accounting tasks are analyzing business transactions, preparing and posting journals entries, compiling financial statements, and performing month-end and year-end closing duties. Other duties are also required, but the main focus is on properly recording and reporting the corporation's financial information.

There are many benefits to working in the private sector. The number one benefit is probably the predictability of the schedule. Corporate accounting usually has a fixed work schedule, very little travel, and the office location is the same every day. If a set routine is desired, private accounting would be the way to go. Since there is very little travel with a fixed schedule, corporate accounting allows for more free time to spend with family and friends. While there are still periods where overtime may be necessary, it does not compare to the hours of overtime in public accounting. Where public accounting works with many different clients with different backgrounds, private accounting has only one client, which is the company where the accountant is employed. The responsibilities are more structured based on your pay grade, so the focus is on the specialized area of the corporation. Corporate accounting involves substantially less stress, and quality of life is rated higher compared to those who work in public accounting. An article on accountingtools.com states "job satisfaction tends to be higher in private accounting." For those who like to work independently and not interact often with others, private accounting is a good choice. While working with others is still required, it is nothing like working with clients in a public accounting setting.

The challenges to corporate accounting is that it can be boring and repetitive. Many tasks are done on a recurring basis, so there is the same routine day in and day out. Most corporate accounting jobs involve sitting at the same desk (or cubicle) every day, so be prepared for it to be somewhat mundane. The busy season for corporate accounting is year-end and budget planning. While most companies also have month-end and quarterly tasks, they do not require as much time as year-end. While overtime may be required during those times, it is significantly less than public accounting peak seasons.

Entry-level corporate accounting positions usually require a bachelor's in accounting. Employees can move up without obtaining additional education, but the process will take longer. Those who want to advance their career quickly should further their education by obtaining a master's degree. Certifications are not generally required for many lower-level positions, but for those who wish to pursue an executive position such as CFO should certainly obtain their CPA license. There are other certifications that benefit those in private industries, such as a Certified Management Accountant (CMA) and Certified Financial Manager (CFM).

A Staff Accountant can expect to start out with a salary range of $42,500 - $47,500, depending on the size of the company. Private accountants can move up fairly quickly, so the salary will increase as well. At the top of private accounting, CFO's from even small corporations can easily pull six digits, while those at large corporations can make into the seven digits.

MANAGERIAL ACCOUNTING

Managerial accounting is another sector of accounting that performs internal work for a business. Managerialaccounting.org states that "Managerial accounting is concerned with providing information to managers, that is, to those who are inside an organization and who direct and control its operations." While corporate accountants perform duties for the corporation that benefit external stakeholders, managerial accountants perform duties solely for internal use within a business that will not be prepared for or reviewed by any external source. The sole purpose is to provide financial data to managers within the company so those managers can make decisions about their departments and/or products.

The benefits of managerial accounting are very similar to corporate accounting. The schedule is fixed with very little travel for lower level employees. Depending on the size of a company, some travel may be necessary to visit managers at other company locations. The tasks for managerial accountants do require discussions with department managers, so there is normally more interaction with others. While many of the monthly tasks are recurring, managerial accountants generally deal with some variation, so it not always as dull as corporate accounting. Managers may want different reports and financial information, so there are days where it may not be exactly the same. Lower stress, quality of life, and lack of overtime makes this sector appealing.

As with corporate accounting, many of the tasks are recurring. Managers are going to want the same daily, weekly, and monthly reports. Sitting at the same desk every day and completing the same tasks can be dull, but the lack of overtime other than month-end and year-end close is a plus. However, budget season will be longer for managerial accountants, as managerial accountants help prepare the annual budgets. Departments are never happy with their budget allowances, so be prepared to work with unhappy department managers.

Entry-level managerial accounting positions most often require a bachelor's in accounting. As with corporate accounting, employees can often move up without obtaining additional education, but the promotions may take longer. As with any industry today, obtaining a master's degree will help speed up the promotion process. Certifications are not generally required for many lower-level positions, but for those who wish to pursue a management position should certainly obtain some certification, probably the Certified Management Accountant (CMA).

The salary for managerial accountants start out a little higher than corporate accountants, mainly because only medium and large size firms have separate managerial accountants from their normal corporate accountants. Smaller firms usually combine tasks, so managerial accountant positions are not available for budget purposes. Starting out, managerial accountants can expect to make from $46,500 - $48,500, depending on the size of the company.

GOVERNMENTAL & NON PROFIT ACCOUNTING

Governmental accounting seems to be somewhat of a hybrid of public and private accounting, as the transactions are accounted for similar to that of private organizations, but it is prepared for the public trust. Government money must be accounted for properly as it is the public's money. The main idea with governmental accounting is "accountability". The funds collected for taxes paid by the taxpayers is supposed to benefit the taxpayer. Governments are not in the business to make profits, but to provide the

citizens with the resources they need. Governmental accounting is different compared to other types of accounting, as they often use "fund" accounts. According to accountingedu.org, "Fund accounting refers to the management and allocation of revenue an organization acquires through donations, tax payments, grants and other public and private sources. The basic idea behind fund accounting is to monitor and document the use of assets that are donated by outside parties." Non-profit organizations are accounted for similarly to a government agency, as the funds they collect are to benefit those on whose behalf they are collecting the funds.

The number one benefit for working as a government accountant is job security. Unless someone is doing something extremely unethical, like stealing government funds, then the job is generally safe. Governments usually do not downsize, they avoid huge layoffs, and frankly they are lax on their standards. If for some reason they do cut jobs in a department, they are usually good about transferring employees to other departments as opposed to laying them off. Government jobs are typically really low stress, and provide a means to move up within the agency or department. There is normally no overtime for entry-level positions, except for possibly fiscal year-end, so the hours and schedule is fixed. Travel is very limited in lower level positions, but often government accounting jobs allow for flexibility to attend continuing education sessions and conferences to learn more about the job and industry. There are many government agencies to choose from on the federal, state and local level, so job opportunities are available. Non-profits are similar to governmental accounting, but job security may not be as strong. The success of the non-profit depends on large donors, so keeping those relationships is vital to keeping a job. Non-profits may involve visiting donors and organizations, so while there are recurring tasks, some site visits may make the routine somewhat less repetitive.

While government accounting jobs are great, be prepared to carry the workload of others. As with all government jobs, there are always those who take advantage of their job security and do not put forth much effort. This is not always the case, but it could play a factor in some departments. As with many accounting jobs, tasks can be repetitive, and prepared to sit at the same desk every day. For non-profits, maintaining the donors and collecting funds are vital to the success and operation of the non-profit. While the accounting employees are rarely the ones who go out soliciting funds and donors, it may be required as part of your job once in a while.

A bachelor's degree in accounting is normally the minimum education requirement for both governmental and non-profit accounting, while there may be some accounting clerk positions that can be obtained with an associate's degree. However, promotions rarely occur for those with an associate's degree, so a bachelor's degree is recommended for those who want to have a solid career. A master's degree is great for those who want to move up quicker, so it is never a bad idea to further your education. Obtaining a CPA license is also helpful if becoming a director or vice president is of particular interest. Other certifications for governmental accountants is the Certified Government Financial Manager (CGFM) and the Certified Public Finance Officer (CPFO).

The starting salary for government accountants range from $43,250 - $48,250, depending on which agency of the government, the location of the government, and education and experience. For non-profits, the salary will range due to the size of the non-profit, so starting salaries can be estimated to be anywhere from the low $40's to high $40's.

EDUCATION

A career in accounting that has a tremendous job growth outlook is the education of accounting. "The accounting profession still suffers from a serious faculty shortage. As the average age of tenured accounting professors is 58, the faculty drought is likely to worsen in the near future" (Vien). With the shortage of accounting faculty, and the expected number of accounting educators set to retire, the number of positions

and the pay are attractive. An accounting educator will provide students with the knowledge and skills needed to prepare them for their accounting career. Along with teaching, job responsibilities also include research and service. In-depth research is encouraged and many times required depending on the type and accreditation of the institution. Other factors that may require research includes the position held, whether it be a Lecturer, Assistant Professor, Associate Professor, and Full Professor. A public versus private college or university may have different requirements as well. Service to the university would involve actively participating and serving on committees or other university or college level activities.

Accounting educators at a college or university level often have excellent schedules, low stress, and high job satisfaction. An accounting educator allows for maximum family time, as the schedules are usually fantastic. A professor will normally teach classes two days a week, so sitting at a desk in the same office every day is unusual, except for weekly office hours. Teaching allows for discussing new topics every day, which eliminates the dull, repetitive aspects of a job. The job is usually very low stress, which leads to better job satisfaction. Also, being able to help students achieve their dream of a college education plays an important role in job satisfaction.

While the schedule is usually awesome due to teaching only two days a week, the teaching days can be long, especially if you have a morning class and an evening class. While it makes for a long day, the time in between classes can be devoted to office hours and other duties, such as committee meetings. As with any job that deals with customers, customer service is of upmost importance as a professor. The students are our customers, so we must provide them with the necessary information and knowledge so they can achieve their goals. Dealing with students can be frustrating at times, but the sense of accomplishment obtained by witnessing them apply the knowledge they learned outweighs any and all frustrations.

Teaching at a research university will require a doctoral degree if a tenure-track position is desired, along with a CPA designation. A PhD or DBA in Accounting is also required to teach graduate level accounting courses in AACSB accredited schools. Some colleges and universities will hire those with a master's degree in accounting, assuming they have at least 18 graduate credit hours in accounting subjects. These are usually not tenure-track positions, and will only allow teaching of undergraduate courses. Some technical colleges will hire those with bachelor's degrees, but the pay will be much less than at a university. Depending on your teaching specialization, any and all certifications are certainly encouraged, especially the CPA.

According to the Association to Advance Collegiate Schools of Business (AACSB), "The average full-time faculty nine-month salary across all ranks and fields was $128,702." That amount does not include summer teaching pay, so salaries are higher for those that teach summer courses. A new graduate from an accounting doctoral program can expect to start out making approximately $151,100, according to research by Bishop, Boyle, Carpenter, and Hermanson published in the *Journal of Accountancy*. In the same article the authors state that a non-tenure track position of a Lecturer makes an average of $73,400.

CONCLUSION

Accounting is an excellent option for students to choose as their major and career choice. There are many options to choose from, and all accounting industries have a high job growth outlook. Whether one chooses to work in public, private, government, or education, any field of accounting is a fantastic choice. Each industry within accounting has its benefits and challenges, so personality and interest should play a factor in the decision. Use internships and shadowing opportunities to gain experience, which will also help determine if that particular industry was of interest. Once a specific area of accounting is chosen, narrow the scope and begin your journey. Now that the time has come to choose your accounting career path, what's the right choice?

LIMITATIONS

While many areas of accounting were discussed, there are other options and industries available. The topic was broad in nature, so the paper is not as detailed for each particular industry. Future studies may involve breaking down each industry in more detail, conducting more in-depth research for each industry, and writing a separate paper for each industry.

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Abstracts

A DICHOTOMY: WHAT THE STATE OF TEXAS STATES IT IS DOING ABOUT ECONOMIC DEVELOPMENT AND WHAT IS ACTUALLY HAPPENING AT THE COUNTY LEVEL

Finance and Economics - Abstract

Dr. Louis Mancuso [1]***, Dr. Robert Jones*** [1]***, Dr. mario krenn*** [2]

1. *Louisiana State University of Alexandria,* ***2.*** *Southeastern Louisiana University*

The top goal of economic development is to improve the economic wellbeing of a community and its residents. The main factors for economic development are viable community, business and local governments. Local governments are the catalyst and responsible for creating opportunities to enhance economic development and businesses are a backbone of Economic Development. According to the Texas Economic Development Council CEOs named Texas Best State for Business Eleven Years in a Row; Area Development Gold Shovel Award Winner (Gold Shovel: 2015, 2014, 2013, 2012, 2008 and Silver Shovel: 2011, 2010, 2009, 2007); Site Selection Magazine's Governor's Cup 2014, 2013, 2012, 2010, 2005, 2004; Top State for Infrastructure, Exports, Natural Gas Production, Renewable Energy; CNBC America's Top State for Infrastructure, 2nd Best State for Business; and Forbes.com Best State for Future Job Growth.

However, there is a dichotomy with the data shown in the United States Census Data; the average median income in the State of Texas is $52,576 and the average median income for Houston is $46,728. Coupled with this data is the poverty level in Texas which is 17.2% and the poverty rate in Houston is 22.9%. Whereas, in the United States the average median income is $53,482 with a poverty rate of 14.8%. The highest median income in the United States is the State of Maryland $70,004 and the lowest median income is the State of Mississippi $36,919.

The above data reveals a disparity between the claims of the Texas Economic Development Agency and the actual numbers presented in the U.S. Census Data. Thus, this begs the question, the effectiveness of the state economic development program and its impact on the well-being of the citizens of the State of Texas, as well as, the local government agencies.

The purpose of this paper is first, to explore the local government economic development initiative to enhance economic development in the State of Texas for their specific areas. Second, to identify the coordination effort between local, regional and state economic development program. Third, to explore the types of programs offered by local governments.

An Interdisciplinary Approach to Cybersecurity Curriculum

Information Technology, Decision Support Systems, and Cybersecurity - Abstract

Dr. Donna Schaeffer [1], ***Dr. Patrick Olson*** [2], ***Dr. Cynthia Knott - Eck*** [1]

1. *Marymount University,* ***2.*** *National University*

Current media has many stories of cyberattacks on the global financial system. The system is inter-related and inter-dependent. Attacks on a single institution in one country can have major economic impacts throughout the world.

In the United States, a voluntary risk-based Cybersecurity Framework was developed for all industries. The Framework is a set of industry standards and best practices to help organizations manage cybersecurity risks. The Framework was a collaborative effort between government and the private sector. The Framework avoids placing additional regulatory requirements on businesses.

The Framework recognizes that organizations in various industries will continue to have unique risks – different threats, different vulnerabilities, different risk tolerances, and implementation of the best practices set forth in the Framework will vary. The Framework is a living document that is updated and improved as there is feedback on its implementation.

We used the framework to design a curriculum and develop courses for a doctoral program in Cybersecurity. The courses are spread among the areas in the Cybersecurity Framework, and course competencies and learning objectives are derived from specifications in the Framework.

This paper will describe how we plan to bring interdisciplinary aspects into the curriculum, while following the framework. In this paper, we focus on coursework in Accounting and Finance. We also prescribe a series of courses in research for cybersecurity, in which students could focus on Accounting and Finance issues if that is a career path they plan to take.

AN OVERVIEW OF JEFF SELINGO'S THERE IS LIFE AFTER COLLEGE AND IMPLICATIONS FOR BUSINESS FACULTY

Educational Practice - Abstract

Dr. Suzie Smith [1]

1. *Presbyterian College*

Former Chronicle of Higher Education editor Jeff Selingo has struck a nerve with parents, students, and higher education professionals in his book There is Life After College (2016). The book analyzes student academic and pre-professional attributes while in college and categorizes three types of post-college 20-somethings: Sprinters, Wanderers, and Stragglers. This presentation will offer a short summary of the book's main points and generate discussion about ways that Business Schools can inspire more Sprinter-like behaviors and reduce the population of Stragglers.

The book draws from Selingo's own research in traveling with and interviewing many college students and young professionals. It also ties back to the existing body of knowledge and current state of research in higher education. Topics include behaviors that maximize future earnings, the best elective courses to take, three good reasons to take a gap year, why employers are redirecting their hiring focus toward interns, the effect of college debt on entrepreneurship, the effect urban locations have on professional success, entrepreneurial models other than college for 18-22 year olds, and where successful job leads are most likely to come from.

All business faculty need to know the basics behind Selingo's ideas in order to advise students, address parent concerns, and design programming to coach students to become confident Sprinters rather than letting them wander aimlessly or straggle helplessly. This presentation will inform participants and generate ideas to improve success on each campus.

Death and Taxes

Accounting - Abstract

Dr. Gail Moore [1]

1. *Lander University Greenwood South Carolina*

ABSTRACT:

Benjamin Franklin said is best when he stated, “In this world nothing can be said to be certain, except death and taxes.” Most people understand that individuals pay income tax on “all income, from whatever source derived,” (IRC 61) and estate taxes are payable upon the death of certain residents, depending on their assets. What about all of the other taxes paid by tax residents of the United States and specifically of South Carolina? Specifically, how much is the South Carolina Gas Tax and when is it paid? What is the South Carolina Use Tax and who pays it? What about the Admissions Tax? Do we pay a tax every time we buy a ticket to an event? This paper will focus on those “little known” and often uncalculated taxes paid.

Enhancing Communication of Transportation Agencies with the Public through Visualization Techniques

Public Sector, Social, and Ethical Issues - Abstract

Ms. Natasha Pokrywka [1]***, Mrs. Juthika Golder*** [1]***, Dr. Marcel Maghiar*** [1]***, Dr. Gustavo Maldonado*** [1]***, Dr. Cheryl Aasheim*** [1]***, Dr. Jennifer Kowalewski*** [1]

1. *Georgia Southern University*

Transportation agencies in the United States have an important mission to generate, facilitate, improve and maintain modes of travel within their states. The Georgia Department of Transportation's (GDOT) core function is to plan, design, improve, manage, control, construct and maintain the state's highway system. In this regard, transportation decisions made by these agencies may positively affect travelers. However, the public often criticizes these agencies because of a lack of understanding of the scope and nature of projects, and how these projects could improve the lives of the public once they are completed.

These agencies may receive negative criticism despite their efforts to follow federal requirements and capture public concerns before designs are finalized. This could be due to the lack of communication about projects or public misunderstanding of the benefits of the proposed projects. Therefore, it is crucial that agencies communicate early and often with concerned citizens to convey concise, clear, and understandable project information while giving the public opportunities to express their concerns. State DOTs should incorporate the suggestions of concerned citizens, especially those directly affected by proposed projects, into the project's design.

The proposed study will investigate several strategies to improve the presentation and format of messages delivered to the public. Of interest in this study is the use of visualization techniques to facilitate and to improve the understanding of project designs early in the decision making process. The use of Civil Information Modeling and three-dimensional (3D) visualization may assist the public in understanding the project's benefits, purpose, and consequences of not implementing improvements to the existing infrastructure. Existing visualization techniques include image and video composites, two dimensional drawings, walk-through or fly-through animations, and 3D rendering models. Agencies also use new techniques for presenting information in user-friendly formats, such as image mapping, 3D visualization, interactive displays, information kiosks, and mapping using Geographic Information Systems. As a part of a larger ongoing project aimed at improving communication between GDOT and the public and improving public participation, a visual preference survey was designed by the research team for use by GDOT to gauge public interaction in open houses and on transportation agencies web and social media sites.

The use of new visualization techniques and the improved communication these techniques foster will help GDOT to collect richer data from Public Information Open Houses that can be used to supplement information about the design and construction intent. At the same time, these techniques will assist the public in becoming more knowledgeable, involved and, hopefully, supportive of the decisions made by the transportation agencies.

Heuristics in Business and Economics

Sustainability and Innovation - Abstract

Dr. Reza Kheirandish [1]

1. *Clayton State University*

According to Gigerenzer and Gaissmaier (2011), “Heuristics, are efficient cognitive processes, conscious or unconscious, that ignore part of the information”. In this view, heuristics are simple rules of thumb that can be successfully used in situations of irreducible uncertainty and complexity. The more dominant view of heuristics, heuristics and biases, studies instances where people make less than rational or biased judgments, and attaches these instances often to the use of heuristics. In their initial research, Tversky and Kahneman (1974) argued that three heuristics, namely availability, representativeness, and anchoring and adjustment can be used to explain the processes underlying a wide range of intuitive and often fallible judgments.

Interestingly, social scientists are not the only group, or the first group, who use and study heuristics. Engineers, computer scientists, and mathematicians, as well as theoreticians in many scientific fields have been using heuristics, simple rules, and rules of thumb extensively as strategies for problem solving. Gathering the ways in which different fields define heuristics and spelling out the similarities and differences between these definitions is a theme of this paper.

The other, more specific goal is to survey the different conceptions of heuristics stemming from different psychological approaches to human decision-making processes. The paper demonstrates which concepts have or have not been extended to economics and other business disciplines. It specifies instances where the study of adaptation, use of heuristic strategies, and less-than-rational behavior is modeled in behavioral economics. It argues that in cases where the predominant conception of heuristics has been adopted in behavioral economics, the implications for understanding and describing decision processes can be traced back to the traditional neoclassical economic theory of rational decision-making.

Finally, it illustrates the ways in which the less explored extension of simple heuristic strategies to economic behavior holds operational promises, which can shed light on our understanding of puzzling behavior in economic markets. Examples from the prevalent use of simple rules in entrepreneurial domain provide a fruitful area for turning the focus of the study of heuristics from being a source for biased judgment to a functional way of treating the actual problem at hand.

Including Activity-Based Costing Constructs in a Survey of Accounting Course - A Basic Analysis

Educational Practice - Abstract

Dr. Bill Pollard [1]

1. *Appalachian State University*

Activity-based costing (ABC) is currently a widely-used multiple-based costing method that students will likely encounter in the workplace. Coverage of a detailed, broad-based analysis of ABC, while very desirable, is likely not possible for students taking a survey of accounting course (often taken by non-business majors) due to the ever-competing plethora of topics deemed essential in the business curriculum. However, including at least a brief discussion of the theoretical determinants of ABC in the survey course, as well as a basic analysis of the workings of ABC is essential since accurately determining the cost of a product is often basic to the successful operation of a business. In this paper, an overview of costing a product is first presented, followed by an illustration of the use of ABC.

Teaching Cost Accounting: A Focus on Bad Debts and Purchases Discounts in the Cash Budget

Accounting - Abstract

Dr. Bill Pollard [1]

1. *Appalachian State University*

This paper presents materials that have been used in the classroom to teach cash budgeting procedures and which, based on exam results, have helped students better understand the workings of a cash budget. An overview of the cash budget is first presented, followed by problems involving projected cash collections and budgeted accounts receivable, first without and then with bad debts. A focus on budgeted cash payments (and accounts payable balances) is next presented, first without and then with purchases discounts. These areas capture the key determinants in the cash flow of a business and are crucial in forecasting and then maintaining adequate liquidity for effective business operations.

The Effect of Nonlinear Inventory Turnover Ratio on Inventory Management Efficiency

Operations, Logistics, and Supply Chain Management - Abstract

Prof. Daesung Ha [1]

1. *Marshall University*

This study examines the effect of nonlinear inventory turnover ratio on the inventory-performance relationship. The inventory turnover ratio is measured by the ratio between inventory and sales. The existing studies on the inventory –performance relationship assumed a linear relationship between inventory and sales: as firm's sales increases, the quantity of inventory should also increase proportionately. The assumption, however, conflicts with the optimal inventory policy based on the economic order quantity model. As such, the linear inventory turnover ratio fails to recognize the fundamental inventory cost tradeoffs and cannot be considered as a good indicator of efficiency in inventory management. Assuming inventory turnover ratios are nonlinear, a few recent studies examined the inventory-performance relationship and reported conflicting results with the existing studies. In this study, we examine the nonlinear relationship between inventory and sales at the firm-specific level, using the panel data of U.S. manufacturing firms over the period of 1980–2014 collected from the Compustat database. Our results show that neither of the assumptions was prevailed over the sample period.

TOTAL MATCH INDEX AS REASONS TO DRIVE GENEROSITY BEHAVIORAL INTENTION: PROPOSITION DEVELOPMENT

Educational Practice - Abstract

Dr. nan nicholls [1]

1. *Slippery Rock University*

This paper examines the impact of matching student's service learning experience on their functional motives to volunteer or donate in the future. The paper lays out the foundation of the TMI a functional motive approach to future volunteering and donating decisions. The theoretical framework is developed using behavioral reasoning theory with the total match index serving as the measure for reasons. The literature is reviewed and research propositions are developed.

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