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*Intellectual Perspectives & Multi-Disciplinary Foundations*

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Intellectbase International Consortium (IIC) is a professional and academic organization dedicated to advancing and encouraging quantitative and qualitative, including hybrid and triangulation, research practices. This volume contains articles presented at the Spring 2010 conference in Houston, TX – USA from March 18-20, 2010.

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# TABLE OF CONTENT

LIST OF AUTHORS .....	II
LIST OF INSTITUTIONS, STATES AND COUNTRIES .....	VI
<b>SECTION 1: BUSINESS &amp; MANAGEMENT</b>	
A Quantum Approach in Strategic Leadership: Investigating a Dynamic Model for Measuring Organizational Entropy and Firm Value B. Tim Lowder .....	1
Cost Efficiency and Economies of Scale in the Supply Chain of Water for Industry in Thailand J. Wachirathamrojn, S. Adsavakulchai and L. Li .....	14
The Affect of Capabilities-Strategy Matches on Financial Performance of Government Business Enterprises Cheaseth Seng .....	20
Strategic Positioning: China's Choice in Global Manufacturing Value Chain Jifu Wang and Yuxia Zhao .....	35
Six Sigma: More Than Statistical Process Management Ralph L. Harper Jr. ....	44
Human Resource Capacity Building in the Public Sector of Balochistan Jan Muhammed .....	51
IT Project Management Best Practices in a ExpAnding Market Emad Rahim and Maurice Dawson .....	59
An Analysis of the Management Consulting Industry in the United States and Japan Brandon Hamilton .....	66
Efficient Market Hypothesis and Technical Analysis: The Irish Stock Index Joseph Armour, Melissa Lofton, Olamide Oyenekan and Massoud Metghalchi .....	71
A Six Sigma Cycle Reduction Project Ralph L. Harper Jr. ....	75
Richness Vs Parsimony: Comparing the Explanatory Power of Technology Acceptance Models Jeffrey S. Siekpe .....	84
Enterprise Architecture and Competitive Analysis Jack Elson .....	90
Opinions of Marketing Faculty About Client-Financed Real-World Projects: A Qualitative Study Using Content Analysis Gary L. Clark, Michael Lee Crawford and Michael E. King .....	96
Corporate Governance in an Ethically Challenged World Uche Nwabueze .....	104
Managing Organizational Wrongdoing: A Diagnostic Approach David F. Summers, Ron Salazar and Cynthia A. Summers .....	113
The Future Outcome from a Discrete Distribution Valbona Bejleri and Alexander White .....	120
The Relationship between Diversity and Organizational Performance Ron Sardessai and T. T. Rajan Selvarajan .....	131
Supply Chain Management Technologies and Strategies Ralph L. Harper Jr. ....	135
Management System Using 7-S's McKinsey Model Case Study in Ceramic in Thailand S. Adsavakulchai and P. Sopajitwattana .....	143

## **SECTION 2: SCIENCE & TECHNOLOGY**

Infrared Pen Development for Virtual Smart Board <i>T. Pongwattana, P. Phangsai, J. Rojanathavorn and S. Adsavakulchai</i> .....	150
An Exploration of Cyber Technology and MBA Students in Thailand <i>Joselina Cheng and Kiattisak Phongkusolchit</i> .....	157
Modeling the Diffusion Process with Indirect Network Externalities <i>Jun Yang</i> .....	167
Interactive Multimedia DVD: Menu Building in Adobe Encore and Aftereffects <i>Lauren Collin Razzore</i> .....	178
Novel Assay for Citrulline Measurements in Serum <i>Siva G Somasundaram, Ryan Shuck, Matthew Hindmarch, Peter Anderson and Richard Gunasekera</i> .....	182
Energy Considerations for Lifting Ice-Melt from the Earth's Gravitational Well <i>Mark A. Wessels</i> .....	187
Phosphorylations of NFkB Serines and breast cancer cell growth inhibition by <i>Indigofera tinctoria</i> <i>Siva G. Somasundaram, Karen Pearce, Nagarajan Anusuya, Bhimu Patil and Sellamuthu Manian</i> .....	189

## **SECTION 3: EDUCATION, SOCIAL & ADMINISTRATION**

Primary Teacher Education in Jeopardy: Pre-Service Teachers' Under Achievement in Attainment of Desired English Competency Levels <i>Agnes W. Gathumbi</i> .....	195
Academic Program Elimination: An Autopsy of Discontinued E-Business Master's Degrees <i>Marcelline Fusilier and Larry Short</i> .....	203
Language-in-Education Policies in Africa: Perspectives, Practices, and Implications <i>Agnes W. Gathumbi and Connie Ssebbunga-Masembe</i> .....	213
Increasing Stem Competency Among Culturally and Linguistically Diverse Students: A 21 <sup>st</sup> Century Imperative <i>Timothy Forde and Heraldo Richards</i> .....	223
The Gender Perspective: Students' Perceptions of and Attitudes Toward the Online Environment <i>Retta Sweat Guy and Carolyn Jewell</i> .....	226
E-Business Educational Program Endurance: Exploring Curricula <i>Marcelline Fusilier</i> .....	236
Electronic Enhancements to Face-to-Face Instruction in Post Secondary Settings: Review of Issues and Trends <i>Ann Hersch and Mumbi Kariuki</i> .....	242
The Rural to Urban Migration Decision in China: An Empirical Investigation <i>Ya You</i> .....	251
Organizational Psychology and American Policing <i>Sloan T. Letman, Alison Duggins, Shirley Chuo and Jack Aschkenazi</i> .....	272
Religious Activity as a Coping Mechanism for Time Stress <i>Donna Y. Stringer and Olga Chapa</i> .....	277

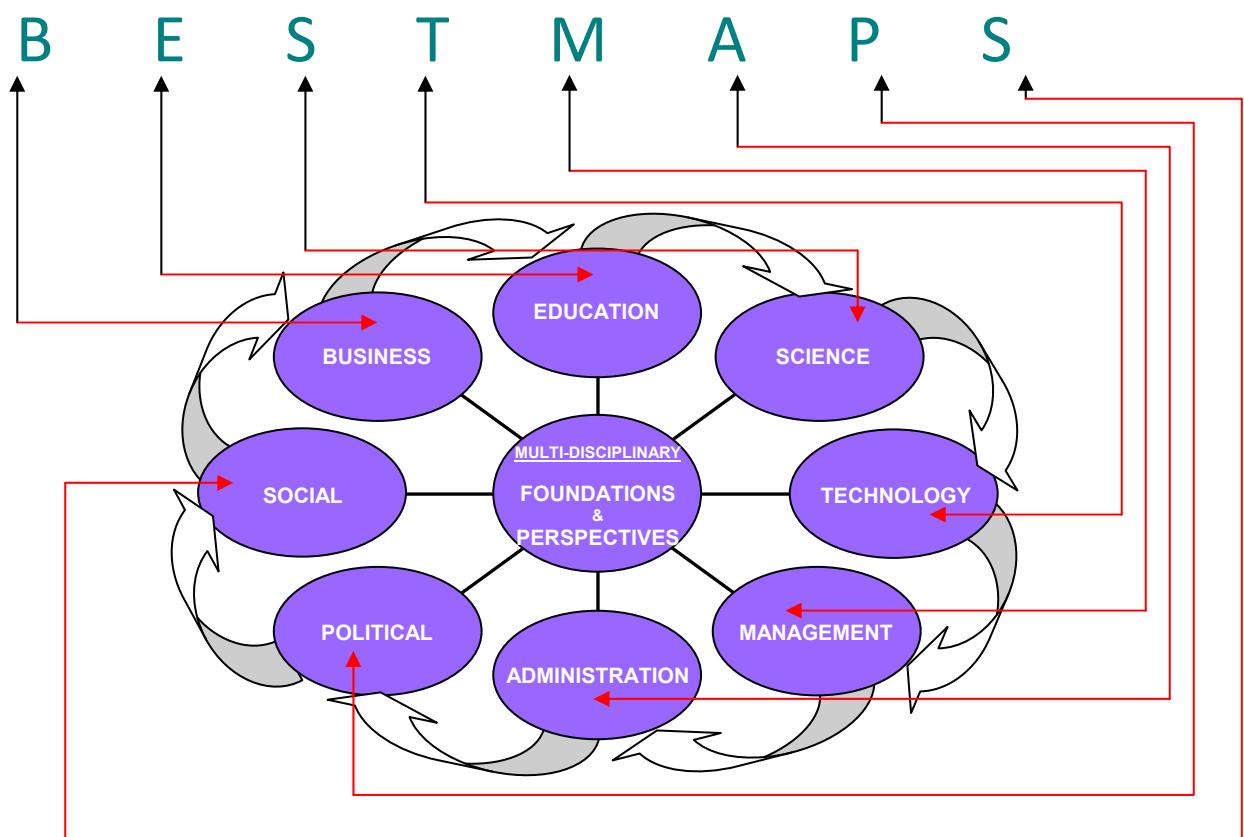
## SECTION 4: ABSTRACTS & POSTERS

Water Trade and Diversion Activity in the Texas Lower Rio Grande Basin <i>Andrew J. Leidner, M. Edward Rister, Ronald D. Lacewell, Megan J. Stubbs and Allen W. Sturdivant</i> .....	283
Analysis of Nonparametric Kaplan-Meier Estimator in OFDM Systems <i>Victor A. Vega-Lozada and Angel Lambertt Lobaina</i> .....	288
Information and Technology Imperatives Upon Higher Education and Job-Oriented Multiliteracy Skills in Urban Settings <i>Ying Liu, Vivian Taylor, Gordon Skelton and Jianjun Yin</i> .....	290
Effectiveness of Social Media Simulation to Teach Introductory Economic Principles <i>Michael H. Lau and Michelle Mullins Santiago</i> .....	292
Minorities in Health Care Paraprofessionals in Houston: A Socio Cultural Study of Ethnic Minorities <i>Uma Pochampalli</i> .....	294
How Should the Government Manage Public Debt? A Case of an Emerging Country <i>Rika Nakagawa</i> .....	295
New Global Challenger: Understanding the Potential of Companies from High-Growth Emerging Markets <i>Emin Civi</i> .....	296
Economic Impacts of BioEnergy Policy <i>Naveen C. Adusumilli, Ronald D. Lacewell, C. Robert Taylor and M. Edward Rister</i> .....	297
Implementing Cooperative Learning in an EFL Reading Class <i>Gordon Myskow, Paul Underwood and Takahiko Hattori</i> .....	298



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# **BUSINESS & MANAGEMENT**

## **SECTION 1**

# A QUANTUM APPROACH IN STRATEGIC LEADERSHIP: INVESTIGATING A DYNAMIC MODEL FOR MEASURING ORGANIZATIONAL ENTROPY AND FIRM VALUE

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## ABSTRACT

Great strategic management is essential to an entrepreneurial firm's success. However, choosing effective strategy and aligning the organization's structure to this strategy is a very difficult task. This paper addresses how specific strategic processual elements that are chosen at the initial strategic planning level can cause an organization's sub-systems to interact and influence entropy at the super-system level. These strategic processual elements are identified and classified based upon their strategic focus and then evaluated and analyzed in the model to determine their entropic impact on the firm's organizational structure. The quantum model developed in this paper has the potential to serve as both a tool for performance measurement and a tool for enhancing strategy development. The model's primary use is to assist management in the mitigation of structural entropy and the enhancement of firm value.

## INTRODUCTION

Great strategic management is essential to an entrepreneurial firm's success. However, choosing effective strategy and aligning the organization's structure to this strategy is a very difficult task for entrepreneurs. This is because entrepreneurial firms operate in a complex, open systems environment where entropic forces cause its systems to deteriorate, disorganize, and progress toward maximum disorder and chaos (Bailey, 1994; Bertalanffy, 1972; Laurie, 1999). In fact, Stephen Hawking (2001) describes entropy as "nothing more than a measure of the total information contained in a system" (p. 64). Entropic forces cause this information to either be used up or remain as excess energy within the firm wherein resources are used inefficiently. This unused energy, or resources, results in slack and decay within the firm's organizational structure (Bailey, 1994; Scott, 2003; Scott, Dornbusch, Busching, & Laing, 1967). Organizational slack is often the result of inadequate or unbalanced strategies which result in resource surpluses or deficiencies as a result of structural and strategic misalignment (Cyert, Dill, & March, 1958; March, 1991).

This paper addresses how the selection of specific strategic choices at the leader's cognitive level influences entropy at the super-system level. Each strategic choice made by the entrepreneurial strategist between alternative strategic options is called a strategic processual element. It is premised that individual strategic processual elements can be identified and classified into groups based on their strategic focus. These multiple groupings fall within two primary sets of strategies that are based on a focus on either exploitation or exploration. After their classification into the groups strategic processual elements are evaluated and analyzed within the model to determine their entropic impact on the firm's organizational structure. The quantum model developed in this paper is based on the aforementioned identification, classification, and analysis protocol. There are several important constructs that are addressed to help explain the background and logic behind the quantum model. The first construct addressed is systems theory.

## SYSTEMS THEORY CONSTRUCT

The paper relies on an open system's paradigm wherein the firm consists of numerous interconnected, symbiotic sub-systems that operate collectively as a super-system. The super-system expends energy by acquiring and using resources that are directed and controlled through management's strategic thinking, planning, and implementation. During the strategic planning process the entrepreneurial strategist consistently makes strategic choices between alternatives that are either exploitative or explorative in nature. Exploitation strategies focus on guarding and maintaining the integrity of the firm's sub-systems toward effective and efficient resource usage while exploration strategies simultaneously span the external environment to attain opportunistic throughput to preserve its structure (Pondy & Mitroff, 1979).

Another key background issue in this paper involves entrepreneurial strategic choices and their relationship to the entrepreneur's personal life experiences. The entrepreneur's personal life experiences significantly influence his or her

individual cognition which affects behaviors, modes of action, and strategic decisions (Bann, 2007; Jue, 2004; Lydon, 2001). The cognitive dimension of entrepreneurial decision making provides a solid framework for studying entrepreneurial strategic leadership. Hence, the quantum approach identifies information specific to the entrepreneur's cognitive dimension as it relates to specific strategic choices between alternatives.

As previously mentioned, each individual strategic choice between alternative is representative of a strategic processual element. Thus, each strategic processual element represents individual strategic choices, or decision, which falls within the entrepreneurial strategist's cognitive domain. Each strategic processual element is classified within a grouping based on strategic focus. These groups represent either exploitation strategies or exploration strategies. It is postulated that attaining a better understanding of strategic processual elements as they are identified and classified will lead to greater certainty concerning the impact of entropy on an entrepreneurial firm's structure. In summary, the collective interaction of strategic processual elements at the systems levels are focused on either exploitation strategies or exploration strategies and have a significant impact on both sub-systems and the super-system. Next, the strategic perspective of the quantum model is addressed.

## **STRATEGIC PERSPECTIVE**

The paper's strategic perspective is based on two dichotomous constructs called exploitation and exploration (Benner & Tushman, 2003; Gupta, Smith, & Shalley, 2006; Ireland & Justin, 2007; March, 1991, 1996; Thorpe, Holt, Macpherson, & Pittaway, 2005; I. Turner, 2006). Ireland and Webb (2007) describe the balance between exploitation and exploration as "the need for a firm to learn how to simultaneously exploit today that which it does well relative to rivals, while also exploring to determine what it needs to do to be successful in the future" (p.50). The quantum approach individually identifies strategic processual elements and then classifies them into groups based on their strategic focus. The strategy groups fall within the framework of either an exploitation strategy or an exploration strategy.

This process of identification was first used by the author in 2006 while doing a case study on General Electric (Lowder, 2006a, 2006b). In 2009, the author further illustrated the impacts of both exploitative strategic processual elements and explorative strategic processual elements in an investigative, qualitative research study entitled "The Dominant Logic of Strategic Entrepreneurial Leadership: A Qualitative Study of Entrepreneurs, Consultants, and Bankers" (Lowder, 2009).

The entrepreneurial strategist may choose an exploitative strategic processual element that is focused on expending energy in order to maintain the integrity of the firm's sub-systems for maximum efficiency and effectiveness (Pondy & Mitroff, 1979). Conversely, the entrepreneurial strategist may choose an explorative strategic processual element that is focused on spanning the firm's peripheral environment in order to map external environmental opportunities into the firm's existing structure (Pondy & Mitroff, 1979). The aforementioned duality of strategic choice between exploitation and exploration strategic processual elements clearly illustrates the open systems construct.

In the open systems level of analysis, exploitation and exploration strategies become a useful tool for the study of strategic choices (Bartee, 1971; Kast & Rosenzweig, 1972; Rivkin, 2000; Scott, 1993, 2003, 2004). This research strives to illustrate the relationship between both exploitation and exploration strategic processual elements. The goal is to establish a model which assists in mitigating firm entropy. Hence, it is proposed that there is an optimal state wherein strategic processual elements are allocated between either exploitation strategies or exploration strategies in a manner that mitigates firm entropy. This optimal state has the potential to provide a synergistic relationship that enhances structural and strategic alignment (Bartee, 1971; Kast & Rosenzweig, 1972; Rivkin, 2000; Scott, 1993, 2003, 2004).

The strategic intent of an individual exploitation strategic processual element is on allowing the firm to maintain its given form, structure, and state while maximizing the system state toward maximum effectiveness and efficiency (Benner & Tushman, 2003; Bertalanffy & Rapoport, 1956; Gupta et al., 2006; Ireland & Justin, 2007; March, 1991; Scott, 2003; Thorpe et al., 2005). Conversely, the strategic intent of an individual exploration strategic processual element is on adaptation and change within the systems state to enhance the potential for additional strategic opportunities (Benner & Tushman, 2003; Bertalanffy & Rapoport, 1962; Gupta et al., 2006; Ireland & Justin, 2007; March, 1991; Scott, 2003; I. Turner, 2006). The optimal situation in an entrepreneurial firm is a strategic plan with contains an optimal mix of both exploitative strategic processual elements and explorative strategic processual elements that provide a solid foundation for aligning structure to strategy in order to mitigate firm entropy (Ireland & Justin, 2007; March, 1991; I. Turner, 2006).

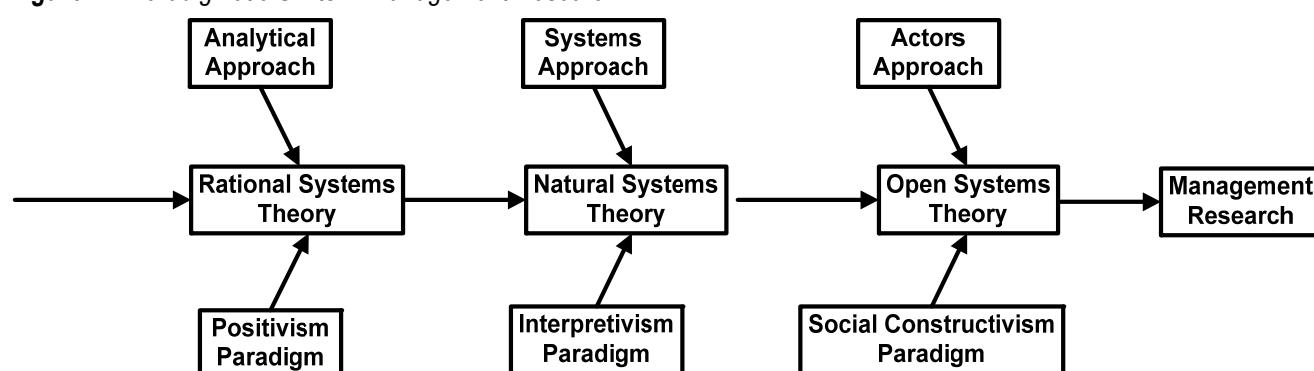
An optimal mix of strategic processual elements also provides the opportunity for significant organizational learning and allows environmental complexity to be appropriately mapped into the firm's structure (Augier, March, & Cyert, 2002; Barnett &

Burgelman, 1996; March, 1996; McDonald, 2002; Scott, 2003). The optimal mix of strategic processual elements also allows the organization's task environment and technical core to attain maximum inputs, deliver maximum throughput, and thus generate maximum outputs which in essence creates a system where the whole is greater than the sum of its parts (Bailey, 1994; Bartee, 1971; Rivkin, 2000; J. D. Thompson, 1960). It is postulated that the entrepreneurial firm's structural integrity is enhanced and entropy is mitigated as the optimal mix between exploitation and exploration strategic processual elements becomes more refined (Benner & Tushman, 2003; Cesaroni, Minin, & Piccaluga, 2005; Gupta et al., 2006; Ireland & Justin, 2007; March, 1991, 1996; Petersen, Boer, & Gertsen, 2004; Thorpe et al., 2005; I. Turner, 2006).

## EVOLVING THEORETICAL CONSTRUCTS

To fully appreciate the reasoning behind the quantum model, it is important to attain an understanding of the evolution of scientific investigation. Through this investigation of paradigmatic shifts in scientific theory, one can determine how quantum theory is related to the study of strategic choices. Scientific investigation specific to management theory has evolved through three distinct phases as illustrated in the following figure.

**Figure 1: Paradigmatic Shifts in Management Research**



One specific field of scientific inquiry that is not often addressed in the shifting paradigms of management theory is the field of physics. The field of physics has experienced a similar shift in paradigms as follows:

**Figure 2: Paradigmatic Shifts in Physics Research**



The reader may observe the similarity between the shifting paradigmatic approaches in management research and physics research. The first phase of both paradigmatic approaches focused on strict analysis based on cause and effect relationships. In phase two of the paradigmatic transformation a new realm of discovery evolved. In this paradigm shift systems and subsystems were studied in wherein subtle relationships and their affects were researched and documented based on the researcher's observations even though no direct cause and effect relationship is present.

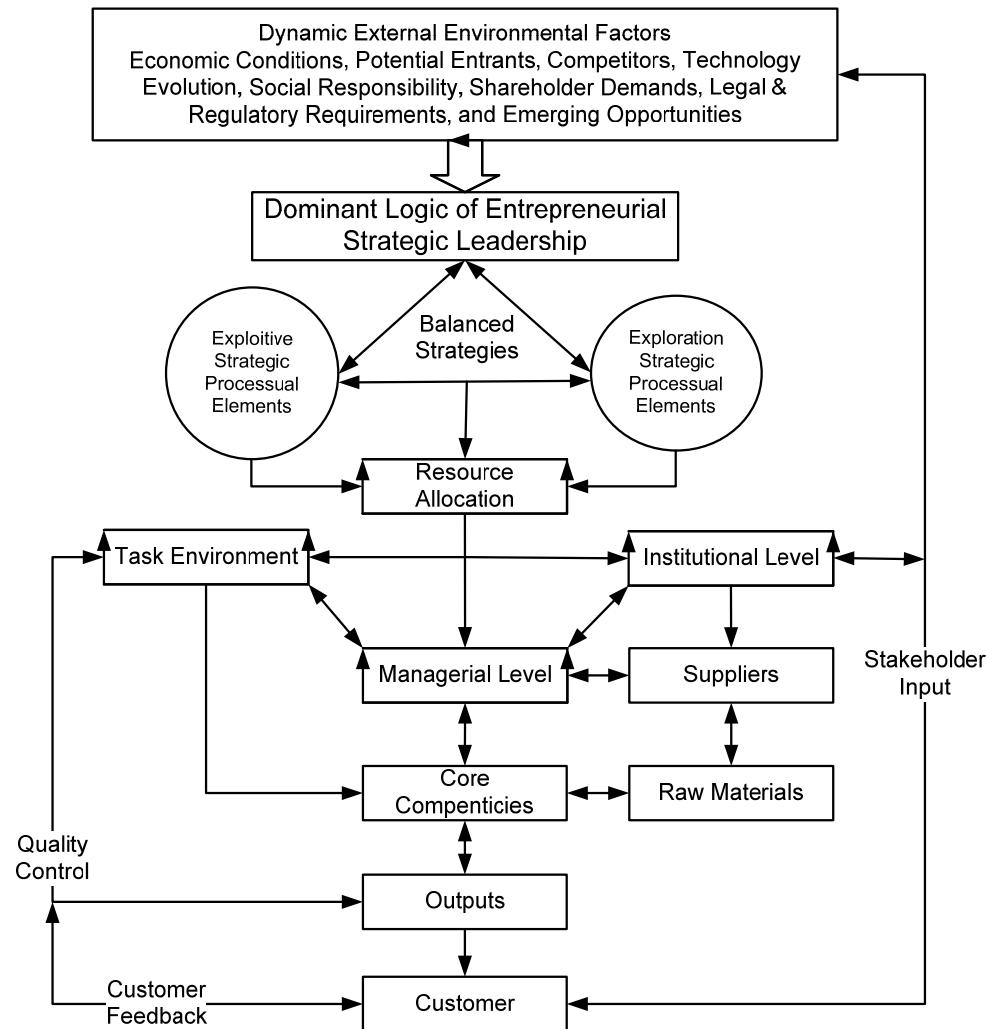
Lastly, in phase three of the paradigm shift, singular occurrences are allowed to have multiple affects and their analysis is closely tied to the observer's perception of reality (Arbner & Bjerke, 1997). This third phase in management research is closely aligned with quantum theory. It is proposed that these singular effects in management research are identical to the quanta that was recognized and developed by Planck and Heisenberg within the construct of quantum theory (Hawking, 1996, 2001). Thus, quantum theory potentially affords opportunities for new discovery in the study of entrepreneurial strategic leadership when viewed from the new paradigmatic perspective which is addressed in the next section.

During the mid-1920's German physicist Werner Heisenberg expounded on Max Planck's research on quantum theory. Planck had clearly proven that light comes in small packets that he referred to as quanta and established the initial uncertainty principle. Heisenberg expanded on the uncertainty principle and proved that when an observer attempts to measure the position of a particle they are less likely to accurately determine or measure its speed. Conversely, when the observer attempts to measure the speed of a particle, they are less likely to accurately measure or determine its position. In essence, the uncertainty principle states that when a longer wavelength is used to observe a particle, the greater the uncertainty of the particle's position and that when a shorter wavelength is used to observe a particle, the greater the certainty of the particle's

position (Hawking, 1996, 2001). This was a revolutionary discovery for the development of quantum theory but also has significant implications for the study of entrepreneurial strategy.

Management strategy is developed from small packets of information which are gathered, compiled, and implemented in the form of a strategic plan. Thus, as the planning process evolves numerous strategies are combined to formulate the company's strategic plan which is then implemented and measured (Exhibit I). Within the framework of strategic choices, the quanta in this model are representative of the individual strategic processual elements that are classified within a set of either exploitative or explorative strategies. Specific groups of both exploitative strategies and explorative strategies are described in greater detail later in the paper. Another interesting observation from these quanta, or strategic processual elements, is their relationship to the uncertainty principle. As mentioned earlier, the Heisenberg's uncertainty principle states that the longer the wavelength that is used to observe a particle, the greater the uncertainty of the particle's position and that the shorter the wavelength that is used to observe a particle, the greater the certainty of the particle's position (Hawking, 1996, 2001).

**Exhibit I: Dominant Logic of Entrepreneurial Strategic Leadership Framework**



It is postulated that the longer wavelength described in quantum theory is of equal nature to a large, complex organization while the smaller wavelength is of equal nature to a smaller, entrepreneurial firm. Thus, in a large, complex organization it is more difficult to determine the position of strategic processual elements and thus more difficult to determine their impact on the organization. Conversely, in a small, entrepreneurial firm it is less difficult to determine the position of strategic processual elements, and thus easier to measure its impact on the firm. These quantum relationships form the basis for the model being presented. Next, in order to better understand entropy, the laws of thermodynamics are addressed.

## MEASURING FIRM ENTROPY

In developing the quantum model, it is important to understand how the model approached firm entropy. The quantum model begins by observing firm entropy from the perspective of thermodynamic theory. The primary formula in thermodynamics is:

$\Delta u = w + q$  where  $u$  = energy,  $w$  = work, and  $q$  = heat flowing into system.

However, the variables in this formula are not descriptive of the terms and concepts used in strategic management. Thus, management-specific terms are substituted for the terms used in the thermodynamic formula to better represent an organization. Remember that the organizational structure is a system which means that the constructs of thermodynamic theory are applicable. The first variable that is defined from a quantum perspective is information which is the same thing as energy in the quantum model. Hawking (2001), describes entropy as “nothing more than a measure of the total information contained in a system” (p. 64). Information, or energy, contained within an organizational structure may experience three levels which include being expended or used up, remaining in a steady state, or increasing. Thus, the quantum model postulates that the change in information, or energy, within the organizational structure is the same as the level of structural entropy.

There is an important relationship between strategic alternatives in the organization. These strategic alternatives are representative of information, or energy, and it is the choice between strategic alternatives that determines the outcomes specific to a firm's structural resources. Hence, as strategic choices are made between alternatives larger amounts of information is generated and various levels of energy are expended within the firm's structure. As energy is used up in the form of information, additional energy in the form of structural resources is either generated, used up, or remain in a steady state. This relationship between energy in the form of information pertaining to strategic choices and energy that is generated or used up in the form of structural resources is important for determining how structural entropy is measured within the firm's super system. The tool used to measure the entropy in the organizational structure is based on real value.

The economics and accounting tool that has been chosen to represent and measure entropy ( $\Delta u$ ) in the entrepreneurial firm is Economic Value Added (EVA). EVA was developed by the accounting firm Stern Stewart and is explained by Shawn Tully in the September 20, 1993 issue of Fortune Magazine. EVA is a performance management tool that adjust a firm's net income to account for all accounting irregularities, or what Stern Stewart refers to as accounting distortions, that occur as the result of using the Generally Accepted Accounting Principles (GAAP) as defined by the Financial Accounting Standards Board (FASB) (Tully, 1993). EVA makes adjustments to and recalculates a firm's net income to a number called net operating profit after taxes (NOPAT). EVA is an expanded construct based on the concept of residual income (RI). The calculation of EVA can be determined as follows:

- 1) EVA or RI = NOPAT – Required Profit (Cost of Capital x Investment)
  - a. Cost of Capital = Firm's Weighted Average Cost of Capital
  - b. Investment = Total Assets – Non-interest Bearing Current Liabilities (NIBCL).

NOPAT represents a firm's income as adjusted for accounting distortions as described by Stern Stewart and provides a realistic assessment of true or real income earned by a firm during a given period, usually a tax year. Hence, EVA is the difference between the firm's real income (NOPAT) and its cost of capital. As Weaver (2009) states, “EVA contains a number of adjustments, over 160 adjustments are suggested. Some of the adjustments are US GAAP based. For example, removing extraordinary items from the definition of income or excluding interest. Other adjustments are non-US GAAP based, such as capitalizing R&D, capitalizing advertising, cash paid (current) taxes and so on” (Weaver, 2009).

First, when the firm experiences real income in excess of its cost of capital there is a positive EVA, or in quantum terms, energy is increasing in the system. In accounting terms, real value is being added to the firm. When a positive EVA occurs it represents a state of negative entropy. Second, when the firm experiences zero EVA, it is experiencing a steady state or zero entropy because no real value, or energy, is being added to the firm. Third and last, when the firm has an EVA that is less than zero it is experiencing entropy. In this case real value is decreasing and energy is being depleted in the firm. Thus, based on the previous discussion of thermodynamic entropy it is postulated that  $\Delta u$  = Level of Structural Entropy = EVA.

The right side of the thermodynamic equation contains the two variables work ( $w$ ) and heat ( $q$ ). It is postulated that exploitative strategies represent work within the system of an organizational structure while explorative strategies represent heat within the organizational structure. A description of both exploitative strategies and explorative strategies is essential for effectively classifying strategic processual elements. Thus, groups of both exploitative and explorative strategies are defined within each set later in the paper. This classification process allows strategic processual elements to be classified and analyzed to establish their quantum dimension as information or units of energy flowing into the organizational structure. In the next section specific groups are defined within the exploitative strategy set and explorative strategy set.

## **EXPLOITATION STRATEGY SET**

### **Value Chain Enhancement**

This processual element focuses on the firm's value chain and is concerned with matching resource demands to products or services, customer sophistication, channels of distribution, infrastructure requirements, customer switching costs, availability of complementary products or services, availability of substitutes, and economic conditions (Berlin, 2004; Feigenbaum & Donald, 1999; Debbie Howell, 2005; Yam, Tam, Tang, & Mok, 2005). The leader plans for appropriate resource demands including people, plant, equipment, and cash flow to implement this tactical component of the organization's value chain.

### **Cultural Enhancement**

Cultural enhancement includes embracing the organization's culture as an essential resource requirement for knowledge creation and organizational sustainability (Allaire & Firsirotu, 1990; Bate, Khan, & Pye, 2000; Burke & Litwin, 1992; Chakraborty et al., 2004). Emison (2004), states that an organization must move "from conscious competence in strategic abilities to unconscious mastery" (p. 56). Thus, the enhancement of the organization's culture through learning programs provides a framework for sustainable and long-term knowledge creation, strategy implementation, and thus, competitive advantage (Allaire & Firsirotu, 1990; Bate et al., 2000; Burke & Litwin, 1992; Chakraborty et al., 2004). In a learning environment, the culture provides a framework for effective strategic management throughout the strategy process and supports the incremental implementation of strategies (Amey, 2005; Argyris, 1976; March, 1991).

### **Empowerment and Enactment**

Empowerment and enactment hinge on the interdependence of the various organization's actors including, managers, employees, customers, suppliers, and strategic partners and his or her relationship to the organization's task environment. Both managers and employees are encouraged to make important decisions related to organizational goals. This empowerment enhances information transfer, knowledge creation, and innovation (Meyer, Paunonen, Gellatly, Goffin, & Jackson, 1989). In addition, decision-making is decoupled which results in a faster, more responsive decision making process, and a leaner, more efficient technical core and task environment (Arussy, 2005; Meyer & Gemmell, 1997; Stewart, 2006; Weick, 1987).

### **Technical Core Enhancement**

Technical core enhancement focuses on strengthening the organization's technical core component of the value chain. To accomplish this strategy, the organization must leverage its technological capabilities by taking advantage of knowledge transfer from its external, peripheral environment (Gephart, 1999; Stewart, 2006). The focus of this strategic management initiative is aligning the company's technical core with its peripheral environment, particularly customer needs. The company may also strategically use the strength, depth, and capacity of its technical core as a bridging tactic to align its technology knowledge base with its service delivery to provide customers with solutions in efficiency, environmental performance, and quality control. In addition, this initiative provides added potential for innovation as the company leverages its technical core to maximize technology development and transfer.

### **Buffering Strategies**

Buffering strategies emphasize hiring people who are excellent decision makers, highly motivated, and very energetic. This tactic enhances knowledge creation, information attainment, and innovation. Buffering is further enhanced if employees and managers receive cross-training, quality certifications, and problem resolution training (David Howell, 2000; Tichy & Cohen, 1998). In addition, cross-functional team building can be used to integrate and synergize organizational resources which creates interdependency among various sub-system components and strengthens its technical core (Kerr & Ulrich, 1995b; Tichy & Cohen, 1998). These initiatives result in a strong normative and cultural-cognitive institutional environment that strengthens, reinforces, and buffers the organization's technical core.

### **Team Coalitions**

Team coalition development enhances organizational learning through a continual assessment of the organization's technical core and task environment to link process excellence directly to customer value (David Howell, 2000; D. Quinn, 2005). Organizational learning links the company's technical core to customer successes through customer feedback. In addition, an organization can use cross-functional team building specifically designed to integrate and synergize organizational resources and stimulate interdependency between various organizational sub-systems to strengthen its technical core through innovation (Kerr & Ulrich, 1995b; Tichy & Cohen, 1998).

## Institutional Conceptualization

Institutional conceptualization involves cultural development and enhancement of normative and cultural-cognitive perceptions toward an alignment with the organization's mission, vision, and values (Argyris, 1976; Mann, 1990). To accomplish this strategic initiative, management must focus on indoctrinating employees and managers to the organization's mission, vision, strategies, values and objectives through training programs. Instilling these messages into the cultural mindset enhances compliance and obligation, voluntary constitutive order, appropriate and orthodox foundation, shared indicators, and morally governed and culturally supported legitimacy that enhances organizational learning and innovation (Black, 2002; Curry, Meyer, & McKnney, 2006; B. A. Turner, 1986).

## Attention Requirement for Performance

A very important cultural-cognitive element of organizational learning includes implementing strategic programs that instill a mindset of high-level management and employee performance. This strategic management process creates an environment of quality when accompanied by a reliable performance management system (Brewer & Bagranoff, 2004; David Howell, 2000; D. Quinn, 2005). This strategic management process places an emphasis on developing and nurturing high performers and providing the resources to train and promote potential leaders from within the company. These employee training and development programs must stress the organizational performance requirements but tremendously affect organizational learning, knowledge creation, and innovation.

## Outcome Driven Perspective

An outcome driven perspective helps to ensure structural and strategic alignment and involves the use of a feedback loop in the control program to assist in organizational learning used to realign the organization's internal processual elements with its customer's needs to improve the speed and delivery of products and/or services (Busco, Frigo, Giovannoni, Riccaboni, & Scapens, 2006; David Howell, 2000; D. Quinn, 2005). These processual elements must develop specific metrics to measure and control the task environment through the implementation of projects that focus on minimizing cycle time and creating controlled, incremental growth. The goal of these metrics is to provide an organizational learning tool to create knowledge that assist in aligning the organization's technical core and its task environment with its peripheral environment, particularly customer's needs. This processual element also provides a tremendous amount of information for use during the strategic management process.

## EXPLORATION STRATEGY SET

### Differentiation Tactics

Differentiation tactics focus on strategic processual elements designed to appeal to a broader range of customers (Hamel, 2006; Herrmann, 2005; Rivkin, 2000; Rothschild, 1993; A. Thompson, Strickland, & Gamble, 2005). This strategic process focuses on making the company's products or services distinct from rivals. The primary focus of this strategy emphasizes excellence in services and/or products and is essential for entrepreneurial firms seeking organic growth.

### Size and Structure Management

**Size and structure management** focus on diversification, expansion, and contraction to control economies of scope and scale. The strategic management process must focus on controlling its economies of scope and scale to attain and/or maintain lower costs. Management can attain greater control over its technical core and task environment through the boundary spanning process, discussed earlier, which allows management to clearly establish its domain in the areas of design, quality, availability, and delivery of both front-end and back-end value chain resources.

### Boundary Spanning

**Boundary spanning focuses on the process of eliminating boundaries** between the organization's internal and external structural components in order to enhance organizational learning and information attainment by making suppliers, customers, and strategic partners, part of a single process. The objective of this bridging tactic is to create an institutional environment that maps the best ideas and practices from other companies into the organization's structure (Bartee, 1971; Herrmann, 2005; Kerr & Ulrich, 1995a; Scott, 2004). The leader accomplishes bridging during the strategic management process through bargaining, contracting, co-optation, joint ventures, strategic alliances, and mergers. This initiative provides mapping of environmental complexity into the organization's structure (Busco et al., 2006; Kerr & Ulrich, 1995a).

## **Barrier Elimination**

Barrier elimination entails an open systems concept which eliminates the boundaries between external environmental stakeholders including both suppliers and customers into a single feedback process that maps the best ideas and practices into the organization's structure (Kerr & Ulrich, 1995a; Scott, 2003). As a result, there is an increased information and knowledge flow to the organization's technical core and task environment, which increases organizational learning.

## **Network Development**

Network development is another open-systems strategic management process that is used to attain competitive advantage is creating synergy within interdependent internal networks that use an integrated performance management system (Busco et al., 2006). A company-wide performance management system allows the integration of operational capacities among the parent company, subsidiaries, suppliers, customers, and strategically aligned partners. Thus, this integration creates an opportunity for information attainment, information sharing, knowledge sharing, knowledge enhancement, and potential innovation. This strategic initiative also supports company's alignment with suppliers and strategic partners to establish a low-cost advantage on the front side of the value chain (Busco et al., 2006; Gephart, 1999; Kerr & Ulrich, 1995a; Williamson, 1981).

## **Stakeholder Coalition Development**

This strategic management initiative creates a dominant coalition which is representative of all the firm's stakeholders and enhances knowledge creation and organizational learning during the strategic management process. This process strengthens the firm's feedback and input loops in the strategic planning process and provides knowledge from all stakeholders including owners, managers, employees, suppliers, partners, and strategic alliances. The purpose of this strategic management initiative is attaining feedback to provide a source of proactive measures to align the organization's managerial structure with its peripheral environment.

## **Contingency Planning**

Another key strategic processual element is contingency planning. Contingency planning deals with variations in customer demands and potential entrance of rivals into the marketplace (J. B. Quinn, 1985; Schreyogg & Steinmann, 1987). Flexibility and adaptability are the key to successful strategic management and much of the company's strategy concerning flexibility and adaptability is based on the number and size of rivals in the industry and how soon these rivals enter the market (Porter, 1979, 1980). Certainly, innovative entrepreneurial companies can count on rivals to follow their lead with a similar product or service with one or more of many differentiating strategies. Next, prospect theory is addressed.

## **PROSPECT THEORY AND PROBABILITY**

Kahneman and Tversky (1979), refer to the term prospect as lotteries or gambles which are in essence sets of outcomes with a probability distribution over them. In their research, the authors discuss three specific effects that tremendously affect decisions and their outcomes. First, the certainty effect causes decision makers to overweight outcomes that are more probable or certain in relation to outcomes that are less probable or less certain (Kahneman, 2003; Kahneman & Tversky, 1979). Second, Kahneman and Tversky (1979), identified a reflection effect which states that when the probability of a prospect is not certain people will choose the alternative with the greatest gain. This is illustrated in the second stage of the Allais Paradox when decision makers face a decision with alternatives that offer both a possible gain and a possible loss. In this paradox their preference over negative prospects are often a mirror image of their preferences over positive prospects. In simplest terms, decision makers are more risk averse in decisions involving gains and more risk aggressive in prospects involving losses.

When combined, the certainty and reflection effects infer that when all prospects fall within a positive realm of potential outcomes the decision maker demonstrates a risk-averse preference for the sure gain over larger gain that is more uncertain (Kahneman, 2003; Kahneman & Tversky, 1979). Conversely, when all prospects fall within a negative realm of potential outcomes the decision maker will demonstrate a risk-aggressive preference for larger losses which are only probable over prospects with smaller losses that are certain (Kahneman, 2003; Kahneman & Tversky, 1979). Lastly, the isolation effect premises that a decision maker tends to make a decision easier by simplifying alternatives by eliminating and disregarding components that are shared between the two alternatives and focusing exclusively on the components that differentiate the alternatives (Kahneman, 2003; Kahneman & Tversky, 1979). The isolation leads to inconsistencies in making a decision because alternative choices in the decision can be analyzed with several different methodologies that use varying approaches.

These three decision making effects including certainty, reflection, and isolation create a tremendous paradox in decision making that is not explained by expected utility theory. Kahneman's and Tversky's (1979), paradox theory model is:

$U = w(p_1)v(x_1) + w(p_1)v(x_1) + w(p_2)v(x_2) + w(p_3)v(x_3) + w(p_4)v(x_4) + \dots$ , where  $x_1, x_2\dots$ , are potential outcomes and  $p_1, p_2\dots$ , are their respective probabilities. The value function is represented by  $v$ , the probability weighting function is represented by  $w$ , and utility is represented by  $U$ .

It is important to note that the concept of utility as used in the prospect theory model refers primarily to income gain and not a gain in assets or wealth. This concept correlates well with the concept of EVA which was discussed in a previous section and. EVA is used in the quantum model as a measure of entropy. Next, the quantum model is addressed.

## THE QUANTUM MODEL

Thus far the paper has defined and explained the construct of strategic processual elements. Additionally, two groups have been defined and explained for classifying the strategic processual elements. The two classification groups are the exploitation strategy set and the exploration strategy set. These two strategy sets contain several groups for classifying the individual strategic processual elements based on their specific focus. The important relationship between individual strategic processual elements, the exploitation and exploration strategy sets, and the organization's structure is illustrated in Exhibit I above. Additionally, Exhibit II illustrates the significant relationship between the exploitative and explorative strategy sets and their classification groups based upon strategic focus. These classification groups contain the individual strategic processual elements.

### **Exhibit II: Exploitation and Exploration Strategy Sets and Their Classification Groups**

- $\sum \epsilon EI_{1-10}$  - Exploitation Strategy Set
  - +  $El_1$  – Value Chain Enhancement
  - +  $El_2$  – Cultural Enhancement
  - +  **$El_3$  – Empowerment and Enactment**
  - +  **$El_4$  – Technical Core Enhancement**
  - +  **$El_5$  – Buffering Strategies**
  - +  **$El_6$  – Team Coalitions**
  - +  **$El_7$  – Institutional Conceptualization**
  - +  **$El_8$  – Attention Requirement for Performance**
  - +  **$El_9$  – Outcome Driven Perspective**
  - +  $El_{10}$  – Contingency Planning
- $\sum \epsilon ER_{1-6}$  - Exploration Strategy Set
  - +  **$ER_1$  – Differentiation Tactics**
  - +  **$ER_2$  – Size and Structure Management**
  - +  **$ER_3$  – Boundary Spanning**
  - +  $ER_4$  – Barrier Elimination
  - +  **$ER_5$  – Network Development**
  - +  **$ER_6$  – Stakeholder Coalition Development**

The thermodynamic model which was discussed earlier is used to establish the basic quantum model. The formula in the thermodynamic model discussed earlier is  $\Delta u = w + q$ . One component of the thermodynamic model,  $\Delta u$ , was previously defined as Economic Value Added, or EVA. Next, the exploitative strategy set and the explorative strategy set are integrated into the quantum model. The exploitative strategy set is representative of work while the explorative strategy set is representative of and heat within the super-system as follows:

$$w = \text{Exploitation strategic processual elements } (\sum \epsilon EI_{1-10})$$

$$q = \text{Exploration strategic processual elements } (\sum \epsilon ER_{1-6})$$

The construct and format of the thermodynamic theory model is used to initially formulate the quantum model which is represented by the formula  $EVA = \sum \epsilon EI_{1-10} + \sum \epsilon ER_{1-6}$ .

Furthermore, it is postulated that the optimal level for the exploitative strategic set is 80%; whereas, the optimal level for the explorative strategic set is 20% (Lowder, 2009). Thus, 80% of the strategic processual elements chosen by the entrepreneurial

strategist's are exploitative in nature, while 20% of the strategic processual elements chosen are explorative in nature (Lowder, 2009). To accommodate this weighting factor the revised quantum formula becomes  $EVA = \sum \epsilon_{ei_{1-10}}(.8) + \sum \epsilon_{er_{1-6}}(.2)$ .

At this point the model has not incorporated the important construct of probability distribution among the classification groups which fall within the exploitative strategy set and the explorative strategy set. To address this issue the prospect theory model's probability constructs are integrated into the quantum model. As previously mentioned, the formula for the prospect model is  $U = w(p_1)v(x_1) + w(p_1)v(x_1) + w(p_2)v(x_2) + w(p_3)v(x_3) + w(p_4)v(x_4) + \dots$ . This methodology is applied to the classification groupings contained in both the exploitative strategy set and explorative strategy set. After applying the probability distribution construct contained in the prospect theory model the final quantum model is:

$$EVA = \sum \epsilon [w_i(p_{i1})v_{i1}(e_{i1}) + w_i(p_{i2})v_{i2}(e_{i2}) + \dots w_i(p_{i10})v_{i10}(e_{i10})] + \sum \epsilon [w_r(p_{r1})v_{r1}(e_{r1}) + w_r(p_{r2})v_{r2}(e_{r2}) + \dots w_r(p_{r6})v_{r6}(e_{r6})], \text{ where } e_{i1}, e_{i2}, \dots, \text{ represent the groups of classified exploitative strategic processual elements, } e_{r1}, e_{r2}, \dots, \text{ represent the groups of classified explorative strategic processual elements; } p_{i1}, p_{i2}, \dots, \text{ represent the exploitative classification groups respective probabilities of occurring and } p_{r1}, p_{r2}, \dots, \text{ represent the explorative classification groups respective probabilities of occurring. } v_{i1}, v_{i2}, \dots, \text{ represent the income value function for each exploitative classification group and } v_{r1}, v_{r2}, \dots, \text{ represent the income value function for each explorative classification group. The weighting function for the two strategic processual element classification groups is represented by } w_{i1-10} \text{ and } w_{r1-6}.$$

As previously mentioned, 80% is used as a weighting function for the set of exploitation strategic processual element groups ( $w_{i1-10}$ ), while 20% is used as the weighting function for the set of exploration strategic processual element groups ( $w_{r1-6}$ ). A very important point is that the 80% weighting function is equally distributed among the individual classification groups represented in the exploitative strategy set ( $w_{i1-10}$ ) and the 20% weighting function is equally distributed among the individual classification groups represented in the explorative strategy set ( $w_{r1-6}$ ). Additionally, please note that all the individual strategic processual elements have passed the editing and evaluation phase and are grouped into the appropriate type of strategy set (Kahneman, 2003; Kahneman & Tversky, 1979). Consequently, the quantum model for determining the optimal mix of individual strategic processual elements is:

$$EVA = \sum \epsilon [w_i(p_{i1})v_{i1}(e_{i1}) + w_i(p_{i2})v_{i2}(e_{i2}) + \dots w_i(p_{i10})v_{i10}(e_{i10})] + \sum \epsilon [w_r(p_{r1})v_{r1}(e_{r1}) + w_r(p_{r2})v_{r2}(e_{r2}) + \dots w_r(p_{r6})v_{r6}(e_{r6})]$$

In the quantum model of entrepreneurial strategic leadership, the impacts of entropy can be measured by the linear relationship between the firm's EVA and the specific occurrences of both strategic processual elements as they are classified within the exploitation strategy set ( $e_{i1-10}$ ) and the exploration strategy set ( $e_{r1-6}$ ). When  $EVA > 0$ , minimal entropy exists and the firm is adding real value. Conversely, when the  $EVA < 0$  entropy is increasing as the firm decreases in real value.

The entrepreneurial strategist's primary objective is to choose strategic processual elements that when classified within the exploitative strategic set and explorative strategic set result in a state of negative entropy. Negative entropy is also known as negentropy, or syntropy. In the quantum model negentropy or syntropy can be attained by focusing on strategic processual elements that maximize EVA. The quantum model provides a tool for the study of strategic processual elements, their relationship to the exploitation strategy set and the exploration strategy set, and their impact on the firm's EVA. In summary, the quantum model has the potential to assist the entrepreneurial strategist in determining which strategic processual elements are most correlated to higher levels of EVA and can provide a tool to help mitigate the impacts of entropy on the organizational structure.

## LIMITATIONS OF PAPER

First, the author acknowledges that additional strategic processual element classifications can be identified and included in the quantum model. However, to expedite model development several pre-identified strategic processual element classification groups were used. Second, the optimal balance ratio between the exploitation strategy set and the explorative strategy set used in the model, 80% and 20% respectively, may vary by organization and/or industry. The optimal ratio that was used was derived from a previous study. Lastly, additional researchers may choose a different tool to measure entropy other than EVA which should not diminish the validity of the model.

## RECOMMENDATIONS FOR ADDITIONAL RESEARCH

First, additional research includes identifying additional classification groups contained within the exploitative strategy set and the explorative strategy set. Second, additional research can be completed to determine if there are better tools than EVA to use as a measure for entropy within the firm. Lastly, and most importantly, research can be performed to test the quantum model's validity.

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# COST EFFICIENCY AND ECONOMIES OF SCALE IN THE SUPPLY CHAIN OF WATER FOR INDUSTRY IN THAILAND

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## ABSTRACT

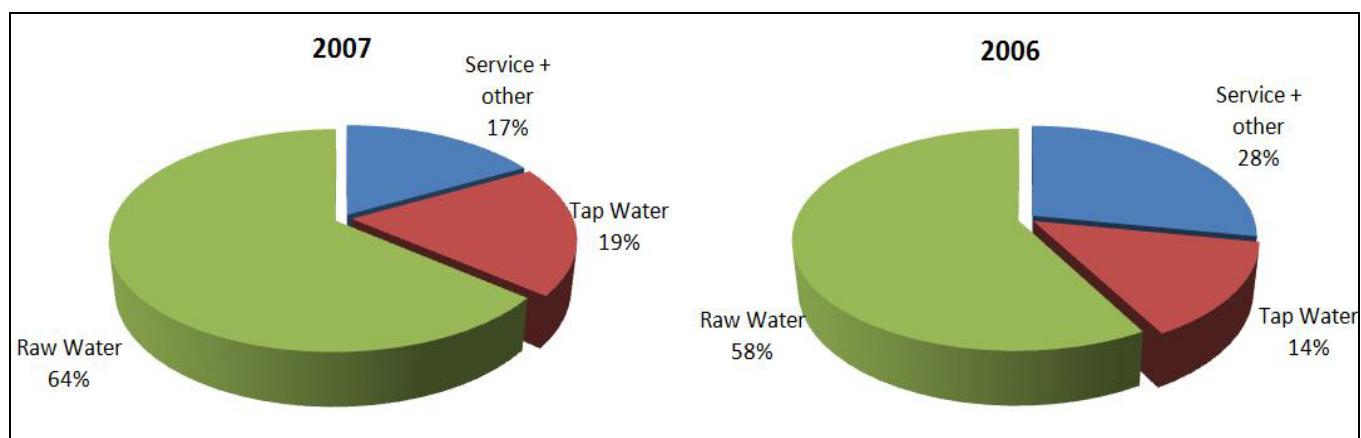
*The availability of water resources in Thailand is important for agricultural and industrials. The economies efficiency in the supply chain of water for industry is based on the economic theory of demand and supply. The demand of water for industry illustrates the impact of infrastructures investment and water cost. In the economic perspective, cost efficiency and economies of scale in the water for industry can be estimated from the total cost of the resources supply and from the demand function. The main objective in this study is to analyze the applicability of econometric analysis to the supply chain evaluation of water for industry. The preliminary result is to estimate a variable cost function using a model approach to assessing the water for industry in Thailand to improve its operating cost efficiency. On the going research, to develop a stochastic cost frontier model to measure the efficiency estimation is a stochastic frontier production function models.*

**Keywords:** Water for Industry, Thailand, A Stochastic Cost Frontier Model

## 1. INTRODUCTION AND BACKGROUND

Thailand possesses abundant water resources but demand has begun to outstrip supply. Water demand and deficits are expected to increase. Water use and water resource are considered to achieve on supply chain of necessary resource. Eastern Water Resources Development and Management Public Company Limited was founded by the Provincial Waterworks Authority (PWA) on October 15, 1992 to be responsible for the development and management of main water pipeline systems in the Eastern Seaboard by supplying raw water to industrial estates, factories and waterworks authorities through the company's main raw water pipelines in Chonburi, Rayong, and Chachoengsao.

In 2007, the company and its subsidiaries recorded a total net profit of 440.68 million baht, representing a 13% decrease from 2006. Total revenue was 2,430.13 million Baht, increasing by 29.20 million Baht, or approximately 1.2%, from 2006. Revenue from each business is shown below.



**Figure 1:** The Revenue Structure in 2007 and 2006

From Figure 1, the revenue from raw water business totaled 1,538 million baht, rising by 182 million Baht or 13% and corresponding to an increase of 5% in the quantity of raw water sold.

## 2. RESEARCH OBJECTIVES

The main objectives of this study are as following:

1. To Evaluate The Supply Chain of Water for Industry System.
  - The Water Supply Evaluation
  - The Water Demand Evaluation
2. To Analyze Cost efficiency and Economies of Scale
3. To develop Stochastic Frontier Production Models

## 3. METHODOLOGY

In this study we use datasets from the supply chain of water for industry surveys to examine the production costs of water supply systems. Preliminary data are collected from the cost in the supply chain of water for using Regression Analysis is one of the statistical analyses among parameters into the logistics cost model.

### 3.1. The Water Supply Evaluation

The total of budget were used for providing clean water to each service areas, developing an integrated framework and a responsible institution for water resource management, improving water basin in each region, building a network for water allocation from each reservoirs, and providing a warning system as well as instructing precautionary and remedy measures in times of any natural disasters. The five main reservoirs (Nong Pla Lai, Dokkrai, Khlong Yai, Prasae, and Nong Kho) in the eastern region had a combined water volume of 450 million cubic meters (as of September 2007), or at 82.61% of their combined capacity as shown in Table 1.

**Table 1:** Total of water distribution capacity and water consumption during 2000-2007

Water Supply Evaluation	2000	2001	2002	2003	2004	2005	2006	2007
Total water consumption	103.97	116.10	140.03	156.52	177.65	190.10	199.36	211.20
Capacity of water distribution	263.00	263.00	328.00	328.00	343.00	423.00	423.00	473.00
Ratios of water distribution capacity and water Consumption	2.53	2.27	2.34	2.10	1.93	2.23	2.12	2.24

(Unit : Million cubic meter / year)

### 3.2. The Water Demand Evaluation

Demand is estimated to be growing about 9 percent a year, but the investment program of the water supply has increased supplies about 6 percent a year. The demand of water in the raw water for industry service areas was approximately 210 million cubic meters. Chonburi and Rayong provinces were the areas where the demand was high, at approximately 201 million cubic meters. The demand for water in these two provinces is expected to increase to 413 million cubic meters by the year 2016. In other words, the demand is anticipated to double in the next ten year as shown in Table 2 and Figure 4.

**Table 2:** Total of forecasted water for industry demand in service areas during 2008-2017

Forecasted Water Demand	2008	2009	2010	2011	2012	2016	2017
Eastern Seaboard Areas	221.50	238.40	265.30	290.30	308.00	389.85	414.80
All service Areas	230.00	247.60	274.80	300.00	319.40	413.82	440.30

(Unit : Million cubic meter / year)

2008 – 2012 : Water Demand Growth approx. 8.6% per year

2013 – 2017 : Water Demand Growth approx. 6.4% per year

\*Source : Water Demand & Forecast for 5 years (latest revise in Q4/2008)

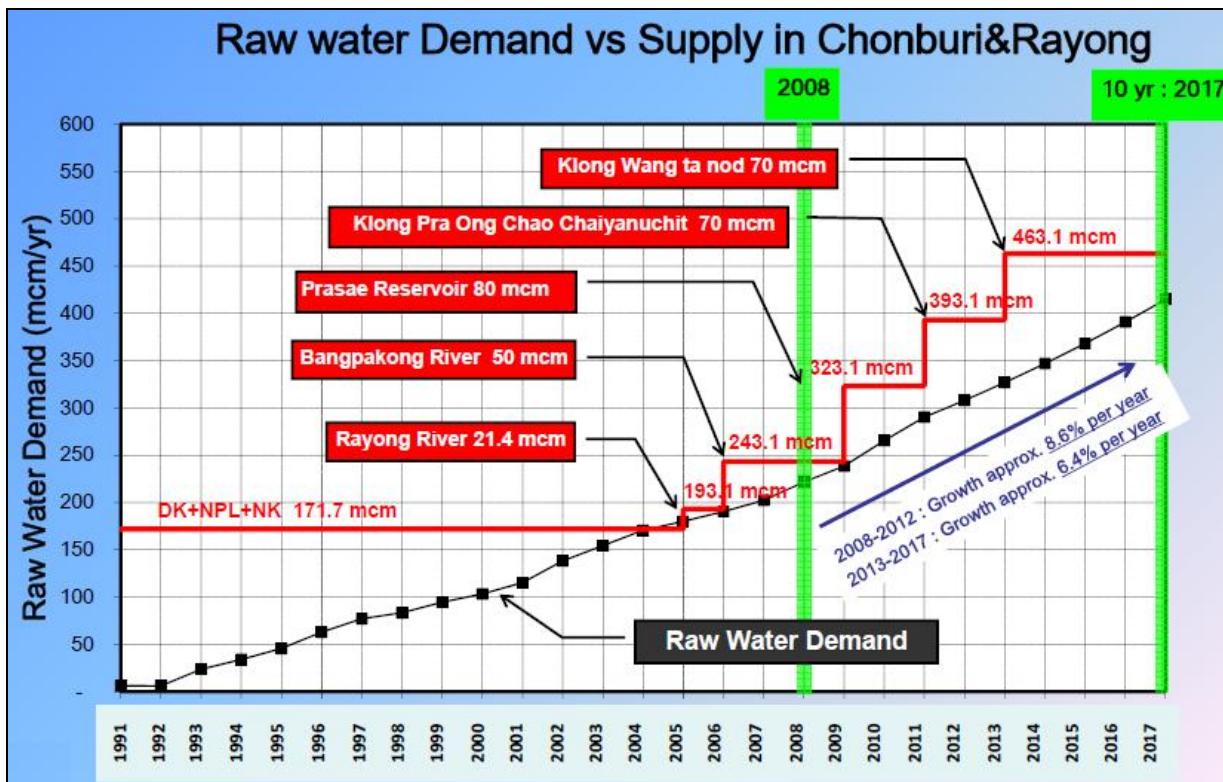


Figure 4: The Demand and Supply of Water

(DK : Dokkrai , NPL : Nong Pla Lai and NK : Nong Kho - Reservoirs)

However, the demand and supply of water as shown in Figure 4 is growing demand of water use for domestic consumption, agricultural and industrial development.

### 3.3. The Supply Chain of Water for Industry System

A supply chain is defined as a set of interaction among suppliers, manufacturers, distributors, and retailers that facilitates the transformation of raw materials into final products. The supply chain of water for industry may include raw water from natural resources, conveyance system as open channel and pipeline network, pumping station as manufacturer plant, raw water production processors, and storage in reservoir as warehouse and transport facilitators, distributors, and retailers. Raw water from natural resources is the upstream supply chain of water as shown in Figure 5.

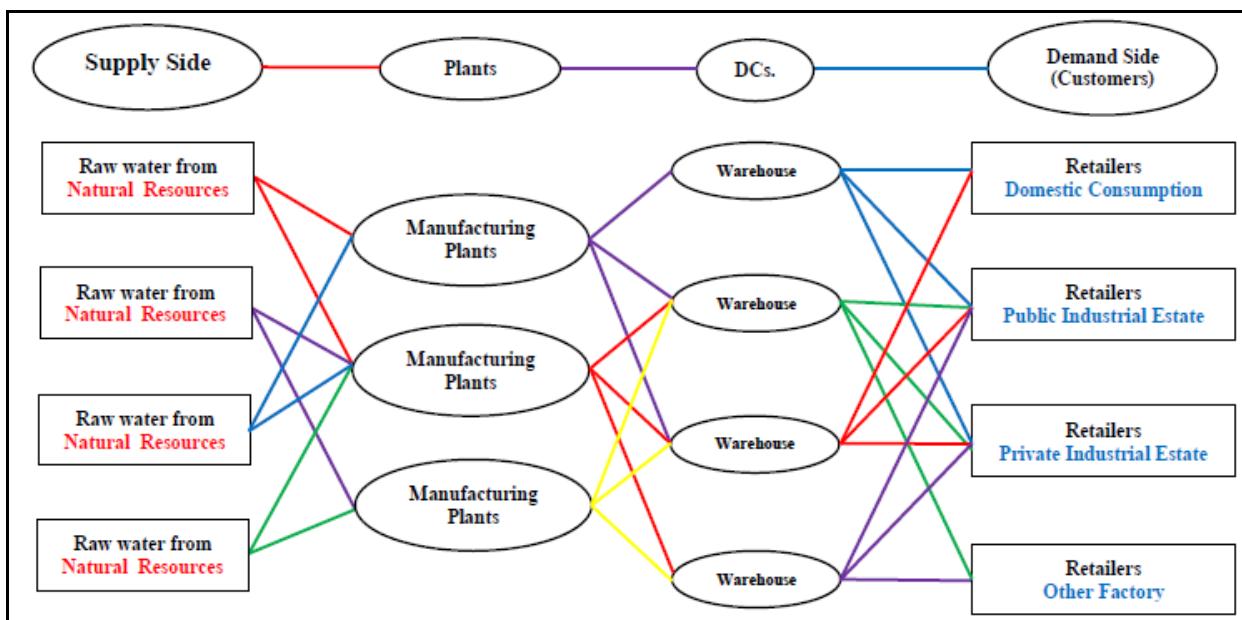


Figure 5: The Supply Chain of Water for Industry

At present, the Thai government encourages the private sector to provide water to industry as well as to the municipalities. A private company had been engaged to supply water to the industrial sector in the eastern part of Thailand. All industries use water in either their main or secondary activities, including those uses characteristic of the domestic sector, such as in office buildings. Industrial estates take either ground water or surface water and treat it to supply factories in their estates. The supply chain of water for industry allocates water sources and manages raw water pipelines networks for adequate consumption and industrial use. This paper is important to emphasize the pipelines network linking as the water grid line in Eastern Seaboard of Thailand. Water resources development for Eastern Seaboard is invested by Royal Thai Government.

### 3.4. Cost Analysis

#### 3.4.1. Description

##### *Logistics cost*

In this study, logistics cost consists of four costs that are administrative cost, transportation cost, inventory cost and warehouse cost. There are several parameters related to each cost as following:

##### *Logistics cost model*

In this study, using SPSS is a tool for logistics cost model. Regression Analysis is one of the statistical analyses among parameters. Stepwise analysis is one of the statistical methods for parameter selection into the logistics cost model.

#### 3.4.2. Estimation Results

The results from regression analysis from each cost as following:

1. Administrative cost consists of labor cost, electricity, number of labor and office supplier. The results from regression analysis of administrative cost as shown in Eq. 1

$$AC = f(\text{labor, electricity, number of labor, office supplier}) \quad (1)$$

From equation 1, the correlation among parameters with coefficient of correlation ( $R = 0.99$ ).

2. Transportation cost consists of labor cost, fuel cost, and number of labor, interest rate and exchange rate. The results from regression analysis of administrative cost as shown in Eq. 2.

$$TC = f(\text{fuel cost}) \quad (2)$$

From equation 2, the correlation among parameters with coefficient of correlation ( $R = 0.99$ ).

3. Inventory cost consists of average inventory cost and interest rate.

From the model, the parameters that related to inventory cost as shown in Eq. 3.

$$IC = f(\text{inventory cost, interest rate}) \quad (3)$$

From equation 3, the correlation among parameters with coefficient of correlation ( $R = 1.0$ ).

4. Warehouse cost consists of depreciation cost of buildings and equipment and labor cost

From the model, the parameters that related to warehouse cost as shown in Eq. 4.

$$WC = f(\text{depreciation cost of buildings and equipment, labor cost}) \quad (4)$$

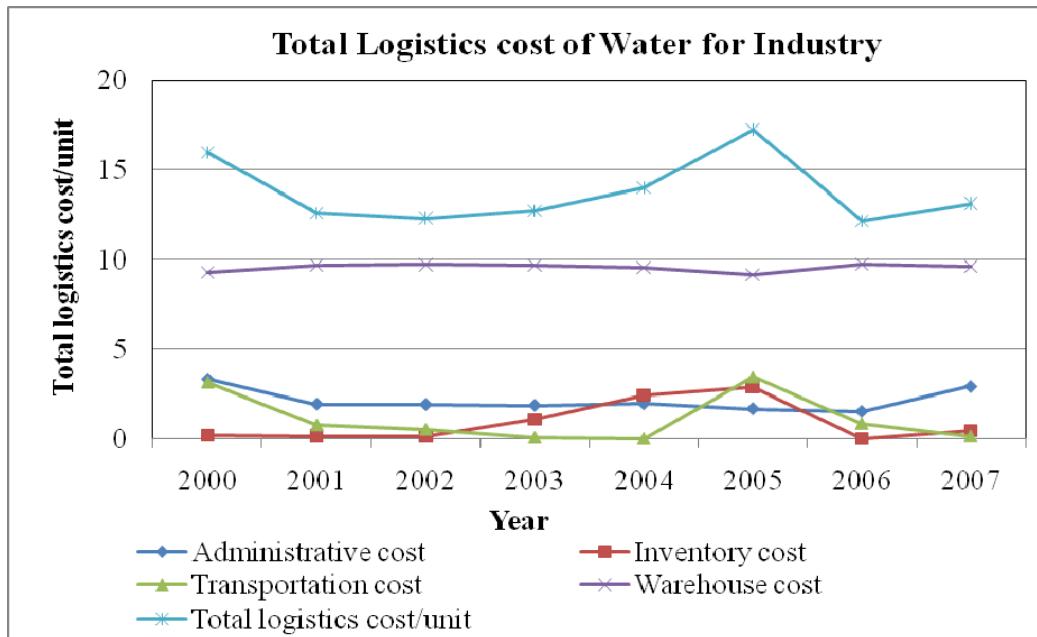
From equation 4, the correlation among parameters with coefficient of correlation ( $R = 1.0$ ).

5. Total logistics cost

From Eq. 1 to Eq. 4, the total logistics cost is the summary of each cost as shown in Eq. 5.

$$TLC = AC + TC + IC + WC \quad (5)$$

To conclude, the results are the total logistics cost depend on administrative cost. This is because of the advertising and public relations expenses as shown in Figure 7.



**Figure 7: Total Logistics Cost of Water for Industry**

## 4. CONCLUSIONS AND RECOMMENDATION

Key risk factors that may affect cost efficiency and economies of scale in the supply chain of water for industry in Thailand include:

- 4.1. Investment in businesses that fail to achieve their goals. Over the years, the company has expanded its operations from raw water to also include tap water, drinking water, and pipe and equipment businesses.
- 4.2. Conflicts with communities concerning the use of water resources. Most of the construction projects are major pipeline projects such as that from Prasae to Khlong Yai, one of the company's main raw water resources.
- 4.3. Inadequacy of water resources to meet water consumption demand. At the beginning of 2007 the water volume in the main reservoirs was 40 million cubic meter higher than in 2006. The projection in 2007 indicated that there would be sufficient water for consumption throughout 2007.
- 4.4. Increased cost due to rising energy costs. Pumping water from newly developed water resources and the rising cost of energy due to a higher Ft rate resulted in higher costs than anticipated.
- 4.5. Policies of the government and related agencies. Uncertainty in the policies of government agencies could affect the company's operations. Furthermore, the company's business is in line with a cabinet resolution to promote industrial investment and tourism in the Eastern Seaboard.
- 4.6. Damage to pipeline systems. The company's pipeline system may face the problem of corrosion or construction of other infrastructure in the areas where the pipelines are laid that may lead to breaking or leaking.

It can be concluded that the increase was due to the administrative cost that went up by 284 million Baht or 108% from the provision for diminution in value of inventories from the drinking water business and pipe business as well the advertising and public relations expenses. The cost of service business decreased, corresponding with the decrease in revenue from the area where the project to reduce water losses was implemented. Interest payable is increased by 99 million Baht or 106% due to the completion of Bangpakong-Chonburi project. On the going research, to improve develop logistic network that results in cost savings, convenient zonal distributions, and responsive supply chain management operations.

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# THE AFFECT OF CAPABILITIES-STRATEGY MATCHES ON FINANCIAL PERFORMANCE OF GOVERNMENT BUSINESS ENTERPRISES

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## ABSTRACT

*The modern operational arrangement of government business enterprises (GBEs) provides a research question for the current study as follow: can GBE management effectively set and match its capabilities and strategies in ways that lead to achieve financial performance target in its current operational arrangement? Using modified concepts and models employed in private sector studies, the current study conducts an empirical investigation on GBEs' capabilities development and strategy setting and their impacts on GBEs' financial performance. The findings are to some extent consistent with prior studies and suggesting a good match between capabilities and strategy setting leads to achieve good financial performance.*

**Keywords:** Government Business Enterprises, Strategy, Capabilities and Financial Performance

## 1. INTRODUCTION

Government business enterprises (GBEs) are the commercial arms of government departments, statutory authorities and other agencies. In Australia, GBEs are established at all government levels, namely territory, state and commonwealth levels (Wettenhall 1998, 2001; Bottomley 2001). These entities were reformed significantly through the 1980s and 1990s, which resulted in a corporatised form of operation. Corporatisation provided GBEs a considerable amount of managerial autonomy enabling their boards of directors to set internal governance mechanisms and commercial strategies. Nevertheless, GBEs remained wholly government owned and subject to accountability control from the government (Bottomley 2001; Barret 2000; Halligan and Horrigan 2005; Wettenhall 1998; Luke 2008; Thynne 1998a, 1998b). GBEs are controlled under statutes and government policy directives that place high expectations on their corporate governance quality and high demands on their accountability performance. At the same time, GBEs are given managerial independence to develop their own organisational capabilities and strategies that can enable them to meet commercial performance targets and be competitive. This modern operational arrangement received considerable attention and been subject to much debate in the public and political arenas (Halligan and Horrigan 2005; Thynne 1998a; Barret 2000). One of the main concerns in the debate is whether GBEs can effectively develop and set their organisational capabilities and strategy that lead to the achievement of its financial performance when they need to fulfil accountability requirements as well. This dilemma gives raise to a research question for the current study as: *can GBE management effectively set and match its capabilities and strategies in ways that lead to achieve financial performance target in its current operational arrangement?*

The current study has the following objectives. (1) To conduct an empirical study on organisational strategy and capabilities of GBEs and bring them to knowledge. (2) To extend the literature on the inter-relationships between strategic-type and organisational capabilities into a new organisational context of government-owned and controlled business. Prior modelling and testing of companies' strategies-capabilities-matches has not been extended beyond the private sector (Smith et al. 1986; Conant et al. 1990; Snow and Hrebiniak 1980). In addition, the current study develops new modelling and testing methods to carry out the investment. These aspects also contribute to the significant of the study. (3) To provide evidence on the effect of alternative mixes of capabilities-strategies alignments of GBEs on its financial performance. (4) To draw conclusions about the extent to which alternative capabilities-strategies alignments support the achievement of financial performance, in order to provide insights of relevance for management practice and government policy-makers.

Understanding factors affecting GBEs financial performance is useful for all parties in the economy and society. This is because GBEs contribute to the development of the economy and wellbeing of the society (Hill et al. 1989). The recent world economic crisis has brought out the significant of GBEs into the spotlight once again and directed for its maintenance-mobilisation purpose- promoting self-reliance (country perspective) in strategic sectors of the economy and provide

<sup>1</sup> The author would like to thank Professor Dennis Taylor, Professor of Accounting at RMIT University for his comments on the study framework and models.

infrastructural facilities for promoting a balanced and diversified economic structure in development. It also aims to increase employment, bridge the gap in investment between the public and private sectors in the economy (Hill et al. 1989). Over the last few years governments worldwide have established new GBEs, nationalised private companies and injected more capital into existing GBEs in order to boost economic activities (NSWTreasury, 2009; Bureau News, 2009; Mora, 2009; Tre, 2009; [Pender](#), 2008). The US government has nationalised many private financial institutions and companies in attempt to stabilise its economy and boost economic activities (Mora, 2009; [Pender](#), 2008). The Australian governments both state-territory and commonwealth levels are considering injecting more capital into their existing GBEs (NSWTreasury, 2009). GBEs thus need to be successful in their operation in order to boost economic activities. This makes it noteworthy to understand GBEs strategy, capabilities and their relationship and impacts on financial performance.

The findings are to some extent consistent with prior studies and suggesting a good match between capabilities and strategy setting leads to achieve good financial performance. In addition, it brings out a unique finding in GBEs context that strategies that aim to expand market share beyond GBEs geographical areas are not suitable for GBEs as they do not support them in achieving financial performance. The strategy of defending market niche is a better approach.

The paper is organised as follows. The next section provides literature review on organisational capabilities, strategy and their impacts on performance. Hypotheses developments are also provided in this section. The third section provides the methodology employed to carry out the study. The fourth section provides the result of the analysis and discussions. The last section provides implications and conclusion remarks.

## 2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Miles and Snow's (1978) much cited 'strategic typology' provides a grand theory of typologies that can, supposedly, be generalised to all organisations, according to Doty and Glick (1994). Miles and Snow portray the type of strategy developed by a firm in terms of solutions by management to the overall interaction among entrepreneurial problem(s), engineering problem(s) and administrative problem(s). When the management chooses to enter into an entrepreneurial position it creates an entrepreneurial problem(s) to be solved. The engineering problem(s) and administrative problem(s) are to be recognised when selecting an entrepreneurial position (Kald et al. 2000). This is the adaptive nature of Miles and Snow's strategic typology, where the engineering and administrative problems and solutions are adaptive to the selected entrepreneurial position. From such reasoning, Miles and Snow identify four strategic positions for firms that exist within an industry, which they term the prospector, analyser, defender and reactor. The main difference among these strategic types is the rate of change in the entrepreneurial position or organisation domain (Zahra and Pearce 1990; Miles et al. 1978).

Miles and Snow (1978) suggested that the three 'archetypal' strategic types (prospects, analysers and defenders) should all perform well, and should out-perform reactors due to the latter's lack of a stable strategy. But this original model did not explore under what circumstances the archetypal strategic types would be the highest in performance, nor was the definition of performance made clear. Subsequent empirical tests of the Miles and Snow framework by Conant et al. (1990), Desarto et al. (2005), Snow and Hrebiniak (1980) and Song et al. (2007) have measured its performance consequences. These studies measured the performance of strategic-types on the basis of profit, return on assets, market share, sales growth and customer retention. These studies confirm that the three archetypal strategic types perform equally well on average.

Doty and Glick (1994) also approach Miles and Snow's typology from a middle range theory perspective. In this perspective, each of the three archetypal strategic types contains sets of engineering and administrative solutions. This middle range viewpoint suggests that each strategic type should align with a set of distinct organisational capabilities. Taking the more general perspective of the resource-based view (RBV), Song et al. (2007) argue that capabilities do not improve productivity of the organisation on their own. Capabilities need to be aligned with the right strategic position to enable exploitation of benefits and, in turn, generate superior value for the organisation. Hence, some capabilities are preferred to others depending on the strategy chosen by the organisation (Song et al., 2007).

Organisational capabilities (hereafter known as capabilities) are defined in marketing and strategic management literatures as "complex bundles of skills and accumulated knowledge, exercised through organisational processes, that enable firms to coordinate activities and make use of their assets" (Day, 1994, p. 38). The concept of capabilities is used interchangeably with the concepts of distinctive competencies (Snow and Hrebiniak, 1980), competitive devices (Davies, 1986) and sources of advantage (Day and Wensley, 1988).

Capabilities can be divided into several categories. Smith et al. (1986) provide a categorization for organisational general capabilities, including general management, marketing, R&D engineering and production, and accounting and finance. Snow

and Hrebiniak's (1980) distinctive competences are similar to Smith et al. (1986) with the addition of distribution, legal affairs and personnel. These capabilities are of a general category and apply to all types of organisations. Hitt and Ireland (1985) identifies 55 different distinctive competence activities within functional areas. O'Regan and Ghobadian (2004) through interviews with six managing directors and two employer representatives provide a list of generic capabilities of small manufacturing firms. Their capabilities range from advertising and promotion to offering consistent quality.

In an important addition to the above capabilities, Day (1994) provides two sets of strategically-related capabilities, namely inside-out capabilities (I-O) and outside-in capabilities (O-I). The I-O (also referred to by Song et al. (2007) and Desarto et al. (2005) as 'technology capabilities') are found to be important capabilities for organisations that compete on the basis of low cost. Alternatively, the O-I (also referred to as 'market-linking capabilities' by Song et al. (2007) and Desarto et al. (2005)) are found to be used by market-oriented or product-differentiation types of organisations. The capabilities listed under the I-O category are consistent with Smith et al. (1986) and Snow and Hrebiniak (1980). By comparison, the O-I capabilities are market-sensing in nature (understand the target market(s) and competitors' capabilities). They consist of customer-linking capability (creating and managing durable customer relationship) and channel-bonding capability (creating durable relationships with channel members such as suppliers and customers). These types of O-I capabilities are also known as distinctive marketing competencies (Conant, Mokwa, and Varandaranjan, 1990) and marketing capabilities (Vorhies, Harker, and Roa, 1999; Vorhies and Harker, 2000).

Returning to the issue of relationships between strategic types and organisational capabilities, empirical studies have sought evidence on the ways certain organisational capabilities and management's selected entrepreneurial position align with Miles and Snow's strategic types. In other words, such studies look at what capabilities each strategic type should possess to enable it to achieve its selected products or services' market domain. In addition, some of these studies look at the relative performance among key sets of strategy-capabilities matches.

Snow and Hrebiniak (1980) look at relationships between a set of distinctive competences and each of Miles and Snow strategic types in the context of more highly entrepreneurial industries. Their findings about the relationships between capabilities and strategic-type suggest that prospectors possess market research, product research and development, and basic engineering. In contrast, defenders have production, engineering and financial management capabilities. This is consistent with the original suggestions of Miles and Snow. Nevertheless, Snow and Hrebiniak (1980) did not find any distinct pattern of capabilities in the analysers, as they could not be distinguished from the prospectors and defenders. They concluded that analysers have both prospectors' and defenders' characteristics. The reactors did not show any distinctive pattern of capabilities. In effect, their findings suggest that a prospector needs to have market research, product research and development and basic engineering capabilities to achieve superior performance. In contrast, a defender must have production, engineering and financial management capabilities to succeed.

In a more recent and comprehensive study, Di Benedutto and Song (2003) employ four sets of capabilities (i.e., Day's (1994) inside-out capabilities, outside-in capabilities, information technologies capabilities and marketing capabilities. Their findings suggest that prospectors have information technology and inside-out capabilities, and the defenders have marketing and outside-in capabilities. The analysers possess both the prospectors' and defenders' characteristics. These result are consistent with more recent studies by Song et al. (2007) and Desarbo et al. (2005). Song et al. (2007) employ technology, IT, market-linking and marketing capabilities and find that prospectors have greater technology, and IT capabilities than defenders, whereas defenders have greater market-linking and marketing capabilities than prospectors.

Generally, the findings of Song et al. (2007), Desarbo et al. (2005) and Di Benedutto and Song (2003) give support to a resource-based view (RBV) of strategies and capabilities alignments. As suggested by Song et al. (2007), the RBV reasons that defenders, in order to maintain a secure niche in a stable product or service area, must quickly anticipate changes in the market and their customers' needs. Thus developing a greater degree of market-linking and marketing capabilities than others is required. On the other hand, defenders have no need to develop technology and IT capabilities to the extent required by prospectors, since they are not innovative, nor do they continuously develop new products or services as with case with prospectors.

Some of the above studies on strategy-capabilities alignment extend their findings to consider performance consequences. Song et al. (2007) find that a good fit between strategic position and capabilities leads to superior financial performance. They find that firms' alignment between the prospector strategic-type and technology/IT capabilities is positively related to firms' financial performance. On the other side, they find that defender-type firms have a positive relationship with financial performance when they possesses market-linking and marketing capabilities. Two other studies look at similar relationships in different contexts. These studies are conducted in Spanish hospitality firms (Garrigos-Simon, Marques, and Narangajavana,

2005) and Australian exporting manufacturing firms (Shoham, Evangelista, and Albaum, 2002). Both studies provide results that are consistent with the predictions of the RBV and middle range theories of Miles and Snow's strategic typology, and they extend the generalizability of this strategic-capabilities-performance framework to various contexts.

Based on the above literature review, the current study hypothesised the following hypotheses:

**H1:** *The extent of organisational capabilities-strategy match of GBEs is positively related to their financial performance.*

**H2:** *The match between prospector-type GBEs and technology capability is positively related to financial performance.*

**H3:** *The match between defender-type GBEs and market-linking capability is positively related to financial performance.*

**H4:** *The match between analyzer-type GBEs and the combination of both technology and market-linking capabilities is positively related to financial performance.*

### 3. METHODOLOGY

The study employs quantitative research models with some qualitative- textual analysis to answer the research question posed in the prior section and test the developed hypotheses.

#### 3.1. Research Models and Variables Measurement

The study employs multiple regressions method instead of one-way analysis of variance that commonly used in prior studies, to analyse the relationship between capabilities-strategy match and financial performance. The research models are as follow:

$$ERR = \beta_0 + \beta_1 ORGSIZE + \beta_2 LEGALFM + \beta_3 INDUSTRY + \beta_4 JURISDIC + \varepsilon$$

$$ERR = \beta_0 + \beta_1 ORGSIZE + \beta_2 LEGALFM + \beta_3 INDUSTRY + \beta_4 JURISDIC + \beta_5 CSM + \varepsilon$$

$$ERR = \beta_0 + \beta_1 DSM + \beta_2 PSM + \beta_3 ASM + \varepsilon$$

Where:

*ERR:* Economic rate of return;

*CSM:* Capabilities-strategy match;

*DSM* = defender strategic position matched with outside-in capabilities;

*PSM* = prospector strategic position matched with inside-out capabilities;

*ASM* = analyser strategic position matched with average of outside-in and inside-out capabilities.

*LEGALF:* GBE legal form;

*INDUSTRY:* GBE industry type; and

*JURISDIC:* jurisdiction of the controlling government of the GBE i.e. State/Territory/Federal.

*ORGSIZE:* GBE organisational size.

The dependent variable, financial performance, is measured in term of economic rate of return (ERR) and accountability-emphasis (ACCBTY). ERR is measured as follow:

$$ERR = \frac{(EBIT + Da + NIBL + FL + CSO) + (Ae - Ab - NI)}{Ab + (NI/2)}$$

Where

*EBIT* = Earning after abnormals and extraordinaries, but before interest and tax;

*Da* = Accounting depreciation and amortisation;

*NIBL* = An adjustment for the implicit interest cost of non-interest bearing liabilities;

<i>FL</i>	= An adjustment for interest cost of assets under financial leases (only made if not already included in EBIT);
<i>CSO</i>	= Net economic cost of community service obligations (if applicable);
<i>Ae</i>	= End period total value of asset;
<i>Ab</i>	= Beginning period total value of asset; and
<i>NI</i>	= Value of net investment through out the year.

The numerator part comprises of two components with the first component represents cash component and the second represents the capital component. The sum of the two components gives rise to economic income. GBEs are expected to be compensated by the government for the capital that forego in delivering community services obligations (CSOs). In this case the recoupment amount will be added back to the EBIT. The interest on NIBL is calculated by multiplying the value of trade creditors, other creditors and prepaid revenue by a prevailing rate of return. The Australia Commonwealth Government's Steering Committee on National Performance Monitoring of Government Trading Enterprises (here onward known as Steering Committee) suggests prime overdraft rate for the year is suitable (Steering Committee, 1996). The current study will use National Australia Bank (NAB) prime business overdraft rate as of 2007.

The NI component of the equation is calculated as follows:

$$NI = Ae - Ab (AsRRe - AsRRb) + Da$$

Where

*AsRRe* = the end of period value of asset revaluation reserve; and

*AsRRb* = the beginning of period of value of the asset revaluation reserve.

As GBEs are not organisations listed on the stock exchange, performance measurement methods like Tobin's Q and other value-based performance measures (e.g., shareholder value added, and weighted average cost of capital) cannot be measured without substantive judgements. Moreover, ERR is the preferred method by the Steering Committee and employ by majority of state governments to measure performance of their GBEs. ERR is, therefore, a suitable measurement method to measure the financial performance of GBE.

The control variables include GBEs' legal forms and jurisdictions, which measured using categorical data. The industry type is measured using dummy variable and the organisation size is measured in term of average of equity

Turning to independent variable, the capability-strategy match (CSM) is developed in two parts: first the relationship between firm's strategic-type and organisational capabilities is established for the context of study. This is because the context of study is distinct from those of prior studies. Second, the match is established.

The study employs Miles and Snow's (1978) strategic typology. The data will be collected via survey questionnaire, using a modified paragraph approach developed by Snow and Hrebiniak (1980). Miles and Snow's (1978) strategic typology is applicable for GBEs as it was based on a field study of a diverse range of industries and have been empirically tested in various context of studies (as indicated in the literature chapter). Day's (1994), Di Benedetto and Song's (2003) and Song et al.'s (2007) outside-in and inside-out capabilities will be used as firm's capabilities. The data for these capabilities will be collected via 6 point- Likert scale survey questionnaire indicating the firm's strengths and weaknesses on each capability's attribute. In addition, both the strategic types and the sets of capabilities attributes will be further modified to accommodate the findings from the textual analysis of GBEs' annual reports and transcripts of the interviews.

Once data is collected the alignment of capabilities and strategic position can be established. Following, Di Benedetto and Song (2003), Conant et al, (1990) and Song et al. (2007), one-way ANOVA is used. The ANOVA is used to determine the significant distinction between outside-in and inside-out capabilities' mean scores among the four strategic-types. The outcome of this process provides a relative basis for each strategic-type GBE in term of their inside-out and outside-in capabilities' mean scores. For example, the prospector GBEs may have a relatively higher inside-out than outside-in capabilities' mean scores.

The match is determined based on Miles and Snow's (1987) strategic positions and the Resource Base View (RBV) on capabilities and strategies alignments. It is expected that the ANOVA results reveal the prospector strategic focused GBEs, on average, have more of inside-out than outside-in capabilities and the defenders, on average have more of outside-in and than the inside out capabilities. The capability-strategy match (CSM) for these two strategic positions will be the raw inside-out capabilities data for the prospectors and the raw outside-in capabilities data for the defenders. For analyser GBEs, their CSM

are established based on the average of inside-out and outside-in capabilities. The rationale behind this choice is that analyser strategic position comprises of both prospector and defender's characteristics. Thus, the average of the two groups of capabilities is seemed to be reasonable for this strategic position. The reactor strategic position is omitted from the study. This is consistent with majority of prior studies (Conant et al. 1990; Shoham et al. 2002; Desarbo et al. 2005; Song et al. 2007) and it doesn't have clear strategic setting and capabilities pattern.

Following Song et al. (2007), the individual strategic-type match variables are measured as follows. First dummy variables are assigned to each strategic type. For example, prospector strategy GBE is assigned with value of 1 if that GBE classified its strategy as prospector, otherwise 0. Second, the match is determined by multiplying the strategic types with their matched capabilities. Such capabilities are determined based on the same method and underlying theory as the overall CSM variable discussed above. To avoid a multicollinearity problem the I-O and O-I data are mean centered. This method was used in Song et al. (2007) and suggested by Jaccard et al. (1990) and Aiken and West (1991).

The qualitative analysis included in the study analyse textual data from selected GBEs' annual reports, interview with two GBEs' senior managers and response to opened questions of the survey questionnaire. The four Miles and Snow's (1978) strategic positions are presented in four sets of statements, which the respondent will be asked to identify a strategic position that closely assemble their current strategic position. The two open-ended questions include question seeking insights from the respondents on information regarding to emphasis that each GBE has in aligning its strategies with capabilities. The questionnaire is sent to GBEs' managers. An extract of the questionnaire is provided in the appendix.

### 3.2. Sampling and Data

A census of GBE is conducted to determine the total number of GBEs across all government jurisdictions. The result provides a total of 160 GBEs, but 16 GBEs are found to be unsuitable for this study. The excluded GBEs comprise of 11 entities of a non-commercial nature, 3 GBEs no longer owned by their respective governments as of January 2008 and 2 GBEs with incomplete management structures (one does not have a management team and the other has no board of directors). Therefore, the GBE population applicable to this study is 144, and the sample used in the study is 141 GBEs, equivalent to 97% of the applicable population. There were a further three GBEs excluded because of their annual reports were not accessible publicly.

Turning to the collection of primary data, the survey questionnaire was sent out in two stages. The first stage was in August 2008 and 423 survey questionnaires were sent to the 141 GBEs. Following common practices used in survey questionnaire data collection, three survey questionnaires were sent to three senior managers in a GBC. At the end of this first period, 94 responses- a 21% response rate were received. A total number of 3 respondents did not identify their organisations, thus an alignment with annual report data could not be made. This left 91 identifiable responses, representing 71 GBEs- approximately 50% of the sample applicable for data analysis. In order to maximise the coverage of number of GBEs in the responses, the follow up questionnaires were sent to GBEs that did not response in the first stage. A total of 95 questionnaires were sent out to 31 GBEs in September 2008. At the end of the period 22 responses- a 23% response rate were received. These responses represent 17 GBEs. Thus, at the end of the two periods a total of 115 responses, representing 91 GBEs-64% of the sample were available for data analysis.

The study uses two data sets, the financial statement and their notes for the 2006-2007 annual reports provide the necessary data to calculate control variables and the year-lagged ERR. The primary data is used to compute CSM and individual capabilities-strategy match variable. The data will be analysed using SPSS software.

## 4. ANALYSIS RESULTS AND DISCUSSION

### 4.1. Variables Validation and Descriptive Statistics

The capabilities variables, namely the inside-out (I-O) and outside-in (O-I) are validated using principle components factor analysis. Table 4.1 provides the loading factor matrix for both variables. Consistent with Song et al. (2007), Benedetto and Song (2003) and Desarbo et al. (2005), the variables are load onto one factor each. The variables are also tested using Cronbach's Alpha for reliability. The result indicates .833 and .80 for the variables respectively- meaning the scales in the variables are consistent with each other in measuring the variables.

**Table 4.1:** Validity And Reliability Test For I-O and O-I

I-O Capabilities	Factor
Product Services Transformation Process	.814
Monitor Predict Technological Changes	.810
Technology Development and Innovation	.804
Financial Management Capability	.558
Cost Management Capability	.514

Extraction method: Principal Axis Factoring; 1 factor extracted; 7 iterations;  
Eigenvalue = 2.57; % of variance = 51.49%; Cronbach's Alpha reliability test = .833

O-I Capabilities	Extraction
Customer linking capability	.789
Creating Supplier Durable Relationship Capability	.666
Channel Bonding Capability	.663
Ability to Retain Customers	.631
Market Sensing Capability	.618

Extraction method: Principal Axis Factoring; 1 factor extracted; 7 iterations;  
Eigenvalue = 2.28; % of variance = 45.73%; Cronbach's Alpha reliability test = .80

As mention above an analysis of variance (ANOVA) is used to determine the relative strengths of each capabilities type among Miles and Snow's (1978) four strategic types. Table 4.2 and 4.3 provide the ANOVA result and Post Hoc Turkey HSD test for I-O and O-I variables among the four strategic types.

**Table 4.2:** Relative I-O and O-I and Strategic Positions

Capability	Strategic Position	Mean	F Stat. and Sig.
Inside-Out:	Defender	4.87	F = 3.236; Sig. = .025
	Prospector	5.04	
	Analyser	4.64	
	Reactor	3.85	
Outside-In:	Defender	5.24	F = 8.500; Sig. = .000
	Prospector	4.93	
	Analyser	4.84	
	Reactor	3.45	

**Table 4.3: TURKEY HSD POST HOC TEST: Multiple Comparison**

Dependent Variable	(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
INSIDE-OUT	Defender	Prospector	-.17375	.20508	.832	-.7084	.3609
		Analyser	.22238	.18466	.625	-.2590	.7038
		Reactor	1.02000	.39407	.052	-.0073	2.0473
	Prospector	Defender	.17375	.20508	.832	-.3609	.7084
		Analyser	.39613	.15618	.060	-.0110	.8033
		Reactor	1.19375*	.38156	.012	.1990	2.1885
	Analyser	Defender	-.22238	.18466	.625	-.7038	.2590
		Prospector	-.39613	.15618	.060	-.8033	.0110
		Reactor	.79762	.37098	.144	-.1695	1.7648
	Reactor	Defender	-1.02000	.39407	.052	-2.0473	.0073
		Prospector	-1.19375*	.38156	.012	-2.1885	-.1990
		Analyser	-.79762	.37098	.144	-1.7648	.1695
OUTSIDE-IN	Defender	Prospector	.30875	.18044	.323	-.1617	.7792
		Analyser	.39556	.16247	.076	-.0280	.8191
		Reactor	1.79000*	.34672	.000	.8861	2.6939
	Prospector	Defender	-.30875	.18044	.323	-.7792	.1617
		Analyser	.08681	.13742	.922	-.2714	.4450
		Reactor	1.48125*	.33571	.000	.6061	2.3564
	Analyser	Defender	-.39556	.16247	.076	-.8191	.0280
		Prospector	-.08681	.13742	.922	-.4450	.2714
		Reactor	1.39444*	.32640	.000	.5435	2.2454
	Reactor	Defender	-1.79000*	.34672	.000	-2.6939	-.8861
		Prospector	-1.48125*	.33571	.000	-2.3564	-.6061
		Analyser	-1.39444*	.32640	.000	-2.2454	-.5435

\*. The mean difference is significant at the 0.05 level.

The combination of the ANOVA and Post Hoc tests indicates that the prospector-GBEs have stronger I-O capabilities than the analysers and reactors but are not significantly different from the defenders. The prospectors, however, still have a slightly stronger strength than the defenders. This result is supported by the Resource Base View (RBV), as it contends that a prospector organisation needs to have strong I-O capabilities strength in order to sustain its competitive philosophy as first-in-market strategy. This is a strategy that required the prospectors to develop new technologies, products and markets rapidly to address the latent market needs (Walker et al. 2003; Song et al. 2007). On a relative basis, the RBV suggests that a prospector organisation has stronger I-O capabilities than a defender organisation. The observed result is also consistent with prior findings (Song et al. 2007; Di Benedetto and Song 2003).

On the O-I side, the above results indicate that the defender-GBEs, on average, have stronger O-I capabilities than the analysers and reactors, but not significantly different from the prospectors. Nevertheless, the defenders have a slightly stronger O-I capabilities than the prospectors. This result is again supported by the RBV, as it contends that defender organisations

need to have thorough understanding of their niche market, which includes customer needs and market changes, in order for them to sustain a competitive basis of maintaining their dominant position in the market (Song et al. 2007; Walker et al. 2003). Therefore, the defenders shall have stronger O-I than the prospectors. Similar to the I-O capabilities, the O-I result is consistent with Song et al. (2007) and Di Benedetto and Song (2003).

The analyser-GBE, given its strategic position as in-between prospector and defender (Snow and Hrebiniak 1980; Miles and Snow 1978; Song et al. 2007), are expected to share I-O and O-I capabilities. This expectation is to some extent supported by the above results. The result on reactor-GBEs is supported by Miles and Snow (1978) and prior findings (Smith et al. 1986; Conant et al. 1990).

The results from Table 4.2 also provide a finding that is unique in the GBE context – i.e. not observed in prior studies (Song et al. 2007; Desarbo et al. 2005; Di Benedetto and Song 2003; Hambrick 1983; Smith et al. 1986). It is evident that, except for the defender strategic position, there is little difference among the I-O and O-I capabilities for the strategic positions. This suggests that GBEs develop and perceive both capabilities groups as important factors in their operations.

The above findings provide the grounds for developing the overall CSM variable and individual strategic type-capabilities match, namely PSM, DSM and ASM, variables.

Turning to descriptive statistics, Table 4.4 provides the distribution (cross-tab analysis) of the four strategic types among GBEs and their industries. It indicates that a majority of GBEs adopt an analyser strategic position, followed by prospector, defender and reactor strategic positions respectively. Given GBEs' ownership structure and operational environment, this distribution pattern is expected. The head of corporate services of GBEA, in an interview, indicates the influence of operation environment and ownership structure on strategy setting as follow:

*Well I rated us as strategic type three [analyser]...the first one [defender] I think that limitations because of what we can and can't do. The second one [prospector] can be a bit political in that first it can be to the detriment of private industry. So therefore three [analyser] can sit really well...*

In terms of individual industries, only the distribution pattern of the Transport and the Other industries is consistent with Miles and Snow's (1978) original finding, which contended that the four strategic positions exist in an industry.

**Table 4.5: Relative Performance and Strategic Type**

ERR	Defender	.136	.234	F = 1.33; Sig. = .267
	Prospector	.130	.145	
	Analyser	.083	.111	
	Reactor	.034	.053	

The level of performance of GBEs among the four strategic types is provided in Table 4.5. The four strategic types are not significantly different. However, on average, the defenders, prospectors and analysers have higher ERR than the reactors. These results are consistent with Miles and Snow's (1987) original findings and prior empirical studies (Smith et al. 1986; Snow and Hrebiniak 1980; Song et al. 2007; Shoham et al. 2002; Miles and Snow 1978).

## 4.2 Multivariate Analysis

The first multivariate analysis is conducted on the relationship between the control variables and financial performance (ERR). Table 5.6 provides the result of the analysis, which suggested that all control variables have no significant relationship with ERR. This result is expected as these specific organisational characteristics were not hypothesised to have an impact on firms' performance. Thynne and Ariff (1990) and Seng and Taylor (2008) also find such organisational characteristics have no relationships with performance in government-owned enterprises.

**Table 4.6: Control Variables and ERR**

DV = ERR	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.116	.067		1.739	.084		
ORGSIZE	-1.030E-8	.000	-.102	-1.178	.241	.974	1.026
LEGALFM	.007	.020	.033	.367	.714	.882	1.134
INDUSTRY	.017	.044	.033	.387	.699	.985	1.015
JURISDIC	-.004	.006	-.062	-.679	.498	.861	1.161

Model Summary:  $R = .125$ ;  $R^2 = .016$ ;  $Adj. R^2 = -.013$ ; Durbin Watson = 2.070; F Stat. = .540;

Sig. = .707

The relationship between CSM and ERR is presented in Table 4.7. It suggests that CSM does not have any significant relationship with ERR, thus rejecting H1. This result challenges the Resource Base View (RBV) in aligning capabilities to Miles and Snow's (1978) strategic positions. In addition, it contradicts the middle range theory of Miles and Snow (1978). Since this study is the first in using CSM-composite variable to predict performance and using multiple regression instead of ANOVA, the result is not directly comparable to prior studies.

**Table 4.7: Capabilities-Strategy Match (CSM) and ERR**

DV = ERR	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-.009	.121		-.073	.942		
ORGSIZE	-1.669E-8	.000	-.121	-1.234	.220	.948	1.055
LEGALFM	.030	.021	.155	1.461	.147	.808	1.237
INDUSTRY	.021	.047	.043	.443	.658	.953	1.049
JURISDIC	-.001	.006	-.020	-.193	.848	.822	1.216
CSM	.014	.022	.063	.646	.520	.959	1.043

Model Summary:  $R = .203$ ;  $R^2 = .041$ ;  $Adj. R^2 = -.005$ ; Durbin Watson = 1.361; F Stat. = .901; Sig. = .483

The aggregated CSM measure in this study may be masking important components of the match between types of capabilities and strategies used by GBEs in the sample. Given the degree contradiction to the relevant theories, a break down analysis of the impacts of each strategic position alignment with its respective set of capabilities on ERR is conducted. The break down analysis is conducted using the following regression model. Table 4.8 presents the findings.

**Table 4.8: Regression of Individual Strategic type-capabilities Match and ERR**

DV = ERR	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.095	.014		6.643	.000		
Defender*O-I	.143	.052	.256	2.761	.007	.999	1.001
Prospector*I_O	.030	.034	.081	.875	.384	.999	1.001
Analyser*Av	-.037	.030	-.114	-1.233	.220	1.000	1.000

Model Summary:  $R = .288$ ;  $R^2 = .083$ ;  $Adj. R^2 = .057$ ; Durbin Watson = 1.406; F Stat. = 3.222; Sig. = .026

It provides a more favourable result in comparison to the overall CSM and indicates that the capabilities and strategy match of one of the three strategic positions is positively related to ERR. The result shows that the alignment between defender strategic position and outside-in capabilities has a significant and positive impact on performance. The *F* statistic and *p*- value indicate that the model is statistically significant. Given all other variables have no significant impact on ERR; the significant of the model is based on the impact of the extent of match of defender strategy - outside-in capabilities on ERR. This finding support H3.

This result suggests that the defender strategy-type GBE needs to develop strengths in market-oriented capabilities to enable it to maintain a dominant position in its niche market which can enable it to achieve superior financial performance. Two responses to the second open-ended question of the questionnaire shed some light into how defender oriented GBEs consider their capabilities and strategies. These responses are as follow:

*The organisation prepares an Annual Business Plan which defines the strategic goals, the strategies to achieve those goals and the resources/skills required to achieve those goals. These issues are discussed at board meetings on a regular basis and approaches put forward and agreed to realign any divergence between targets and achievement (Defender, Chief Financial Officer, GBE AE)*

*[Aligning strategies to capabilities] is achieved by holding regular Business Plan Reviews with all managers- where performance against the plan is reviewed with all involved. Separately a strategic update is provided to all employees each quarter by the managing director (Defender, General Management Team, GBE AG).*

These findings lend partial empirical support to congruence theory and RBV in terms of aligning capabilities to Miles and Snow's (1978) strategic-types. Support is given to Song et al.'s (2007) finding that a defender with strong market-linking capabilities (same orientation as O-I) has a positive impact on profit margin. Nevertheless, Table 4.8 does not support the findings by Song et al (2007) concerning the significant impact of a capabilities and strategy match of the prospector and analyser strategic-types on ERR. These findings reject H2 and H4 posed in the prior section.

Qualitative data from responses to the open ended questions provides a further insight into the above findings. It suggests that financial target is a secondary consideration in developing and changes of strategies and capabilities. The comments are as follow:

*They are seriously aligned with government policy i.e. state strategic plan; internally they are aligned to maintain a delivery organisation (Prospector, General Management Team, GBEAK)*

*[Our organisation pays attention to aligning our strategies to capabilities] to [the] best of its abilities but much of its work is what the government wants. Business planning, risk management and compliance structure have become more important over the past years (Analyser, General Management Team, GBEAJ).*

This qualitative evidence that management does not give the same extent of attention to financial targets as to accountability requirements, could be attributed to the nature of operations and markets of GBEs. Many of the GBEs under study have a monopoly market in their geographical area, for example, port authorities and water corporations. These geographical areas are commonly limited by the jurisdiction of their government-owner – e.g., state and territory governments. There are also government pricing controls on services that GBE's provide. Thus, strategies that aim to expand market share beyond their geographical areas are not as successful as strategies to defend the market niche. Once all of a geographically bounded market share is captured and pricing of major services is outside the control of management, then there is reduced incentive for management to seek innovative ways to increase the profitability of their GBE. In other words, the aligning of capabilities with a defender strategy-type creates a more suitable fit for GBEs in meeting their relatively stable and predictable financial performance requirements.

**Table 4.4:** Strategic position, industry type and GBEs

			Industry								Total	
			Energy	Port	Finance	Water	Transport	Infrastructure	Other	Tourism		
Strategic positions	Defender	Count	5	3	3	1	1	2	3	1	19	
		% within Strategy	26.3%	15.8%	15.8%	5.3%	5.3%	10.5%	15.8%	5.3%	100.0%	
		% within Industry	27.8%	27.3%	25.0%	4.2%	14.3%	22.2%	11.1%	14.3%	16.5%	
	Prospector	Count	1	2	1	6	1	6	10	5	32	
		% within Strategy	3.1%	6.2%	3.1%	18.8%	3.1%	18.8%	31.2%	15.6%	100.0%	
		% within Industry	5.6%	18.2%	8.3%	25.0%	14.3%	66.7%	37.0%	71.4%	27.8%	
	Analyser	Count	12	6	8	17	2	1	13	1	60	
		% within Strategy	20.0%	10.0%	13.3%	28.3%	3.3%	1.7%	21.7%	1.7%	100.0%	
		% within Industry	66.7%	54.5%	66.7%	70.8%	28.6%	11.1%	48.1%	14.3%	52.2%	
	Reactor	Count	0	0	0	0	3	0	1	0	4	
		% within Strategy	.0%	.0%	.0%	.0%	75.0%	.0%	25.0%	.0%	100.0%	
		% within Industry	.0%	.0%	.0%	.0%	42.9%	.0%	3.7%	.0%	3.5%	
Total		Count	18	11	12	24	7	9	27	7	115	
		% within Strategy	15.7%	9.6%	10.4%	20.9%	6.1%	7.8%	23.5%	6.1%	100.0%	
		% within Industry	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

## 5. IMPLICATIONS AND CONCLUSION

The implications of the findings for GBEs to most effectively achieve financial performance are: (1) GBEs should adopt and maintain a defender strategy as their default position; (2) GBEs should ensure they develop strengths in outside-in capabilities.

The findings and suggested implications of the study should be cautiously relied upon in the light of the following limitations. First, the multi-scale items used to measure the accountability-emphasis variable and the modified scales used to measure strategic-types and organisational capabilities variables have not been tested for validity and reliability in prior studies. Nevertheless, the current study has conducted statistical testings, namely principal-components factor analysis and Cronbach's Alpha, to establish their validity and reliability for the context of this study.

Second, the explanatory power of the models is quite low in chapter 7. This indicates that other important explanatory variables of GBEs' financial performance and accountability-emphasis could be omitted, especially situational factors of a temporal or contextual nature. Research using an ethnographic approach might reveal factors such as a sudden change of relevant minister, a major event affecting the GBEs operations, a media report about the GBE or an imposed change in government policy that has impacted in unique ways on financial performance or accountability-emphasis of particular GBEs in the sample.

Lastly, the study is conducted in the context of Australian GBEs. This means the findings can not necessarily be generalised to other types of organisations that operate under different regulatory regimes, different market conditions and different ownership structures.

In conclusion the study has extended the literature on the inter-relationships between strategic-type and organisational capabilities into GBEs context. In addition, it has provided evidence on the effect of alternative mixes of capabilities-strategies alignments of GBEs on its financial performance for management practice and government policy-makers.

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## APPENDIX

### EXTRACT FROM THE QUESTIONNAIRE

#### Organisational Capabilities

In relation to possessing the following types of general capabilities, how strong is your organisation?

	Very Weak	Somewhat Weak	Slightly Weak	Slightly Strong	Somewhat Strong	Very Strong
<b>Financial Management capability</b> (investments in strategic projects/programs , cash management, financing decisions)	1	2	3	4	5	6
<b>Cost control capability</b> (cost efficiency in service/product supply and delivery, tight budgeting)	1	2	3	4	5	6
<b>Ability to monitor and predict technological changes in the industry</b> (through research and cooperation with experts in the field the organization able to determine and forecast future technology trend affecting them)	1	2	3	4	5	6
<b>Technology development (know how) and Innovation capability</b> (capacity to develop new product/services or apply appropriate process technologies to produce new product to satisfy the market needs)	1	2	3	4	5	6
<b>Product or Service Transformation processes</b> (ability to turn resources into product or services efficiently, meet design specifications, developing and delivering benefits/value promised)	1	2	3	4	5	6
<b>Customer-linking capability</b> (creating and managing durable customer relationships)	1	2	3	4	5	6
<b>Capability to create durable relationships with suppliers</b> (establishing and maintaining strong working relationships with suppliers and contractors)	1	2	3	4	5	6
<b>Channel-bonding capability</b> (creating durable relationships across channel members such as suppliers, wholesalers and retailers)	1	2	3	4	5	6
<b>Ability to retain customers</b> (achieving high repeat business or retention rate of customers)	1	2	3	4	5	6
<b>Market sensing capability</b> (understand the target market(s) and competitors' capabilities)	1	2	3	4	5	6

#### Strategic Type

Each group of statements below relates to an alternative type of strategic position for a profit-making organisation. Please indicate which set of statements (type 1, 2, 3 or 4) most closely fits your organisation.

Circle *one number only* that currently characterizes your organization's strategies.

Strategic Type	Statements about strategic position
1	<ul style="list-style-type: none"> <li>• This type of organisation attempts to locate and maintain a secure niche in a relatively stable product or service area.</li> <li>• This organisation tends to offer a more limited range of products/services than its competitors.</li> <li>• This organisation protects its market domain by offering high quality, superior services and low prices.</li> <li>• This organisation tends to ignore the industry changes that have no direct influence on its market domain.</li> </ul>
2	<ul style="list-style-type: none"> <li>• This organisation typically operates within a broad product/ services market domain that undergoes periodic redefinition.</li> <li>• The organisation values being "first in" in new product/service and market areas even if not all of these efforts prove to highly profitable.</li> <li>• This organisation rapidly responds to area of opportunity, which leads to new round of competitive action.</li> <li>• This organisation may not maintain market strength in all areas it enters.</li> </ul>
3	<ul style="list-style-type: none"> <li>• This type of organisation attempts to maintain a stable, limited line of product/services. At the same time following a carefully selected set of the more promising new developments in the industry.</li> <li>• This organisation is seldom "first in" with new products/ services, however by carefully monitoring the actions of major competitors in areas compatible with its stable product market base.</li> <li>• This organisation can frequently be "second in" with a more cost-efficient product or service.</li> </ul>
4	<ul style="list-style-type: none"> <li>• This type of organisation does not appear to have a consistent product or service market orientation.</li> <li>• This organisation is not as aggressive in maintaining established product/services and markets as some of its competitors</li> <li>• This organisation also not willing to take many risks as other competitors</li> <li>• This organisation responds in the areas where it is forced by environmental pressures.</li> </ul>

#### Open Ended Question

From your perspective, to what extent does your organization give attention to aligning its strategies and capabilities? If so, how is this done?

# STRATEGIC POSITIONING: CHINA'S CHOICE IN GLOBAL MANUFACTURING VALUE CHAIN

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## ABSTRACT

*From the 1990s, the manufacturing International Labor Division has been progressing rapidly. With the deep of it, China Manufacturing Corporation is facing the issue of how to join into the system of the International Labor Division and how to hold a dominance position in the International Labor Division. As to enhance the competition advantage constantly, Transfer to the more new and advantageous global value chain, and to promote the international marketing performance, The Corporation of China should choose the proper International Marketing Strategy wisely with the consideration of design ability, manufacture ability and marketing exploited ability.*

**Keywords:** *International Labor Division, Global Value Chain, International Competition Strategy*

## INTRODUCTION

Since China's entry into the World Trade Organization, Chinese manufacturing industry has been involving in international division of labor in greater depth. With the deepening and development of the system of world division of labor, there are two main issues in front of our Chinese manufacturing companies in selecting international competition strategy, one is from which place to be involved in and another is how to establish and develop their own value chain. Rationally speaking, how to maintain our comparative advantage and gradually transfer to its competitive advantage, then fulfill the linking, expanding and stretching the value chain is the most realistic choice for our manufacturing companies' international competition strategy.

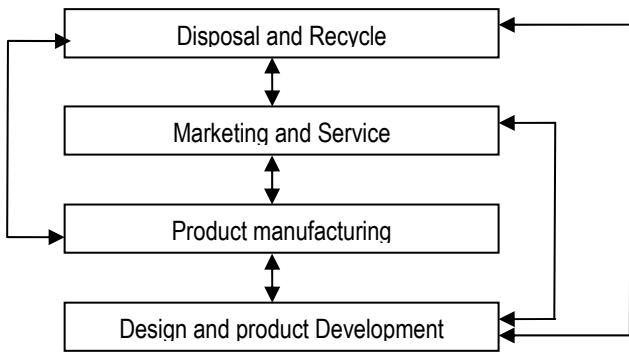
## 1. DEVELOPING TREND OF THE WORLDWIDE MANUFACTURING VALUE CHAIN

After the industrial revolution, international division of labor has undergone three gradually deepening stages: inter-industrial international labor division, within-industrial international labor division, and then international labor division within products, the development of manufacturing global value chain covered both division of labor within industry and products. Since 1990s, with the accelerating of economic globalization and informationalization, consistent expansion of multinational global investments and adaption of freely investments policy by more and more countries, manufacturing industry has further developed.

### (1) The Boundary of Manufacturing Global Value Chain has Changed Substantially

The international division of labor of the traditional manufacturing industry is mainly the division of different departments within one industry, in particular, the international division among labor-intensive, capital intensive and technology intensive manufacturing industry departments. In practice, the international division of manufacturing industry is separated by different industrial departments. With the deepening of international division, the boundary of the manufacturing industry has transferred from inter-industrial division to the internal industrial department. Value chain is the boundary for the international division of modern manufacturing industry. The main stream of modern manufacturing industry's international division is the division of different segments in manufacturing industry's value chain.

The value chain of manufacturing industry includes a series of value-adding activities such as design, produce, distribute, service, dispose and recycle; all these reflect the connection of companies around the world. These firms are conducting a series of related independent activities in order to start a product or service from the concept, and then undergo different production stage, finally distribute it to the end users, and ultimately dispose it after usage (See graph 1). Manufacturing companies in different regions worldwide has established an orderly set network of the value creation through global value chain, each firms within the network are connected via a variety of interaction and relation. A company could expand its production line and realize the expansion of international market by establishing new connection with Multinational Corporation that has already built global value chain.



**Graph 1: Value chain of manufacturing industry**

## (2) Factors that Impact the Global Value Chain of Manufacturing Industry has Changed

In the traditional international division of manufacturing industry, the major key factors that influence division are natural resources, capital and labor. Therefore, earlier international divisions of manufacturing industries were the division among textile industry, manufacturing industry and high-processed industry and so forth. However, in the division of global value chain of modern manufacturing industries, critical factors that affect divisions have expanded. The position and effect of factors such as traditional natural resources, capital and labor has weakened, while the functions of technology, information, Talents and creative mechanism has strengthened. As a result, the divisions of the global value chain for the modern manufacturing industry are the divisions among labor-intensive, capital-intensive and technology-intensive industries departments of each country's traditional factors, and further the divisions within one industrial departments or one product which has the intensive characteristics such as labor-intensive, technology-intensive and knowledge-intensive or each segment of other intensive factors.

Nevertheless, as the position and effect of every factor has changed apparently, the expanding value of factors such as technology, knowledge and information have increased substantially. As a result, these factors endowed those rich countries or companies critical positions in manufacturing industries' global division, and they have gained majority benefits in the industry's global value chain. However, other countries are in the low value adding sections in international division and have limited benefits.

## (3) Multinational Companies have Become the Main Part that Could Influence Manufacturing Industry's Global Value Chain

In the practice of traditional international divisions, country has been the main part within the division, and theories of international division mainly reveal the bases that propel the division in countries and the model of benefits distribution. The separation of so-called vertical division, horizontal division or mixed division are the divisions of international division model for separation between developed countries with developing country and division among developed countries. However, in the division of modern manufacturing industry's global value chain, country boundaries of international division has been weakening, just as the boundaries of manufacturing industry's global value chain has blurred, internationalized corporation, especially multinational companies are becoming the major part of manufacturing's global value chain. International division has evolved from division among countries to divisions that have been existed among companies in different countries, and even the division among segments different value chain in the process of value creation for the same product or service. The bases for this kind of manufacturing industry's global value chain lie in the fact that, in order to intensify their core capability, large multinational companies invest more and more resources in high value-adding technology, knowledge-intensified segments such as design research and development, product design, marketing, brand management and after-sales services, and then outsource more and more uncompetitive capabilities such as production section to independent companies all over the world, and they even abandon their production section completely.

## (4) The Ways to Realize Manufacturing Industry's Global Value Chain Tend to Diversify

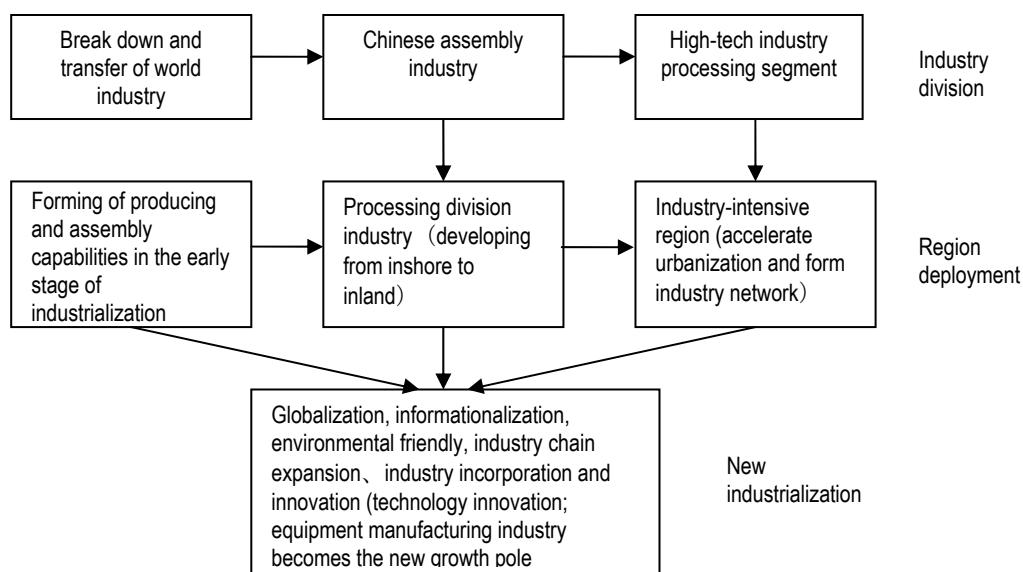
The traditional ways to realize international division are primarily limited in international trade, and conventional definition of international division is referred to as the production connection that manufacturers in each country created through world market. However, with the rapid development of multinational companies, outside market system has developed substantially, and international trade begin to change from the exchange among different countries, companies and different products to the internal exchange within a country (among different multinational company's branch), a firm (within the multinational firm) and a product (different production section). This arrangement means that international production relations are not necessarily had

to be established through external market, the way that propel the establishment of manufacturing industry's global value chain which previously relied on international trade in external market has changed to the multi-structure where both external and internal market exist. While in the internal market, manufacturing's global value chain can be established through equity investments, or through the way of non-equity arrangement.

Thus so far, it is more precise to describe manufacturing industry's international division using manufacturing industry's global value chain. In this manufacturing industry's cross-function, cross-process and cross-border global value chain, corporations with different competitive advantages would find their own place so as to participate in global economic activities. In the present time, although the major driving force of manufacturing industry's global value chain is derived from those multinational companies in developed countries that have capital, technology and knowledge advantages, Chinese Manufacturing Corporations would actively incorporate themselves into the global value creation network, and then they can get access to international market, and obtain the knowledge and information of global competitors and therefore benefit from enhancing their own international market competition capabilities.

## 2. POSITIONS AND CHARACTERISTICS OF CHINESE MANUFACTURING INDUSTRY IN GLOBAL VALUE CHAIN

Separating from 1970s, there are two distinctive periods for Chinese manufacturing industry in recent 50 years, the early industrialization before 1970s where the development of manufacturing was established on the basis of planned economy and self-supporting import replacement strategy, and this is a stage isolated from international division system. The years beginning from 1980s is called the rapid industrialization period where the manufacturing industry is developing with the market-oriented economy revolution and the opening of national economy expansion, and the scale and extent of the involvement of manufacturing industry in international division has expanded. Chinese economy has changed from policy-oriented openness to the period of institutional openness to the outside world, and Chinese manufacturing industry are realizing the incorporation of global industry from a more comprehensive scale and higher extent (see figure 2).



**Figure 2:** The development of manufacturing industry in the process of Chinese industrialization in 1980s

However, how to judge the position of China manufacturing industry in global value chain division and to predict the future trend of Chinese manufacturing industry in global value chain are still controversial issues. Up to now, the development of Chinese industry has basically accomplished the period task of overtaking the total amount. Nevertheless, the derivative of our industry structure increased the difficulty in growing industry. With the relative lagging of rural area and agriculture, peasants' income and consuming level are comparatively low, and domestic market needs has been the significant factor of limiting industry growth. Therefore, comparing to other giant industry countries, the growth of Chinese manufacturing industry relies more on the needs of foreign market and expansion of product exporting. The impact of intrinsic impulse of exporting has resulted in an increase in total market share of our manufacturing products in international market, and rising of the market share of Chinese exporting products are more apparent in some major trading partners such as US, Japan, Europe and Southeast Asian countries. And this might be the fundamental reasons why China is named world factory.

However, let's analyze the structure of Chinese product exporting in great depth, and then it is noticeably that a majority of exporting industry product are labor-intensive goods. So far, labor-intensive textile products, processed appliance and electric telecommunication goods (See table 2-1) still have large comparative advantages. Although shares of high-tech products are growing, most of them are "hardware" products, and those patents of high value-adding sections, technical recipe and brand are in the hands of multinational companies. If we simply divide manufacturing industry's global value chain into several sections, namely design exploitation, product manufacturing, service and management, brand and marketing sections, Chinese manufacturing industries have some kind of competitive advantages in product manufacturing section while it has large potential value-adding sections such as design exploitation, service and management, brand and international marketing and so forth. Most of Chinese companies do not have comparative advantages, and it is still in the lowest end of global value chain. As a result, to put Chinese manufacturing industry in the center of world factory assembling part is in line with Chinese manufacturing's present situation.

**Table2-1: Chinese import and export product structure in 2003**

Product Category	Export (%)	Import (%)
Initial product	7.94	17.63
Industrial product	92.06	82.37
Include: Chemical product and related goods	4.47	11.86
Finished product categorized by raw materials	15.75	15.48
Include: textile, finished goods and related products、	6.14	3.44
Mechanics and transportation equipment	42.86	46.72
Include: Universal machinery equipment and parts	3.09	3.78
Office machinery and automatic process data facility	14.28	5.87
Telecommunication, voice record & reply equipment	10.27	4.73
Electric machinery, equipment and parts	9.66	19.33
Other product	28.77	7.99
Include: cloth and cloth accessory	11.88	0.34
Footwear	2.96	0.09
Unclassified products	0.22	0.31

At the same time, for the part of foreign trade, the position of processing and assembly trade in our foreign trade has been enhancing (See table2-2), and most of them has involved in a majority of industrial department of manufacturing industry at present. However, relying heavily in the model of processing trade in foreign trade would be a big concern for Chinese manufacturing industry in the long term. In processing trade, foreign investment companies control the entire market and distribution channel, and strictly control the core technology. They put the developing procedure of technology and product overseas, merely leave Chinese factories to process and assemble sections. Besides, some of the foreign investors even transfer the low-end technology and severe environment contamination industries to China, bringing us with catastrophic effect to the environment. For the usage of raw material, companies usually import a large amount of raw materials from foreign counties, which would be an obstacle for the development of our related raw material industry and delay the upgrading of whole processing trade and improving extent of domestic assembly, thereafter holding up the driving effect of processing trade of industry.

Therefore, Chinese manufacturing companies should constantly increase its place in global value chain, and also take the place of developed countries in some important manufacturing field in global manufacturing industry. Only by doing so, Chinese manufacturing industry would really be an important base for global manufacturing industry.

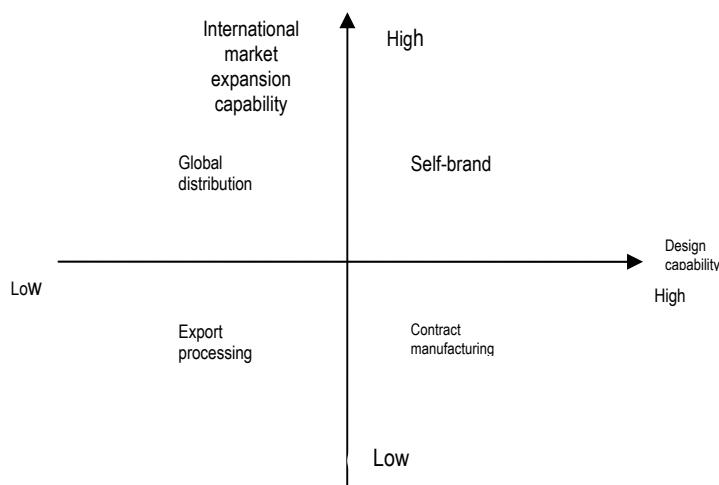
**Table 2-2: Ways of Chinese foreign trade in 2003**

Trading methods	Import		Export	
	Total value (amounts in 100 million dollars)	%	Total amounts (amounts in 100 million dollars)	%
Total value	4383.7	100.00	4128.4	100.00
Normal trade	1820.3	41.52	1877.0	45.47
Processing trade	2418.5	55.17	1629.4	39.47
Including: processing clients materials	543.3	12.39	391.2	9.48
Processing imported materials	1875.2	42.78	1238.2	29.99
Other trade	144.9	3.31	622.0	15.07

### 3. CHINESE MANUFACTURING INDUSTRY'S INTERNATIONAL COMPETITIVE STRATEGY AND GROWTH PATH

Looking at Chinese manufacturing industry's competitive strategy, the key issue is how to choose companies' strategy and according on what kind of strategy to make adjustment. We think, for Chinese manufacturing companies, determining its external basis of international competitive strategy is determined by the position of Chinese manufacturing industry in international manufacturing industry, and its internal basis is based on the international expansion, design, processing and production capabilities. Considering its processing and production to be the basic capability of Chinese manufacturing companies, international market expansion and design ability are these companies' fundamental capabilities.

Basing on companies international market expansion and design capability, Chinese manufacturing companies can choose from four kinds of international competitive strategies, namely exporting processing, contract production, self-brand creation and global distribution models (See figure3-1).

**Figure3-1: Chinese manufacturing companies' international competitive strategy selection model**

#### (1) Export Processing Model

Export processing model means that companies are involved into manufacturing international division by processing trade and expanding international market. When firms have strong processing capability, but weak design and international market expansion abilities, it is reasonable to adapt this model. The characteristic of this model is that in the global manufacturing value chain, multinational companies are in charge of product research and development, providing raw material and parts, as well as distribute finished products worldwide, while Chinese manufacturing companies are responsible for product processing and production (See figure3-2).

Major advantages of export processing model is that it can make use of Chinese manufacturing companies competitive advantage of strong capability, and low labor costs, and at the same time it can make up of its disadvantages of weak design

and international market expansion capabilities, thus provide large room for Chinese small and medium manufacturing firms to come into international market. So far, because of low production costs, many small and medium manufacturing firms have attracted much attention of the world top500 companies, and become the assembly and production factories for multinational companies. In the long term, this cooperation would be good for Chinese companies to improve their design capability and become dedicate equipment and parts suppliers for multinational company, and help them to improve their place and international marketing performance in manufacturing industry' global value chain.

In the upper stage of export processing model, Chinese companies has gradually changed from processing firms to be the supplier of raw material, pars and finished products, but in general, they are still the supplier of production department. It is certain that these two conditions are not mutually exclusive, they are actually coexist but with different proportion.

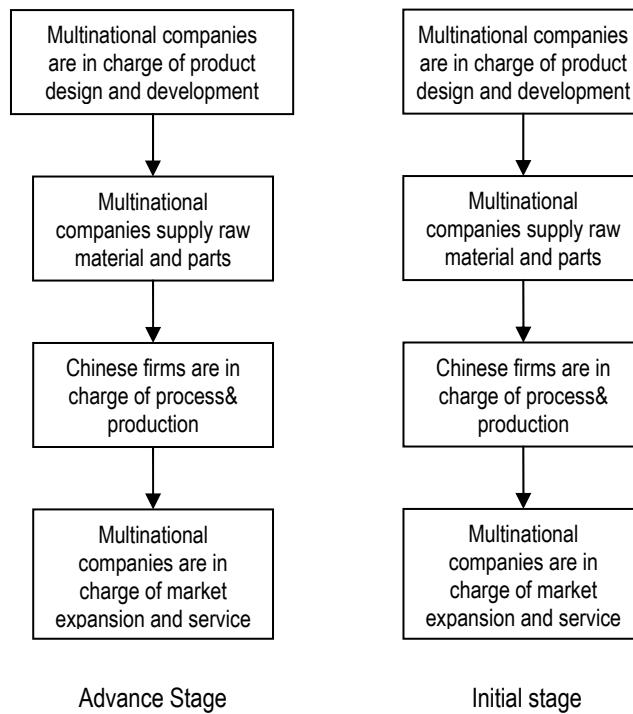
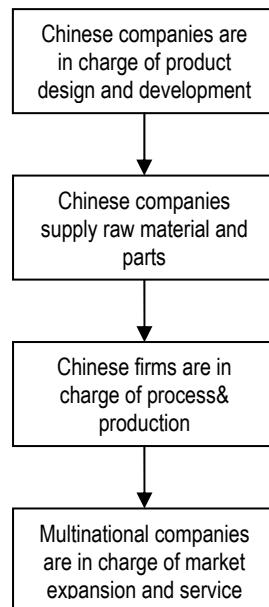


Figure 3-2: Illustration of export processing value chain

## (2) Contract Manufacturing Model

Contract manufacturing model refers to that suppliers participate in international division and international market expansion. When firms have strong design and production ability while weak international market expansion, it is wise to take this strategic model. The main features of this kind are that Chinese companies participate in research and development and producing finished goods in manufacturing industry's global value chain, and they provide products and services according to supply contract, while multinational companies control brand and global market distribution network (See figure 3-3).



**Figure 3-3: Contract production value chain**

The primary advantages of contract manufacturing are that it can elaborate some Chinese manufacturing companies' strong processing capability and its competitive advantages in improving design ability, and meantime offset these companies' present drawbacks in international market expansion thus providing effective ways for Chinese manufacturing corporations to step into international market. At present, with their design and processing capabilities, a large number of manufacturing companies in Zhejiang, Yangtze Delta and other domestic regions become multinational companies' OEM suppliers in China. In the long run, this kind of cooperation would benefit Chinese companies in improving their own brand competitive edge and become multinational's competitive rival at same level, and then close to the key place in manufacturing industry's global division.

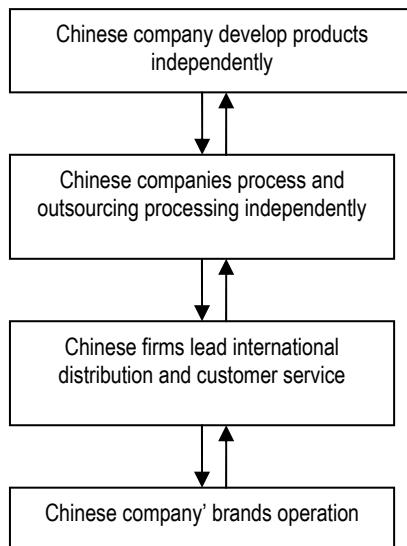
In the advanced stage of contract manufacturing, producers could provide different customers with products and services, and they would have much higher effectiveness and efficiency in equipment usage. Besides, producers can invent new product for clients and take charge of other businesses related to goods production, such as logistics, order, after-sales service and so forth.

### (3) Global Distribution Model

Global distribution model is used to take part in international division and expand international market through foreign trade. When firms are strong in international marketing expansion and high brand recognition but weak design and processing and producing capabilities, it is rational to take this strategy. The major characteristics of this model is that, in the manufacturing value chain, Chinese companies are in the end of division, and they are charge of products global distribution and customer services, while both domestic and foreign producers are responsible for product research and development and supply of finished products. Basically, adapting this kind of strategy would require the firm to change their business overall into a firm of business services. Up to now, there is no such kind of manufacturing companies in China, and it is not so applicable.

### (4) Self-Brand Creation

Self-brand creation is that companies get into international division as brand suppliers of finished products and expanding international market. When companies have strong capability in design, produce and expand international market, it is wise to take this strategic model. The major features of this model are that in the global value chain, Chinese companies are leaders in some industrial department division. They have design ability and brand. These firms control international distribution network, produce in domestic market, purchase worldwide, use optimized facility and provide service and products to clients (See figure3-4).



**Figure3-4:** Value chain of self-brand creation

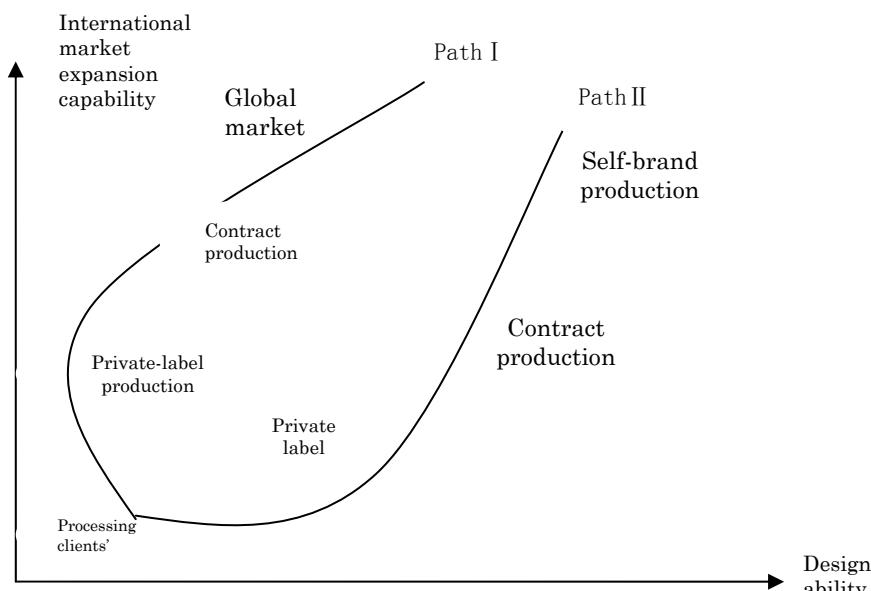
The advantages of create self brand is that it can take advantage some Chinese manufacturing firms' capability in design and international market expansion, as well as their competitive advantages in improving brand recognition, despite the fact that there is such a few firms are in this stage, such as Haier company some companies. However, in the long term, if China intends to be the base for global manufacturing, it has to have a series of manufacturing companies which have strong design and brand competitiveness, and make them become the key firms for some manufacturing industry's global division and therefore to create more greater performance. And this model would be the dominant model for Chinese manufacturing multinational companies to expand international market.

## (5) Growing Path of Chinese Manufacturing Firms' International Competitive Strategy

The above four model is basically a static selection, and most of Chinese manufacturing companies' design and international market expansion capabilities are still in the period of export process and contract manufacturing model. These two models are basically in line with Chinese manufacturing firms' comparative advantage, but in order to compete in international market, Chinese firms still have to improve their competitive advantages continuously, and thus enhancing their international competitive capability, especially the international market expansion and design abilities.

In order to enhance international market competitiveness, there are two methods for Chinese manufacturing firms to develop their international competition strategies (See figure3-5). The first one is producing clients' material, then private-label products production or contract production, and finally self-brand production. This method emphasizes to expand Chinese manufacturing firms' production, design and market expansion capabilities in order to realize global marketing performance. Companies' international marketing model is gradually begin from producing clients' materials, produce private-label products including some contract manufacturing, and finally market their research and development of themselves and expand global market.

The second method is producing clients' materials, produce private-label goods or contract production and then distribute globally. This way illustrate the start of Chinese manufacturing companies from producing clients materials, and then gradually change to private-label producer or contract producer and ultimately take charge of many processing and producing activates and assemble it to the third world suppliers. Since raw materials, parts or even finished goods come from suppliers in different country or regions, end-users are located in different countries or regions, purchase, assembly and distribute these products requires for strong capabilities in international market distribution. Therefore, companies should focus their strategies in control of global market distribution network.



**Figure 3-5: Growing path of Chinese manufacturing firms' international competitive strategy**

In sum, manufacturing industry' global value chain division provide opportunities for Chinese manufacturing companies to participate in international market competition with their own skill and market expansion capabilities, which becomes the basic for companies to create and study international market. However, Chinese manufacturing industries must constantly improve their competitive advantages, and transfer to new, more beneficial global value chain in the worldwide division, and even obtain various global value chains. By doing so, these companies can enhance not only themselves, but also the other related companies in the value chain to a new performance and level of quality, and therefore propel Chinese manufacturing companies' international operation performance as a whole.

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# SIX SIGMA: MORE THAN STATISTICAL PROCESS MANAGEMENT

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## ABSTRACT

*Six Sigma products quality has become one of the key drivers of corporate profitability. Indeed, product quality is a pervasive thread on any yardstick of competitive positioning, from time-to-market, quality initiatives reduce cycle times in product realization, to cost, rework and recalls can quickly eat into any profit margin.*

*This paper will provide a definition of Six Sigma from a statistical perspective and from the much broader perspective of a business process improvement. Six Sigma is a statistical method of translating a customer's needs into separate tasks and defining the optimum specification for each depending on how all of the tasks interact. Based on what is revealed, the steps that follow can have a powerful affect on the quality of products, the performance of customer services, and in the professional development of employees. Six Sigma can reduce defects in products and services because of its strong emphasis on statistical analysis and measurement in design, manufacturing and the entire area of customer-oriented activities. This Six Sigma paper is using a research design that is exploratory, empirical, non-experimental, cross-sectional qualitative assessment. Data collection will consist primarily of ex post facto document review.*

*Two major factors differentiating Six Sigma from other quality programs are measurable results and the insight senior executives have into various projects. The earlier programs focused on defect elimination for the sake of defect elimination. In contrast, Six Sigma requires big structural changes and lots of top-down directives.*

**Keywords:** Supply Chain Management, Six Sigma, Logistics, Communication, Operation Management

## INTRODUCTION

The name Six Sigma was coined by Motorola Inc. and is a federally registered trademark and service mark of Motorola, Inc. The Greek letter sigma (Sigma) is used as a symbol to denote the standard deviation or the measure of variation in a process. The greater the number of sigmas, the fewer the defects in an one item. According to the Juran Institute (DeFeo, 1999), the best organizations operate at about Three to Four Sigma, which translates into about 6,200 defects per million. In a true Six Sigma environment, defects would be driven down to only 3.4 per million. W. Edwards Deming acknowledged that by decreasing variations, costs would be decreased (Walton, 1986). Phillip Crosby (1979) stated that it is much less expensive to prevent errors than to rework, scrap, or service them and he estimated that the expense of waste can run as much as 15 to 25 percent of sales, and does in some companies. Various comments throughout the current Six Sigma literature still use 20 percent as the amount of waste in companies.

The opportunity to apply the ideas of Six Sigma quality outside of Motorola came in 1993 when Richard Schroeder and Mikel Harry took the idea to Asea Brown Boveri (ABB). One of the most difficult tasks in developing a Six Sigma process change system is to get support from the Corporation leadership. If you are going from a decentralized free-for-all methodology of management to a quality form of management then, there is a paradigm shift. The executive team at ABB bought into the ideas of Six Sigma quality, but the key concern was how this translated to the bottom line. This is when Mikel Harry set up his own consultancy (Six Sigma Academy) by modifying the ideas of Six Sigma, a quality initiative, into Six Sigma the Breakthrough Strategy a business initiative.

The purpose of other quality initiatives and Six Sigma is to drive out waste, improve quality, cost and the time performance of any business. That can mean millions in dollars of savings after the investment of a fraction of that amount. Those who have lived through quality initiatives during the last 20 years will recognize many of the Six Sigma concepts (Paul, 1999). Six Sigma is not new it is the correct application of the steps and tools. Interestingly, previous initiatives that had faded out at GE and elsewhere had used similar tools to Six Sigma. Six Sigma focuses on measurement, but once the measures have been decided, advanced statistical methods are not needed. The well-used seven simple quality tools, including histograms and run charts, in conjunction with basic statistical process control and simple statistical methods, will suffice for many situations.

Jack Welch proclaimed that GE was making great savings with Six Sigma in the mid-1990s other major American firms then became Six Sigma devotees. Six Sigma is a statistical process control technique and a business process improvement philosophy.

This paper will provide a definition of Six Sigma from a statistical perspective and from the much broader perspective of a business process improvement philosophy using a research design that is exploratory, empirical, non-experimental, cross-sectional qualitative assessment. Data collection will consist primarily of ex post facto document review.

## DEFINITIONS

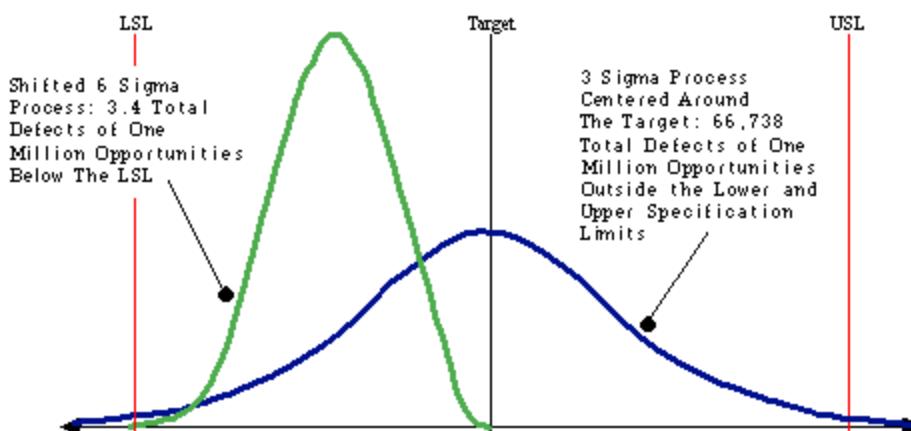
Six Sigma is a statistical method of translating a customer's needs into separate tasks and defining the optimum specification for each depending on how all of the tasks interact. Based this interaction the steps that follow can have a powerful affect on the quality of products, the performance of customer services, and in the professional development of employees. Six Sigma can reduce defects in products and services because of its strong emphasis on statistical analysis and measurement in design, manufacturing and the entire area of customer-oriented activities.

The statistical definition of Six Sigma at many organizations simply means a measure of quality that strives for near perfection. Sigma is a letter in the Greek alphabet. The term "sigma" is used to designate the distribution or spread about the mean (average) of any process or procedure. Sigma measures the capability of the process to perform defect-free-work. A defect is anything that results in customer dissatisfaction. The sigma scale of measure is correlated to such characteristics as defects-per-unit, parts-per million defective, and the probability of a failure/error.

Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving towards six sigmas between lower and upper specification limits) in any process -- from manufacturing to transactional and from product to service.

The statistical representation of Six Sigma describes quantitatively how a process is performing. To achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities. A Six Sigma defect is defined as anything outside of customer specifications. A Six Sigma opportunity is then the total quantity of chances for a defect.

The statistical implications of a Six Sigma program however, go well beyond the qualitative eradication of customer perceptible defects. It's a methodology that is well rooted in mathematics and statistics. The objective of Six Sigma Quality is to reduce process output variation so that  $\pm$ six standard deviations lay between the process specifications upper and lower limits. This will allow no more than 3.4 defect Parts per Million (PPM) opportunities, also known as Defects per Million Opportunities (DPMO), to be produced. Several studies suggest that overtime a process mean will shift approximately 1.5 sigma. In order to ensure that the customer's requirements are being met, the narrower the variations the better one is prepared to continue meeting those requirements over time. Figure 1 is a graphical representation of this concept.



**Figure 1: DECREASED VARIATION** Adopted from (<http://www.isixsigma.com>)

As the process sigma value increases from zero to six, the variation of the process around the mean value decreases. With a high enough value of process sigma, the process approaches zero variation and is known as "zero defects." Decrease your process variation (remember variance is the square of your process standard deviation) in order to increase your process sigma. The end result is greater customer satisfaction and lower costs.

The philosophical definition of Six Sigma is the implementation of a measurement-based strategy that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects. As reported by Hahn, Hill, Hoerl, and Zinkgraf (1999), the main focus of Six Sigma was initially on manufacturing, and specifically on cost and waste reduction, on yield improvement, and on operations where there is opportunity to improve capacity without major capital expenditure. There was also strong emphasis on understanding and satisfying customer needs. One of the current trends, for example, is applying Design for Six Sigma (DFSS) to the design process of products to accelerate the cycle time for improving customer-oriented features. Performance metrics are established that directly measure the improvement in cost, quality, yield, and capacity. Six Sigma has also been compared to the Total Quality Management (TQM) movement of the 1980's and 1990's. Some have even referred to Six Sigma as TQM on steroids because financial figures are required both to select projects and to evaluate success, and performance metrics are tracked rigorously. The results are products and services that are faster, less expensive, and better.

The opportunity to apply the ideas of Six Sigma quality outside of Motorola came in 1993 when Richard Schroeder and Mikel Harry took the idea to Asea Brown Boveri (ABB). The executive team at ABB bought into the ideas of Six Sigma quality, but the key concern was how this translated to the bottom line. This is when the ideas of Six Sigma, a quality initiative, were transformed into Six Sigma, the Breakthrough Strategy a business initiative.

Continuous improvement is an ongoing quest for Six Sigma. Motorola was part of a consortium which conceived the Six Sigma concept over fourteen months ago. For more than a decade Motorola has implemented the Six Sigma process with dramatic results. Increased productivity an average of 12.3% per year, reduced the cost of poor quality by more than 84%, eliminated 99.7% of in-process defects, saved more than \$11Billion in manufacturing costs, and realized an average annual compounded growth rate of 17% in revenues, earnings, and stock price

There are eight fundamental stages in applying the Breakthrough Strategy to achieve Six Sigma performance. The stages are Recognize, Define, Measure, Analyze, Improve, Control, and Standardize. And Integrate. Each of the stage is designed to ensure, that companies apply the Breakthrough Strategy in a methodical and disciplined way that Six Sigma projects are correctly defined and executed, that the results of these projects are incorporated into the day-to-day business.

Shand (2001) provides information on the difference between Six Sigma and other quality initiatives such as Total Quality Management and Continuous Process Improvement. Two major factors differentiating Six Sigma from other quality programs are measurable results and the insight senior executives have into various projects. The earlier programs focused on defect elimination for the sake of defect elimination. In contrast, Six Sigma requires big structural changes and lots of top-down directives. First, employees are trained in the Six Sigma ways and take on new titles such as project champion and black belt. These staffers run short term projects aimed at achieving cost reductions or revenue enhancements. The finance team, senior executives and black belts try to determine in advance how much bottom-line potential the projects hold and prioritize opportunities along those lines. By assigning values to each project, a Company has a basis for quantifying the extent to which Six Sigma efforts helped contribute to the bottom line.

The typical cost of poor quality - hardware defects and process wastes - is 20 to 30 percent of revenues. The possibilities in quality improvements, cost savings, customer satisfaction and loyalty, and employee development are enormous. Today's challenge is to measure and manage our resources. Six Sigma is a methodology whereby almost immediate quality can result from the effective use of technology and investment in intellectual capital. Significant benefits are possible in two important areas: repetitive processes in manufacturing, such as in a foundry and printed circuit board assembly and production because of greater efficiencies with multiple variables like temperature, speed and, for circuit boards, the insertion rate. Another area where major improvements are possible is in transitional processes, like completing an invoice or writing an insurance policy.

Clients of the Six Sigma Academy reported additional savings. An international pharmaceuticals company completed a cost-of-quality study that identified 22 percent more waste than did traditional accounting procedures. The company was able to increase profits dramatically by reducing waste and cycle time and improving customer satisfaction. DuPont announces 4th quarter earnings for 2000, savings from Six Sigma of \$700 million, Noranda announces 3rd quarter earnings, savings of \$51 million from first 97 Six Sigma projects, Invensys announces year 2000 earnings, savings from Six Sigma £110 million pounds., and Toshiba expects to cut ¥130 Billion in fiscal year ending March 2001 through Six Sigma . An international airline facing a decreasing share in its hub market conducted an analysis of its customers' buying behaviors and uncovered weaknesses not found in the airline's extensive customer surveys. Critical service and operational improvements were identified in the frequent-flyer program and relationship with a partner airline. The result: \$79 million in savings; a medical-device manufacturer sought to improve its quality system and become certified in an industry standard within a short time. The 80-year-old company, a leader in its industry, accomplished its goal within 15 months and was certified on the first attempt; and an internationally recognized

aerospace company in an FAA-regulated industry achieved the same result as the medical-device company in only 14 months. (DeFeo, 2000)

## STRATEGIC REQUIREMENTS FOR SUCCESS

Daniel T. Laux, President Six Sigma Academy stated in part "... that all six sigma initiatives are not created equal." Mr. Laux went on to state "...six sigma implementation and support are the keys to success - as defined by financial benefits achieved." (Laux, 2001). Many, including Hahn, et. al (1999) have observed that the major elements of successful Six Sigma implementation are strong leadership, clear performance metrics, aggressive project selection, and selecting and training the right people for success.

## TOP MANAGEMENT RESPONSIBILITIES

The Six Sigma process is being applied by a wide variety of businesses to improve quality, reduce defects and cut costs. A proven means to maintain leadership and ensure survival is to focus on customer satisfaction first before determining the direction and efficiency of any business. Basic management strategy should be developed and implemented to ensure Six Sigma success. The strategic planning process has evolved to include many layers of those who help determine the success or failure of a business or its strategy - all levels of the work force, customers, suppliers, governments, groups with vested interests and competitors. It has been proven that a focus on customers and their needs must permeate every organization. For most companies, this calls for a cultural change, characterized by high levels of collaboration, commitment and creativity from the top down. Top management can overcome the powerful forces in any company that may resist unity of direction. The answer is to find a universal thought process like Six Sigma - a common way of thinking about quality that fits all functions in an organization. Basic management strategy must be in place that includes: A vision of where the company is going - clearly stated and communicated to every single employee at all levels in language they understand; Clear definitions of a small number of key objectives that the company must be achieve if it is to realize its vision; and Translation of these objectives throughout the entire organization so that each person knows how his or her performance helps achieve those objectives. This alignment with the top priorities is critical.

## CHIEF EXECUTIVE OFFICER RESPONSIBILITIES

Just as other dramatic change programs have shown it is vital that commitment starts and remains in the strongest of terms with direct and well-publicized involvement from the chief executive officer down throughout the process. Experience shows it is a waste of valuable resources if the CEO does not express his or her personal vision, provides steady and enthusiastic encouragement, assess results and reward the participants. He or she must articulate what it means to the company's bottom line and make clear that full participation is the only choice.

Success in achieving results with the Six Sigma process depends almost completely on whether chief executive officers accept responsibility for their non-delegable roles. There are steps every CEO must take if his or her company is to achieve the quality and defect-free levels sought. These responsibilities are strikingly similar to those CEOs already routinely take, and would never delegate, in managing for financial results.

To successfully lead a Six Sigma revolution, The Juran Institute has published seven things that every CEO must do: 1 Set up and serve on the company's management council to get Six Sigma started; 2. Establish goals for the process. Make them part of the company's business plan and communicate a clear vision of where the company is going. Define a manageable number of objectives so that everyone knows his or her job helps get results, perform fair appraisals so everyone knows the results, and cite ways for continued improvement; 3. Lead the deployment process. Divide key objectives into manageable pieces. Make provision for training the entire company hierarchy in managing Six Sigma. Part of the process for many CEOs has been active participation on a Six Sigma team. This may be a real eye opener that shows CEOs their companies in totally new ways; 4. Allocate needed resources. Six Sigma is doomed to failure if the company does not allocate adequate resources to achieve the CEO's vision, objectives and goals. Resources include the time for education and training; support from trained Black Belts, data analysts and management; and information with the facts on which to act and perform assigned tasks; 5. Assign responsibilities for review and measurement. One of the necessary elements of support is a working measurement system for reviewing performance and results against goals on a regular basis. Conduct systematic reviews across the entire company. Where are we compared to competitors? What is our market position? Is it improving or getting worse? Where are we regarding cost objectives? What about employee goals? Is morale improving? Is employee turnover decreasing? Where do we need to redouble efforts? When can we take a deep breath and celebrate? 6. Lead the recognition ceremonies. One of the most non-delegable tasks of a leader is recognition. It has to be a constant effort with sincerity and come from the right person,

often the CEO. No substitute is any better than a consistent display of involvement and inspiration throughout an organization by the CEO and staff. 7. Revise the company's reward system. One of the keys to making Six Sigma a part of everything employees do is a direct link between quality and compensation. Not all CEOs believe in this link, but some may even consider involvement in the Six Sigma process a company and career requirement or necessity.

## **SENIOR MANAGEMENT RESPONSIBILITIES**

Once the CEO has clarified the vision, objectives, goals and responsibilities, senior management must follow through by doing the following: 1 .Identifying the business or businesses with the best opportunities for improved performance, set strategic and annual goals, and document accountability. 2. Establish the infrastructure and set up or revise management systems for projects, organizational reporting, accountability, appraisal, reward and recognition. 3. Select projects, leaders, teams and missions critical to meeting the goals. 4. Support projects and monitor progress by enabling teams to carry out their mission and provide the necessary training, resources, budget, time, support and monitoring to keep projects on track.5. Ask the right questions throughout until each project has been completed.

Six Sigma places the entire value chain for product design, production, testing, and delivery; information and customer services; and the organizational structure and decision-making that support it under an intensive review process. The disciplined approach focuses primarily on the most vital processes, those whose outputs have the biggest impact on customer satisfaction and costs.

## **APPLICATION OF THE SIX SIGMA PROCES**

Six Sigma is a data-driven method for achieving near-perfect quality by using a traditional set of quality tools that have been evolving for years. In the 1980s, everyone had a different problem-solving method for improving quality. One of the most universally used was Juran's method that provided a standardized way of achieving Six Sigma results. The Six Sigma approach has almost become a standardized five step process. Paul (1999) identifies Six Sigma's five-step (DMAIC) process. The process is a method of translating a customer's needs into separate tasks and defining the optimum specification for each, depending on how all of the tasks interact. Six Sigma can reduce defects in products and services to unprecedented levels because of its strong emphasis on statistical analysis and measurement for product design, manufacturing and the entire area of customer-oriented activities.

The tools and techniques Six Sigma's process uses are the basic fundamentals of quality management. The five steps are: 1. Define: A Six Sigma project team identifies a project suitable for Six Sigma efforts based on business objectives as well as customer needs and feedback. As part of the definition phase, the team identifies those attributes, called CTQs (critical to quality characteristics), that the customer considers having the most impact on quality. 2. Measure: The team identifies the key product characteristics, key internal processes, and process parameters that influence CTQs and measures the defects currently generated relative to those processes. 3. Analyze: The team discovers why defects are generated by identifying the key variables that are most likely to create process variation. 4. Improve: The team confirms the key variables and quantifies their effects on the CTQs. It also identifies the maximum acceptable ranges of the key variables and validates a system for measuring deviations of the variables. The team modifies the process to stay within the acceptable range and optimizes performance. 5. Control: Tools are put in place to ensure that under the modified process the key variables remain within the maximum acceptable ranges over time.

How Does Six Sigma Work? In addition to the strategic steps that must be taken, the real results come from hard work at the front line level. Successful Six Sigma project execution is highly dependent on properly walking through the Visualize and Commit steps prior to full-scale characterization and solution development. Also key is properly scooping the project so execution can occur in a reasonable period of time. The Six Sigma informal or mirror organizational hierarchy and training of key players lead to this success. The Six Sigma Academy identifies the corporate hierarchy for successful Six Sigma institutionalization: The Breakthrough Strategy Players - At every level of the organization the Breakthrough Strategy requires that personnel be trained in the ways of Six Sigma and each has unique responsibilities .Executive Team - Owns vision, direction, results. Actively Leads change. Deployment Champions - Develops deployment plan. Actively leads business units and functional areas (IT, HR, Finance, and Communications). Project Champions - Identify projects, implement solutions, and regularly review Black Belt results. Black Belt - Full-time project leaders, use six sigma tools to identify and solve problems, and train and coach project teams. Green Belts - Individuals who support the implementation and application of Six Sigma tools by way of participation on project teams. Project Team Members - Part-time process experts who work with a Black Belt to identify and solve problems (project specific). Master Black Belt - Train and mentor Black Belts, facilitate large projects.

Six Sigma begins with the selection of employees whom outside specialists will train as leaders. Many of them will devote full time in carrying out each project. Next, briefings will help executives gain a common understanding of the Six Sigma approach. Following this is a two-day “champion” workshop that generates excitement among the management ranks.

First, four days of training enables participants to learn methods of achieving Six Sigma levels of quality, using a problem-solving and improvement methodology in addressing chronic situations through root-cause analysis. Completion of these sessions certifies employees with what is called Green Belt status.

Second, four interactive sessions of four days each over about sixteen weeks will certify a small number of employees as Black Belts. The company selects projects after the first week, and candidates must apply what they learn to their project during the three to four weeks before the next session. They must demonstrate results to graduate. Candidates typically are at managerial or technical specialist level and will have responsibility to implement Six Sigma in a business unit. They develop, coach and lead process improvement teams; mentor and advise management on prioritizing, planning and launching projects; and use, teach and disseminate tools and methods to Green Belt associates and team members.

The third and top level of experience is Master Black Belt status. Employees with this responsibility are experts on the theory and implementation of Six Sigma and must teach the process. They are company-wide quality experts on the methodologies, tools and applications in all functions and levels of the company. Also, they provide leadership in integrating the Six Sigma approach into the company's business strategy and operational plans. A Master Black Belt candidate must lead several successful project teams to become certified.

At General Electric alone in the initial stages of Six Sigma, more than 100,000 people were trained in its science and technology. By the end of the year 2000, the total number of people trained in Six Sigma throughout business and industry will be well over that number.

Black Belts launch and support project teams that deploy Six Sigma. Projects can be of different size and duration, are highly structured and take a very systematic approach within three categories: Transactional business process projects, large scale improvement of a business process, such as order taking that extends across an organization; Traditional improvement projects aimed at solving chronic problems crossing multiple functions of an organization; Work team project within one department.

Once the company has selected one or more repetitive processes and has chosen and trained teams, the discipline identifies natural and unnatural patterns of variation in each process. In making revolutionary improvements, the process reveals unnatural sources of variation and removes them. Six Sigma provides the means of reducing that variation and then controls the process so variations will not return. If variations do return, a statistical warning detects them quickly. A trend that seems to be gaining momentum is that companies are using their Black and Master Black Belt employees full time in these assignments, instead of part time in addition to their regular responsibilities.

Depending on the circumstances, it is not always necessary to achieve Six Sigma, but you should aim for the levels that will significantly improve quality and reduce defects. Using the basic Six Sigma set of tools, an organization can pursue the process step by step to achieve the necessary results for its purposes and not have to reach the ultimate potential. Companies must build around their capabilities and proceed at a level consistent with their resources. For example, train and use the number of Black Belts best assimilated in your organization. In other words, if your target, for example, is to get \$50 million in improvements, then you need up to 1,000 employees qualified as Black Belts.

## CONCLUSIONS

Everything a company does is a candidate for the Six Sigma process, whether it is design, yield, communications, paper work, training, production, inspection, testing, returns, recalls, rejects, response time, attitude, waste, or organizational structure. The disciplined processes Six Sigma uses also apply to high-level knowledge work, finance, law and engineering, but the procedural steps are specialized. In any event, only those improvements that affect customers will help companies gain a competitive advantage.

The possibilities in quality improvements, cost savings, customer satisfaction and loyalty, and employee development are enormous, but the Six Sigma process requires a commitment of time, talent, dedication, disciplined persistence and an investment in company funding. It is a quality or productivity program with many lessons learned from the 1980s. It must become a central, pervasive effort that demands unprecedented focus and teamwork.

Proper communication of project status to key stakeholders, especially during solution development and implementation phases, cannot be overstressed. The degrees to which communication efforts may need to be stepped-up often depend upon the level and concentration of Leadership commitment to the project. This is one of the key elements of Six Sigma.

Six Sigma is a significant cultural change that takes time to complete. It is not free. It requires resources and training. But it delivers customer satisfaction, quality products and services; a healthy return on investment, and satisfaction that all employees have from being on a winning team and proud to be part of such a company. This study extends the research of Six Sigma systems into the area of cross-functional, organization boundary spanning, and technical management.

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# **HUMAN RESOURCE CAPACITY BUILDING IN THE PUBLIC SECTOR OF BALOCHISTAN**

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## **ABSTRACT**

*Today, the world has realized the strategic importance of human resource as crucial factor for the socio-economic development of a country. The accomplishment of national goals and objectives through the network of public sector organizations is directly indebted to the human resource potential. A capable human resource can miraculously increase the pace of development in a country if properly utilized. The aim of this research article is to build the human resource capacity in the public sector of Balochistan through a systematic analysis of the human resource capabilities for the organizational goals and objectives accomplishment. The main focus of the study is on the capacity development model to cater the organizations human resource needs in a dynamic environment. Modern organization has to constantly modify, adapt and orient its plans, principles, practices and techniques to keep pace with the fast changing environment and to prepare its employees accordingly. The study is descriptive in nature and mainly secondary sources of data are used.*

**Keywords:** **Human Resource Capacity:** The capability of the organization's human resource to perform specific assigned task effectively and efficiently on continuous basis, **Mission Statement:** The long term vision of an organization, stating its reason for being, **Government By Objectives:** It is a process whereby superior and subordinate in a public sector organization jointly identify common goals and assigning responsibility to individuals and groups for accomplishment of those goals and assessing their contribution, **Job Description:** A simple, concisely written statement delineating the contents and essential requirements of a job, summarizing of the duties to be performed and personal requirement, **Job Specification:** A statement of essential skills, knowledge, abilities and other credentials that a person needs to perform the job.

## **INTRODUCTION**

Public sector has assumed greater role and the socio-economic uplift of the people of almost every country heavily rely on its institutions. These institutions have been established in various spheres to serve the public, but the expansion of public sector and the growing number of socio-economic development projects and programs have strained the professional capacity of the public servants in almost all the developing countries. Balochistan is not an exception, and the concern for improving the quality of services provided by the public sector has intensified. The scarce resources of the province need to be properly utilized to achieve the required objectives more efficiently and effectively. But the province is facing with acute shortage of well-educated and well-trained work force in different areas of expertise, which has resulted in serious inefficiency. In order to improve the performance of public sector institutions, greater attention is required to build the human resources capacity in the province.

Capacity can be defined as capability to perform the specific assigned task effectively and efficiently on a continuous basis. Capacity is like a container having some volume. The container can be filled to the extent of its volume. However, human capacity to perform assigned specific tasks efficiently and effectively is not fixed, it can be enhanced and improved through training, interaction and exposure to new methods, skills and opportunity to use acquired skills<sup>2</sup>.

Institutional capacity is the ability of institutions, agencies, organizations and officials to make policies, ensure coherence and coordination and ensure compliance. Government has been a labour-intensive activity<sup>3</sup>. Its productivity can be enhanced by the human resources capacity building. Institutional mechanism is in the hands of human resources. It is human who plays an important role. A good system can be spoiled if it is given in the hands of a bad person and the opposite is also true<sup>4</sup>. The

<sup>2</sup> Seemi Waheed, "Capacity Bulding in Public Sector Organization", Islamabad: Pakistan Institute of Development Economics (PIDE), The Pakistan Development Review, Volume 38, 1999, p. 915.

<sup>3</sup> George W. Downs, Patrick D. Larkey, "The Search for Government Efficiency", New York: McGraw Hill, Inc. 1986, p. 190.

<sup>4</sup> Iqbal A. Kidwai, "Governance: Balochistan Conservation Strategy Background Paper", Quetta, IUCN, The World Conservation Union, 2000, p. 56.

important constraints on the institutional ability to design and implement the public sector programmes, are under-developed human resources. In the provision of public services, the skills and knowledge that are essential to plan service delivery systematically, is lacking at all levels, particularly at district level in Balochistan. This lack of human resource capacity has hampered the performance of public sector in Balochistan to a great extent. The absence of cost-effectiveness in the whole range of action, from planning to delivery in public sector is a major impediment to the effective delivery of economic and social services in Balochistan. Building an effective work force is, thus a prerequisite for reaching a high level of productive efficiency. The ability of public sector institutions to allocate scarce economic resources for the best possible uses, in Balochistan, requires a careful strategy for the human resources capacity building. The central argument of Pakistan's first five year plan was that, the rate of progress of the country is determined not only by the magnitude of resources, but also by the administrative and managerial capability<sup>5</sup>.

There is always room for more effective and efficient way of performing work by developing the human resources skills and talents. The human resources of an organization are said to be more efficient if they produce more and better results with less labour and in a shorter period of time. Efficiency implies, "more, better, faster, and cheaper"<sup>6</sup>. Effectiveness, on the other hand, is producing the desired results with greater accuracy and precision. Efficiency may involve the introduction of new and better methods, and technology, for the accomplishment of objectives and goals. Efficiency in the public sector is also related to change. In order to achieve efficiency, effectiveness and fairness in public sector organizations, change is required<sup>7</sup>. Building human resource capacity can better facilitate this change. It can also accelerate the adoption of change. Employees are the most important [and dynamic] asset of an organization<sup>8</sup>. Building human resource capacity will ensure the successful implementation of social sector activities in Balochistan.

The lack of capacity in general, is perhaps, the single most important impediment to attaining the goal of sustainable development in Balochistan. There is a local scarcity of technical expertise, especially in the area of sustainable development<sup>9</sup>. This has steadily increased reliance on contracting outside consultants, but ironically, the knowledge and skill to benefit from the contracted consultants is also diminishing<sup>10</sup>. The public sector has expanded in size in response to the increasing population and its civic needs but the capacity for good governance has also shrunk. Decision-making is mostly on ad hoc basis and remote from implementation due to acute shortage of expertise and technical staff in the public sector organizations.

Balochistan is the poorest province of Pakistan. The public sector services in the province are allocated monetary resources through the NFC award, five-year plans and special programs, e.g. Social Actions Programs<sup>11</sup>. Balochistan receives very meager amount as a provincial share from federal revenue. In Balochistan, the public sector straddles all economic, social and cultural activities through a variety of agencies. Its contribution to equitable and sustainable economic and social development is minimal due to inefficient utilization of these resources.

Most planners and economists agree that the best mechanism for sustainable development in the future is to ensure effectiveness and efficiency of public sector institutions through the human resource capacity building. Human resources capacity and capability are important elements which can affect the quality of public service delivery. Moreover, resource constraints make it imperative for the public sector to leverage all possible means to preserve scarce economic resources. Human resources capacity and capability directly affects the well being of the poor in Balochistan. Both economic progress and poverty reduction are dependent on the quality of public sector institutions. There is considerable evidence to link higher quality and efficient public sector to a higher pace of economic development and social well-being. Low human resources capacity and weak institutions have strong and significantly negative effects on growth and development<sup>12</sup>. Poorly staffed and bad institutions play a considerable role in bringing about low economic development, thus leading to poverty. The lack of capacity in general, is perhaps the single most important impediment to attaining the goal of sustainable development in Balochistan. Human resources capacity is important for the economic development of the province because, capacity building is synonymous with development<sup>13</sup>. The development of human resources capacity will enable the public sector to translate sound development goals into effective plans and then proper implementation of these plans to achieve desired results. The problems associated with the human resources in Balochistan, include poor planning, waste of resources, mismanagement inefficiency and the absence of work ethic. Bad working practices and poor performance are the main impediments for the

<sup>5</sup> Govt. of Pakistan, "First Five Year Plan 1957", Islamabad: Planning and Development Department, 1956.

<sup>6</sup> Robert Albanese, "Managing Towards Accountability for Performance", New York: Richard D. Irwin, Inc. p. 13.

<sup>7</sup> Iqbal A. Kidwai, "Governance: Balochistan Conservation Strategy Background Paper", Quetta, IUCN, The World Conservation Union, 2000, p. 20.

<sup>8</sup> Scot Adams, "The Dilbert Principle", New York: Harper Business, 1996, p. 51.

<sup>9</sup> IUCN; The Word Conservation Union Pakistan and GoB., "Balochistan Conservation Strategy 2000", Karachi: IUCN, GoB., 2000, p. 202.

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<sup>11</sup> Iqbal A. Kidwai, "Governance: Balochistan Conservation Strategy Background Paper", Quetta, IUCN, The World Conservation Union, 2000, pp. 10, 11.

<sup>12</sup> Rodrik D. "TFPG Controversies, Institutions and Economic Performance in East Asia", London: Cambridge Mass, NBER Working Paper 5914.

<sup>13</sup> Merilee Grindle, "The Good Government Imperative: Human Resources, Organization and Institutions", Boston: Harvard University Press, 1997, p. 205.

efficient utilization of resources in Balochistan. Several initiatives by the government in Balochistan failed to bear results not due to lack of money but because of ineffective employment of available resources. There is a perceived gap in the existing capacity, both in terms of human and system support resources<sup>14</sup>.

The development of human resource capacity is a dynamic process and needs to be updated with changes in the organization's priorities and targets.

The effectiveness of public sector is ensured when clear missions, goals and objectives are set and the human resources are directed to achieve them. For achieving defined goals, the employees must have clear job descriptions and job specifications. The mission statement and clear goals and objectives are important elements since human resources can not be expected to accomplish a task with effectiveness or efficiency unless they know what the end points of their efforts should be<sup>15</sup>. Clear job descriptions and job specification would help the public sector organizations to identify their work force requirements in terms of skills, abilities and talents to perform their duties. The capacity building issue in Balochistan must have clear objectives. The up gradation of skills and professional competencies require achieving targets in the short term and in the long term. This up gradation of skills and professional competencies require training and development programmes.

The Cohen framework for analyzing capacity building issues consists of dimensions like, targeted personnel capacity (i.e., personnel who carry out public sector functions, such as public sector manager, professionals, technicians and workers), capacity building stages (beginning with anticipating, planning and advocating manpower needs; training and upgrading skills through in-service programmes), external institutional, manpower, and support system (e.g. obtaining support from institutions, in charge of training, institutions that play a role in supporting capacity building efforts). But his framework does not cover some important aspects of capacity building. Human resources capacity is a relative term which means the potential of human resources to discharge work and accomplish specific goals and objectives efficiently and effectively. The human resources capacity must be measured in relation to the goals set for them and the tasks assigned to them. Thus the starting point for building human resources capacity, is the mission statement and the goals and objectives are than derived from it. But Cohen, Boeninger and others have not mentioned goal setting or developing mission statement in building capacity in the public sector organizations<sup>16</sup>. Similarly in Balochistan, ministries, divisions and departments lack mission statements. Majority of the activities carried out, are run on the "treadmill" without due cognizance to identification of problems and its resolution through capacity building<sup>17</sup>.

## MODEL FOR BUILDING HUMAN RESOURCE CAPACITY OF THE PUBLIC SECTOR ORGANIZATIONS IN BALOCHISTAN

In order to build human resources capacity in the public sector of Balochistan, a viable model is developed. The basic elements of the model are, mission statement, goals and objectives determination, spotting organizational performance problems, recognizing individual and group performance problems, job analysis, job description, job specification, performance appraisal, training and development needs assessment, formulating training and development programmes, deciding the type and method of training, conducting training and evaluating training.

The model suggested for the building of human resource capacity is generic one. It can be applied to any public sector organizations, e.g., (ministry, division, department, semi-autonomous body etc) in Balochistan to improve performance and thereby increase the efficiency and effectiveness of the organization. The elements of the above model may require some modification in peculiar circumstances.

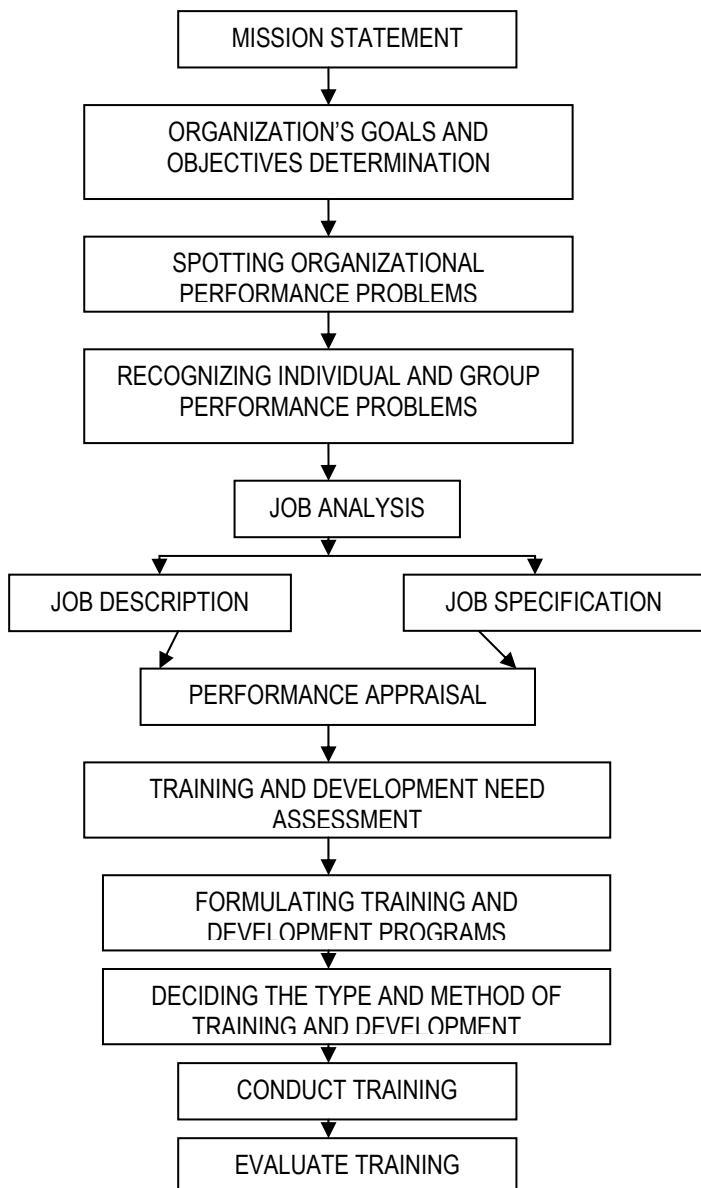
It will help in identification of the variables of building human resources capacity for the effective and efficient performance. Following is the model for building human resources capacity in the public sector organizations.

<sup>14</sup> Govt. of Pakistan , National Commission for Human Development, "Report on Capacity Building, Need Assessment Workshop for Executive District Officers", Islamabad: 2002, p. 1.

<sup>15</sup> Heinz Weihrich, Harold Koontz, "Management, a Global Perspective", 10<sup>th</sup> Edition, Singapore: McGraw Hill, 1994, pp. 61, 62.

<sup>16</sup> Edgardo Boeninger, "Governance and Development Issues and Constraints", World Bank: Proceeding of the World Bank Conference on Development Economics, 1992.

<sup>17</sup>Seemi Waheed, "Capacity Building in Public Sector Organization", Islamabad: Pakistan Institute of Development Economics (PIDE), The Pakistan Development Review, Volume 38, 1999, p. 916.



## ORGANIZATION'S MISSION STATEMENT

The starting point for building human resources capacity is the mission statement. Without mission statement, the concept of building human resources capacity, would be like a journey without destination. The mission statement set the direction for building human resources capacity in any organization. Mission statement is sometimes called a statement of purpose. The mission statement explains what the organization is and what it seeks to achieve. A mission statement reveals the long-term vision of an organization in terms of what it wants to be and [what goals and objectives it wants to accomplish]<sup>18</sup>. It gives identity and direction to the organization<sup>19</sup>. The mission statement is a declaration of an organization's "reason for being". It is essential for effectively establishing objectives for performance. A clear mission statement is the foundation for plans and work assignments. The question of developing human resources capacity is meaningless without clear mission statement. The argument is that, we are developing human resources capacity for what. Every public sector organization is established to satisfy a specific social need. The mission of a university is teaching and research etc. All the public sector organizations have different missions entrusted to them by society. The goals of the organizations with regard to their stakeholders are always necessary. What philosophy governs the activities in the organization is to focus the efforts of employees towards desired ends. In the absence of a mission statement, neither goals nor objectives can be formulated, nor can capacity be enhanced<sup>20</sup>. In the presence of clear mission statement, the performance of employees can easily be measured.

<sup>18</sup> Fred R. David, "Strategic Management", 6<sup>th</sup> Edition, New Jersey: Prentice Hall Inc.1997, pp. 78, 79.

<sup>19</sup> Seemi Waheed, "Capacity Building in Public Sector Organization", Islamabad: Pakistan Institute of Development Economics (PIDE), The Pakistan Development Review, Volume 38, 1999, p. 916.

<sup>20</sup> Seemi Waheed, "Capacity Building in Public Sector Organization", Islamabad: Pakistan Institute of Development Economics (PIDE), The Pakistan Development Review, Volume 38, 1999, p. 916.

## ORGANIZATION'S GOALS AND OBJECTIVES DETERMINATION

From the mission statement a set of goals are derived, and from those goals the objectives, which are specific, measurable, achievable, realistic and time-bound are spelled out.

The selection of sound goals and objectives contribute to the organization's mission. They are the ends toward which all the organization's efforts are aimed. The selection of appropriate goals and objective are highly important for an organization's success and failure. The efficiency and effectiveness of an organization is measured by the extent to which it achieves goals and objectives

The employees' performance can only be evaluated by setting clear objectives for them. Without clear objectives and goals, the performance evaluation of an organization and its employees would be like taking a shot in the dark. Peter Drucker, one of the most prolific writers on management, has introduced his famous theory of Management by Objectives (MBO). Drucker realized that one of the major problems, confronting many large organizations was a lack of identification by the employees with the objectives of the organizations. With functionalization and specialization so highly developed, many employees were very much divorced from the direction and purpose of the larger system. The purpose of MBO is to give employees clear direction for exactly what they are expected to accomplish, in a given time span. According to Peter f. Drucker, "the activities performed in an organization should be result oriented and these results must be truly meaningful; that is, the results that are relevant to the idea of the organization, for which it is established, its excellence, its priorities, and its opportunities"<sup>21</sup>. Thus MBO is concerned with goal setting and planning for individuals and their units or work groups<sup>22</sup>.

MBO has received a great deal of attention in both public and private sectors organizations. This goal- setting theory also has an impressive base of research support. For the public sector organizations, the term, "Government by Objectives (GBO)" is coined to improve their performance. The aim of introducing GBO is to determine goals and objectives for a public sector organization that are tangible, verifiable and measurable. These overall organizational objectives are than converted into specific objectives for organizational units and than further for individual's employees. GBO operationalizes the concept of objectives, by devising a process by which objectives cascade down through the organization. The organization's overall objectives are translated into specific objectives for each succeeding level (that is, divisional, departmental, individual) in the organization. And for the individual government employee, GBO provides specific personal performance objectives.

The objectives in GBO should be concise statements of expected accomplishments. Each objective has a specific time period in which it is to be completed. The public sector employees should also receive continuous feedback on how well they are performing in pursuit of those goals and objectives.

Once the public sector organizations have established their goals and objectives, the next step is to arrange activities in a way to facilitate the achievement of its goals and objectives. This is possible through proper jobs description and jobs specification.

## SPOTTING ORGANIZATIONAL PERFORMANCE PROBLEMS

Once the public sector organizations have established their goals and objectives, the next step is to identify the existing and potential organizational problems in productivity, efficiency, and effectiveness. Organizations initiate training and development programs to overcome problems which they are facing in the achievement of their goals and objectives. A problem is normally defined as a difference or discrepancy between what is actually happening and what should be happening. A problem can also be an uncertain or disturbed situation. All the organizational problems may arise due to some factors. These factors include performance problems, technology change, change in external and internal environment, and new legislation, changes in social and political preferences requiring new improved performance. Once the organizational performance problems are identified, the next step is the analysis of jobs.

## JOB ANALYSIS

Job analysis defines all the jobs within the organization and the behavior necessary to perform these jobs. It analyzes each job with its requirements and the actual behavior of the job holder and then compares the job holder performance with the standard performance. The result of this comparison shows the gap between performance standards and actual achievements expressed in terms of missing competence. Job analysis gets information about jobs and uses that information to develop job descriptions and job specification

<sup>21</sup> Peter F. Drucker, "Managing By Results", New York: Harper and Row Publishers, 1964, p.216.

<sup>22</sup> Stephens J. Carroll and Henry L. Tosi, "Management by Objective", New York: Macmillan, 1973, p.83.

## **JOB DESCRIPTION**

In order to achieve the objectives of a public sector organization, many tasks and activities must be performed. A group of tasks performed by one person makes up position. Identical positions make a job, and broadly, similar jobs combine into an occupation. Every employee in an organization must have clear job descriptions which mean that their duties must be put in writing. To make useful information available for each employee in an organization about his activities, a form called job description is used for communicating to jobholders what their duties are. It is simple, concisely written statement, delineating the contents and essential requirements of a job. It contains a summary of the duties to be performed and a statement of the personal requirements of an adequate employee. The job description typically contains three sections, which identify, define, and describe the job<sup>23</sup>. The job description is very useful for job evaluation, training and performance appraisal<sup>24</sup>.

The effectiveness of any organization is established when every employee is quite clear about the duties he or she is performing. This makes him responsible for the tasks which are assigned to him. The accountability of the each worker can be enhanced by establishing clear job description in the public sector organizations. An organization is composed of numerous individuals with different job descriptions. Each job description gives direction to the individual employee much the same as mission statement gives direction to the overall organization. This job description also sets a sort of standard for the performance of an individual employee.

The public sector employees in Balochistan mostly lack job description. Particularly, the employees of lower grades do not have proper job descriptions. Many Non Government Organizations (NGOs) and the United Nations agencies, working in the province, have adopted the international standard of employment practices, by establishing clear job description for their employees. The job description helps the organizations to motivate their employees, by setting clear performance standard and goals and objectives for individual employees. The public sector jobs are mostly secure, permanent, and there is no incentive to work hard because promotions and benefits depend on seniority not on performance<sup>25</sup>. This situation has resulted into apathy, boredom, and lack of commitment towards job. In order to improve performance, the determination of goals and objectives, which are clearly mentioned in job description, is highly valuable. Job description is a process of converting overall organizational objectives into specific objectives for individuals. It provides for the individual public sector employees, specific personal performance objectives.

## **JOB SPECIFICATION**

Job specification is also related to the performance of individual employees. The job specification lists the skills, abilities, and other credentials needed to do the job<sup>26</sup>. The job specification document explains in detail, each job factor and the importance and meaning of each sub factor and also its degree of importance in rating a specific job. It also contains statements of mental, physical, and other demands, made on job incumbents. To perform a job or to accomplish an objective requires some skills, knowledge, ability or competency. The degree, to which an employee produces results, varies from employee to employee. It depends upon the level of skills, knowledge and competencies. The job specification serves many purposes. It is the criterion for determining personal efficiency, training employees, achieving work simplification, achieving better performance rating, and granting promotions and transfers. In this highly dynamic world when rapid changes are taking place in technology, economic and social environment, the job requirements, are also constantly changing. The job specification document must constantly be up dated and modified for all categories of jobs in the public sector organizations to meet the emerging trends. In Balochistan, the public sector organizations must keep appropriate human resources potential to cope with present and future challenges. The organization's objectives are constantly changing in this dynamic world. The job specification of each individual employee must properly match the job description and the job description of each employee must fit into overall organizational structure to achieve the organization's objectives and goals. It should be recognized that many jobs require numerous combinations of abilities and temperaments for their successful completion<sup>27</sup>.

## **PERFORMANCE APPRAISAL**

Since organizations in the public sector exist to achieve goals, the degree of success that individual employee has in reaching their individual goals are important in determining organizational effectiveness. The assessment of how successful employees have been at meeting their individual goals is the purpose of performance appraisal. The performance appraisal of employees

<sup>23</sup> George T. Milkovich, John W. Boudreau, "Personnel: Human Resource Management, A Diagnostic Approach", 5<sup>th</sup> Edition Delhi: Richard D. Irwin, Inc.1998. p.137.

<sup>24</sup> Robert Albanese, "Managing: Towards Accountability for Performance", Delhi: Richard D. Irwin Inc .p. 513.

<sup>25</sup> Syed Tahir Huazi, "Motivational Aspects of Good Governance", Islamabad: Pakistan Institute of Development Economics (PIDE), The Pakistan Development Review, Volume 38, 1999, p. 905.

<sup>26</sup> Ricky W. Griffin, "Management", 5<sup>th</sup> Edition, Delhi: A.I.T.B.S. Publishers & Distributors, 1991, pp. 388, 389

<sup>27</sup> Frederick Herzberg, Bernard Mausner and Barbra B. Snyderman, "The Motivation to Work", 2<sup>nd</sup> Edition, New York: John Wiley & Sons, 1959, p. 134.

is used to identify areas where training and development are needed. Through performance appraisal, the employee's specific skills and knowledge deficiencies are spotted and the training and development needs are assessed.

## TRAINING AND DEVELOPMENT NEED ASSESSMENT

The human resources capacity building requires that the training and development needs of the employees must be properly assessed. This entails ascertainment of the existing knowledge and skills of the employees present performance levels and their deficiencies and the performance required after the changes in the employees job description and job specification. In addition, it involves finding out that what type of higher skills and competencies are required to be provided to certain people for placing them in higher positions or to facilitate the change in organization's objectives and goals. In order to facilitate a proper assessment of the training and development needs, analysis is done at three levels.

Organizational analysis studies the organization, in the context of its socio-economic and technological environment and its human resources requirements in the changing scenario.

Operational analysis scrutinizes the job performance of the employee in the light of their job descriptions and job specifications and arrives at facts which enable the organizations to set training and development objectives and standards and identify the skills and abilities needed by the employees.

3) Man analysis involves judging of the performance of an employee and using diagnostic analysis to compare the job description and job analysis to find out reasons for his deficiencies. Similarly, there are many ways of diagnostic tests for man analysis, such as observation on the job, scrutiny of personal records, interviews and questionnaire etc.

## FORMULATING TRAINING AND DEVELOPMENT PROGRAMMES

After thorough analysis of the organization and individual employee's training and development needs assessment, the next stage is the formulation of training and development programmes. The human resources capacity building requires that the training and development programmes must be properly arranged to pinpoint the organization's capacity building needs and the performance needs of individual employee. A carefully formulated training and development programme can benefit the organization to achieve its objectives more efficiently and effectively. After formulating the training and development programmes, the next stage in the human resources capacity building process, is to decide the type and method of training and development.

## DECIDING THE TYPES AND METHODS OF TRAINING AND DEVELOPMENT

At this stage of the human resources capacity building process, the decision relating to the type and method of training and development of employees is required. In deciding the type and method of training, the organization's objectives and goals must be kept in mind. Moreover, training is a costly venture, involving shifts in financial, material, and manpower resources which must be carefully decided. It must be clearly indicated that what are the objectives for which training is to be given, and the manner in which training will be conducted in the organization for various levels of staff. The estimated costs for conducting training and development programmes and the expected benefits for the organization must be properly matched. The question of what is to be achieved in terms of changes in knowledge, skills and attitudes of the trainees, the cost associated with each training programme, and in what manner training is contributing to the furtherance of organizational efficiency, are highly important. There is always a need to know as to what type of training should be given to the employees in the organization, what method should be adopted to train the employees.

There are different methods used to help the workers acquire knowledge, skills, and behaviour. These methods can be organized into three broad categories, "(a) presentation methods, (b) hands-on methods, and (c) group building methods"<sup>28</sup>. The method so chosen must be evaluated on the bases of training and development requirements of the employees and organization. Each method has some advantages and disadvantages, some methods are more effective for one category of workers than the other methods. The usefulness of methods depends upon the elements like, nature of skills to be developed, required workers category to be trained, and the cost effectiveness. The selection of a training method should be based on increasing learning effectiveness and reducing training costs.

<sup>28</sup> Mc Murrer D. Van Buren M. and Woodrell Jr. W. "The 2000 ASTD, State of the Industry Report", Alexandra, VA: American Society for Training and Development, 2000, pp. 57-66.

## **EVALUATION OF TRAINING AND DEVELOPMENT**

The final stage, in the process of capacity building, is the evaluation of training and development programmes. Training and development evaluation determine whether our efforts are achieving its results in terms of correcting the deficiencies in skills, knowledge, and attitude for which the training and development programmes were initiated. The training and development programmes must be cost effective; that is, to ensure that training and development costs generate meaningful returns.

## **CONCLUSIONS**

Human resource is the most precious asset of an organization. Building human resource capacity can greatly enhance the efficiency and effectiveness of the public sector organizations. Balochistan is a resource rich province of Pakistan. It is endowed with vast reservoirs of natural resources. But the utilization of these natural resources for the prosperity and welfare of the people of Balochistan requires the building of human resources capacity. Building human resource capacity is a systematic process encompassing various steps. These steps are arranged in a logical sequence to form a suitable model for capacity building purpose. The model suggested is generic one and each step is elaborated to understand its importance.

# IT PROJECT MANAGEMENT BEST PRACTICES IN A EXPANDING MARKET

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## ABSTRACT

*This article examines emerging trends in the profession of IT Project Management in a global economy. Within the last decade project management theories and concept have become accepted standards in many organizational industries. The increasingly important role of information technology is undoubtedly the effect of rapid globalization that requires companies to have a larger capacity, timelier and more accurate information management within their decision making system. The IT project management “body of knowledge” has advanced greatly through the collaborative work of project management practitioners, trade associations, training institutions and universities. The expansion and innovation to this “body of knowledge” seems to be contributed by the growing practice of open sourcing by practitioners and educators alike through social network sites, blogs and other media sharing outlets. The future of IT project management may become more of an external operation with more organizations outsourcing their IT program and portfolio departments. This article should provide the framework necessary to further understand the relevance of IT Project Management in the global market and where it is headed.*

**Keywords:** *Enterprise Management; Outsource; Open-Source; IT Project Management*

## I. INTRODUCTION

The need and presence of project management knowledge has developed to become a necessity in many organizational industries, while project management methods, processes and certifications have become accepted standards in many industries. In 2008 Global Knowledge and Fortune Magazine listed project management in their top 10 career of choice, while in a recent salary survey conducted by ZDNET's Tech Republic organization, the PMP (Project Management Professional certification) was listed as the highest paying certification to have in the technology industry, while other project management certifications governed by the International Project Management Association (CPD, CPM) and Office of Government Commerce (PRINCE2) are highly sought after in European industries. Many IT certifications include various aspects of project management such as risk management, strategic alignment, and resource management as an area for testing overall proficiency. The increasing attention on project management has increased the need to educate and further develop project managers and staff in order to provide better services, especially in the IT sector.

Communication and information technology has also developed rapidly within this decade. With the enhanced role of information technology, project managers must also prepare themselves to face the challenges of the future, both in the industry of project management as a whole and in the IT sector in particular. The increasingly important role of information technology is undoubtedly the effect of rapid globalization that requires companies to have a larger capacity, timelier and more accurate information management within their decision making system. This paper is directed to discuss the development of IT project management with regards to the increasingly globalize world.

## II. PROJECT MANAGEMENT

### II.1 Definition by Purpose

Before we discuss the development of project management in the global environment, this paper will briefly describe the understanding behind the concept of project management. There are numerous perspectives regarding the concept. Thus, the definitions generated by these perspectives also vary, according to the context in which it is discussed. However, the purpose of most project management activities is generally similar. Project management is a way of managing and organizing corporate resources so that the available resources can generate the completion of a project within the given time, scope and constraints (Wideman, 2001).

The understanding behind project management also accounts definitions of 'a project' itself. A project is a unique endeavor performed to create a certain product or service (PMI, 2009). This definition is dissimilar to the definition of process and operation due to several factors. The easiest to define is the time-constraint factor. A project performed activities in limited time of work, while process and operations generally accounts for continuous efforts. A project is aimed to produce a single or a group of product or services and the chain of activities are terminated once the goods or the services are produced.

## II.2 Project Management and Enterprise Management

Besides time-constraint, there are other factors that differentiate project management from other concepts. For instant, people tend to confuse project management with enterprise management. The two managerial terms have differences in the following respects:

### ***Management and Enterprise Management: Direction***

In enterprise management, the sense of direction is revealed in the form of goals. Enterprise management's goals are characterized with continuity. It result activities to produce of goods and services in repetitive manner. The goals are defined into a set of objectives.

On the other hand, a project management expresses its sense of direction in formulation of a purpose. A purpose is different from a goal in its nature of being singular. Purposes are reasons of being. Activities are over once it served its purposes. The purpose of a project is to produce a single or a set of goods and services. Afterwards, the project is obsolete. In a sense it is directed to change something, rather than doing continuous activities. The direction of the change is defined through sets of programs.

### ***Management and Enterprise Management: Process***

In enterprise management, the goals are achieved by means of strategies and tactics. The sets of strategies and tactics resulted consistent activities which resulted continuous production efforts. In project management, the purposes are achieved through sets of projects. The projects will ten be specified into sets of tasks and efforts to produce a unique product rather than continuous production efforts (Al Neimat, 2005).

## II.3 Basic Principles of Project Management

After justifying the differences between project, management and enterprise management this paper will focus more on the project management concept. The traditional project management concept consist of three main constraints, they are:

### ***Basic Principles of Project Management: Time***

As mentioned previously, an important characteristic of project management is its attention on time constraints. Time management is an inseparable part of a good project management. One of a project's important values of success it its ability to fulfill the job within the given time-constraint. The entire time-frame of a project is broken down into time required to complete components of the project, which is then broken down further into time required to complete each task as a part of each project component.

### ***Basic Principles of Project Management: Cost***

Due to its unique (incidental) nature, a project management has a considerable different cost management models compare to those of enterprise management. Cost determination is faced by larger challenges of financial fraud due to the project's incidental nature.

### ***Basic Principles of Project Management: Scope***

This constraint elaborates the end result of a project, the level of quality required, etc. Determination of the scope of a project generally accounts for a trade-off between cost and quality, time and quality, etc. (Sribnivasan, 2005)

## III. ROLE AND BENEFITS OF PROJECT MANAGEMENT

The elaboration in the previous chapter has described the constraints of a project management activity. However, it is vital that we understand the usefulness of project management before this paper continues to further discussion.

Because of the incidental nature, the project has different managerial factors to account for. For instant, a project manager would generally have more time and intellectual resources to prepare for a project, compare to an enterprise manager. On the other hand, a project manager also has no chance of correcting his/her mistakes after the activity is performed. A large portion of human activities are not continuous in nature. Events like the Olympic Games, World Cup, and buildings like the Empire State, Chrysler, and Chicago Tower are all built by means of excellent project management activity.

As an agent of change, project management is an inseparable part of modern lives. Project management has been around, improving the quality of life longer than we might realize. According to Max Wideman, pyramids, ancient buildings and tombs are evidences of the existence of project management in the very beginning of humanity itself. From a survey, participant revealed the values generated by a good project management activity, they are: teamwork, bonding, chaos prevention, visibility of risks, increased project quality, enhanced morale, accountability, etc.

## IV. CHALLENGES IN THE FUTURE

As the role of project management increase, so do the challenges that meet them. This chapter is discussing about the challenges that would face the project management activities of the near future.

### IV.1 Managing Change

Experts have identified that project management has underwent a tremendous change during the decade. Similar level of change is expected for the next decade as the two influential factors above are still experiencing rapid growth rate. However, other factors have also contributed to the possibility of the rapid rate of change. Some of them are:

- The increasing complexity of projects and project environments, which include chaos and change
- Connectivity, networking and the increasing magnitude of activities, including the increasing amount of global projects
- The rapidly changing environment that demands any manager to encourage their organization toward the change management concept and the willingness to learn continuously
- The need of a new model of development that support team learning approaches, help create a learning communities and environment, integrate social, cognitive and teaching aspects, allow for multidimensional form of communication, provide for change-oriented trainers.
- The presence of internet that leads to demands of better management system by means of web-based project management (Turbit, 2005).

### IV.2 Factors of Change

Many have stated that the most apparent factors to project management are the issues of globalization and technological development. Mary Brandel (2006) mentioned the five biggest challenges of 2006 and the near future. Some of them are related to the two factors mentioned above. Those challenges are:

#### **Factors of Change: Managing Global Teams**

With the increasing necessity to manage projects globally, it is no longer strange to have members of a team collected from across the globe. Project teams are dispersed across wide areas around the world and partnership are established around the globe. This calls for additional preparation of team members. Managers must provide team member the ability to cope with overseas collaboration and greater understanding of cultural differences. Language barriers and technical issues could generate errors and difficulties in managing operations.

#### **Factors of Change: Moving Parts Worldwide**

By the increasing number of global projects, project managers face considerable challenges in coordinating team effort. Thus, the most probable solution is to break projects into smaller pieces and perform the tasks separately. This means project managers must be more careful in identifying what to do and what to achieve in each small units of operations. The existing project management culture is to consult with mid-level managers before making any type of decisions. This is both time consuming and complicated.

#### **Factors of Change: Riskier Projects**

The next identified challenge is the riskier nature of projects. Companies acknowledging this phenomenon generally offer clients with the agile development technique. This technique enables people to invest in risky projects because they can cancel the investment scheme before they go ahead with additional investment. The benefit of managing risk is that projects are

aligned with the corporation's current and future objectives thus increasing the companies' ability to compete in the global environment (Munoz, Charvat, Ho, Ha, Everhart, and Dawson, 2007).

### **Factors of Change: Managing Vendor Partner**

Experts forecasted that project manager will receive more requests from clients. In the light of this development, practitioners predicted that project manager will make various adjustments in its operational structure. For instance, in order to be more focused on core competencies, project manager will likely distribute IT functions to vendors to offload the burden of management.

### **Factors of Change: Managing Project Portfolios**

In the older days, a good project manager will generally have to choose from several profitable projects, to obtain the best deal. They gather information regarding their portfolios, including costs, purposes, time-constraint and risks to review resource allocations for maximum profits. Today however, with the increasingly tense competition around, project managers cannot accept a project and reject others. Thus, managing the portfolio becomes a little more complicated than it was (Brandel, 2006).

## **V. MANAGING IT PROJECTS**

After defining the challenges faced by project management activities, I will focus on IT projects. This chapter will elaborate the importance of IT in the global environment, the concept of Knowledge management and how it relates to IT projects, how to manage IT assets and an explanation of why IT projects fails.

### **V.1 Role of Information Technology in Global Environment**

Information management has an increasingly important role in business today. The rapidly changing markets and society has created various factors that shift quickly in the middle of corporate operations. Companies need to be aware of market conditions and the changes within it at all time. Thus, many have stated that we are living in an age of information, an age where information is considered the most valuable commodity in the realm of business.

In this age, being informed of the changes within the market and all of its surrounding is an important survival trait. Therefore, managing technology to support corporate operations is an important part of managerial operations in most companies. There is a strong need to create a learning organization, an organization where information learned by individuals are shared to the team, and furthermore, to the entire company. Technology is the only way such condition will be able to exist in a timely and widespread manner. Some of the largest and the strongest companies in the world discover their wealth in the Information technology industry.

Companies like Google, Yahoo, and Microsoft Inc, are acquiring their profit from abilities to support information management activities within companies. They build software, create programs, information retrieval center and networking systems that helped companies obtain timely information and manage them in the manner they see fit. However, there are also companies that gained profit by installing, consulting or managing information management of other companies by means of an outsourcing business.

These companies generally perform projects that involve installation or modification of certain information assets, rather than performing continuous processes to induce changes within client's companies. With the increasing number of managers realizing the importance of creating a learning organization and having a sound information management system within their companies, IT projects is gaining tremendous role in the new global economy.

There are nearly limitless possible applications of IT in the production or service business. It improves productivity, streamlines processes and enhances efficiency and makes possible of growth and expansion to new markets or collaboration with new partners. It has been one of the major drivers of both easiness and complexity of the modern business realm.

### **V.2 Knowledge Management**

#### ***V.2.1 Definition of Knowledge Management***

The ability to better manage information is the goal of every IT project. Today, information management is often mentioned in the same environments as the term 'knowledge management'. Knowledge management is defined as an integrated and collaborative approach to creating, capturing, organizing, accessing and using information assets. Information assets are

installed and modified through IT projects in order to support the application of knowledge management within companies (Taylor, 2002).

### **V.2.2 Stages of Knowledge Management Activities**

There are a few stages that characterized knowledge management processes, they are:

- Knowledge is created when human minds generated useful conclusion from a series of experience that will help him/her manage the company in a better way.
- Afterwards, knowledge is captured when it is put on paper, computer file or other means of storage and recording.
- The captured knowledge is then organized, in the sense that it is classified and modified in order to enhance the understandability and the easiness of use of the knowledge.
- The final and most complicated part of knowledge management is sharing the modified knowledge throughout the entire organization and using it to generate creation of more knowledge, this is where the presence of information assets are important and IT projects gained importance (Taylor, 2002).

### **V.2.3 Increasing Scrutiny**

As IT projects gained increasing requests, so does the attention on how much the project benefited client's companies. Project managers have the obligation to ensure that the information system installed is capable of providing the company with a sound knowledge management processes.

In spite of the willingness to take risk by investing in IT projects, companies are also being increasingly scrutiny in evaluating the knowledge management system and expect real result from the IT projects performed (Taylor, 2002).

## **V.3 Managing IT Assets**

As mentioned previously, most IT projects are directed to result better management of IT assets. In a sense, IT projects help CIO to better operate and maintain IT assets as an important corporate investment. In this increasingly complex global environment, managing and being informed regarding numerous and widespread IT assets can sometimes become an impossible task.

In order to have such control, the CIO must develop an IT asset portfolio model that lists the IT assets and processes, including hardware, software, IT people, project status, risk, benefit and impact of a program, etc. In turn, this model will provide the CIO with a structured dynamic view of an IT organization, along with the linkage between resources, assets and processes. The benefits of having an IT portfolio model are:

- Having control over resource inventory
- Knowing the risks and the problems
- Determining which projects and partnership that are most profitable for future decision references
- Support the corporate strategy formulation processes

The IT portfolio should at least account for:

- Practical elaboration of IT department/organizations which describe the composition of individual employees as well as development teams
- Lists and description of business sponsors, including internal and external business users that provide financing of IT projects.
- External Support Unit, includes any internal or external non-IT organization that provides any types of support for IT projects
- Hardware infrastructure, includes any group of hardware that support IT projects
- Software infrastructure, including any software modules that support IT projects (Urusov, 2005).

## **V.4 Why IT Projects Fail**

As a final sub-chapter I would like to add a simple elaboration that offers explanation of how IT projects fail. Despite the importance of information management in business operations, many companies experience difficulty in completing IT projects within the pre-determined time or budget constraints. Many IT designs are even cancelled before completion or never

implemented. A research by Al Neimat indicated that most IT projects failed due to poor project management skills. Tillman and Weinberger (2004) also stated that despite the existence of various sources of failures, the common source of project failure is within the project management process itself. Researches discovered estimation mistakes, unclear and unstable project goal and objectives. Beside these factors, complex IT projects have other common sources of failure. Some of them are:

### **Why IT Projects Fail: Poor planning**

IT manager are often lack the time resource to make appropriate planning because of the pressure from senior management and as a result, the project is performed before the plan is appropriately defined (Fichter, 2003).

### **Why IT Projects Fail: Unclear Goals and Objectives**

IT projects often fails because the parties involved does not have the understanding that defining a clear requirements for a project can take time and lost of communication. Some project managers might fail because they lack the experience to describe the type and the extent of resources they really require (Fitcher, 2003).

### **Why IT Projects Fail: Misalignment**

Aligning information systems to corporate goals has emerged as a leading concern over the last couple years, according to survey responses from Information Technology (IT) executives (Strassman, 1998). Information systems need to be aligned with organizations' business objectives. When discussing alignment, innumerable virtues are essential: market share, customer satisfaction, taking care of employees, acting as good citizens, and innovation (Strassman, 1998). Customer satisfaction is of importance as the end user is the customer using and purchasing the product. An organization must take care of its employees, the backbone of its success. Evaluation comes first, as an organization must properly assess everything before aligning information systems. Management needs to know how to measure the potential information systems that shall be aligned, including those already parts of the baseline in the organization (Strassman, 1998). All assets need to be weighted by the management team with an associated cost and placed in relative importance as they see fit for the organization. Once this has occurred, then realigning items with shifted business goals should occur. Thus, exploring the disconnect between executives shall uncover why there is misalignment with IT.

### **Why IT Projects Fail: Quality of Interaction**

A related paper discusses quality of the interaction between the Information System (IS) project team and the users in a development project, mentioning that this interaction is not clearly linked to the success of projects in terms of meeting budgets and product goals (Coughlan, Lycette, & Macredie, 2003). This is due to lack of collaboration that allows visibility across business units and into program status, and that optimizes operational reviews. Also noted is that quality interaction may be pertinent in understanding why past research is important in support of the development maxim that user involvement is crucial to the success of an information system project. Within this particular study, internal conflicts among the IS project team are separated from the conflicts of project team members with external users. Both internal and external team conflicts are found to impact interaction quality negatively, which reflects negatively on the project as in the quality of work and cooperation between. These relationships indicate that attention to both internal and external conflict is needed in order to accomplish the project goals successfully.

### **Why IT Projects Fail: Changing Objectives during Project**

Inside the realm of project management, there is the need to make a good judgment whether to remain loyal to the initial requirements and objectives or to make the necessary change. Sometimes project managers cannot handle trade-offs decisions and make decisions without the basis of rational insights.

### **Why IT Projects Fail: Unrealistic Resource Estimates**

Project managers often fail to differentiate between time, scope, and duration. Time on task generally means the time required to complete a task without interruptions, while duration is the time actually required to finish a task taking account of problems and interruptions. Project Managers often have difficulty understanding the scope of the task they are to execute. Furthermore, project managers often uses linear thinking in making allocation without consideration of other factors that might disrupt the harmony of simple linear thinking. Project manager tend to place more human resources on a project rather than understanding what the Total Cost to Performance Index (TCPI) actually is.

### **Why IT Projects Fail: Human Capital**

Project Managers often face difficulties in obtaining and retaining personnel. In certain industries where work cannot be outsourced such as Defense & Aerospace where very technical skill sets are required to include military clearances key

personnel can be the leading factor in being able to execute on key projects. In the United States (U.S.) the ability to retain is even harder due to the cultural norm of working for the highest bidder. For companies trying to obtain key personnel from other organizations it may be just as difficult as some companies ensure people are properly compensated. Motivation plays a part in retention as once key personnel are attained so that they do not go work for a competitor in the same market space. The environment that is created by the project manager is important as work/life balance is a major issue when selecting jobs.

## VI. CONCLUSION

IT projects gained increasing importance in its role to the global economy for the last decade. The interest over project management is expected to increase in the near future, partly due to rapidly developing globalization and the knowledge management concept. Companies are facing the challenge of a wider range of coverage, increasingly complex information system architecture, and the rapidly changing environment. In order to face such challenges CIO's should establish an IT portfolio management model that is aligned with the business goals. It will help the CIO to maintain control over corporate IT assets and IT processes. Furthermore, the CIO and IT project manager should be aware of the common mistakes that destroys IT projects and learn from the identified mistakes. These learning experiences should be captured in a repository so that the successors do not make the same mistakes.

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# AN ANALYSIS OF THE MANAGEMENT CONSULTING INDUSTRY IN THE UNITED STATES AND JAPAN

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## INTRODUCTION

*Management consulting is in great demand among business and government organizations. It is growing at an accelerating rate. Every year many individuals join the profession. Every day many organizations become management consultant clients. One of the challenges in choosing a career of management consulting relates to defining attributes of a management consultant. Determining a strict definition of management consulting is an elusive process. The term is so broad that its definition has defied the efforts of experienced management consultants themselves (Barcus, 1986). Management consulting is a profession whose members provide services to managers. According to Datamonitor, management consulting can be classified as corporate strategy services, operations management services, information technology solutions, human resource management services and outsourcing services (2009). Regardless of how one defines or classifies this profession, most agree that management consulting is a personalized service industry requiring a close relationship and rapport with the client. Does the structure of the home country and of the consulting company affect this relationship? Sam Barcus and Joseph Wilkinson have suggested that "a management consultant must maintain close relationships with a variety of cultures" (1986). These relationships combined with the demand to narrow one's concentration to a few related areas of expertise shape a consulting firm's character (Fuchs, 1975). Does this character also shape the American management consultant's relationship with Japanese culture? This paper analyzes these structural and cultural factors as entry barriers of management consulting in the Japanese economy.*

**Keywords:** *Foreign Direct Investments, Government-Business Relations, Interventionists Policies, Mixed Capitalist Economy, Multidivisional M-Form Structure, Zaibatsu, Keiretsu, Ministry of International Trade and Industry, Insider-Oriented Culture*

## GOVERNMENT AND BUSINESS: AMERICA AND JAPAN

This study explores the challenges of an American consulting company in a Japanese marketplace. Japan is a particularly interesting economy to compare with the United States due to the sheer size of its economy, the strong contrast between its corporate governance systems and those of the United States, the increasing penetration of foreign portfolio investment, and the strong embeddedness of its institutions.

The Great Depression of the 1930s in America, preceded by the stock market crash, ushered in the New Deal and with it the beginning of vastly changed relations between government and business in the United States. Regulation of business increasingly replaced laissez faire as the philosophy of government-business relations. This changed role of government also changed American capitalism dramatically (Monsen, 1979).

This study analyzes the consulting industry from the prospective of American and Japanese economies. Considering the frames of command economy versus market economy, this study will analyze the management consulting industry looking at recent economic performance, structure of market, and environmental stability between the United States and Japan. Japan is a particularly contrasting economy due to the sheer size of its economy, the strong contrast between its corporate governance systems and those of the United States, the increasing penetration of foreign portfolio investment, and the strong embeddedness of its institutions (Yoshikawa, Tsui-Auch & McGuire, 2007). The research about differences in these economic systems should prepare an American consultant to conduct business in this Asia-Pacific region.

## PRELIMINARY THOUGHTS AND EXPECTATIONS

Historians have documented the development of economic systems as hunter-gatherer societies, pastoral and agrarian societies and classical slave economies. Another dimension that economist use to compare structures of economic systems is

the degree of reliance on planning or the market as means of coordinating economic activity. A form of planning that was pursued in Western European nations and Japan was called indicative planning. It is an attempt to make informed decisions about future economic environments. Indicative planning was used to bridge an information gap. The Japanese government's interventionist's policies, its capacity to marshal information and its ability to draw the actors in the economy into a dialogue about their needs and intentions put it in a strong position to compile a comprehensive and consistent set of forecasts about the future direction of the economy (Kennett, 2004). This process laid out the likely course of the economy. It was designed to function in parallel with, rather than exclusive of, the market (Kennett, 2004). This form of economic planning was used in the 1950s and 1960s but subsequently declined (Kennett, 2004). Because of globalization, it became very difficult to coordinate performance within the country.

In the 1980s, Western economists perceived Japan's interventionist policies as an advantage that would lead to the eclipse of United States business (Kennett, 2004). However, the current slow growth of the Japanese economy stimulates a critical reassessment of the Japanese model, particularly with regard to the financial sector. Most United States consulting industries value a market system for its impersonal rationality (Kennett, 2004). However, the performance of the management consulting market in America is forecast to decelerate, with an anticipated compound annual growth rate (CAGR) of 0.9% for the five-year period 2008-2013, which is expected to drive the market to a value of \$146.3 billion by the end of 2013 (Datamonitor, 2009).

## AMERICA AS A CAPITALISTIC MARKET

Adam Smith, the author of the *Wealth of Nations*, was the original defender of the free market system. He talked about the free market system as "The Invisible Hand" as the salient characteristic of industrial capitalism. He advocated a system of natural liberty rather than the regulation of an industry. The American government for many years certainly has had an integral part in the overall vision of the functioning of society. However, although government played a substantial role in the development of the United States economy, most economic decisions have been and are now made in private markets. What shall be produced, how it shall be done, and who shall receive the fruits of the production processes are largely determined by individual consumers and business managers – not by public agency officials. The underlying idea is that consumers and managers should be free ordinarily to determine their own economic decisions without government interference (Asch & Seneca, 1989).

## PERFECT COMPETITION

The traditional rationale for the free market is that it allocates scarce resources in the best possible way (Asch & Seneca, 1989). If demand is a measure of the value that consumers attach to market outputs, this marginal value is measured by the price of the product or service. The supply side of this economic function is a measure of the cost of output. If a company is interested in profits, its marginal cost and marginal revenue of output are critical. The market thus achieves the result of balancing the marginal costs and benefits of production. Business activities are pursued to the point where their market price is just equal to the marginal cost of resources used by these activities.

If we define a perfect competition as many small firms where no one has a major impact on the total market supply, a homogenous product, easy entry and exit, and perfectly informed buyers and sellers, there is no pricing decision to make. Price is dictated by market supply and demand. An efficient market amounts to firms being concerned only with cost minimization (Leibenstein, 1966). Even a cursory glance at the industrial structure of the United States economy reveals that perfect competition is virtually nonexistent. According to the United States Department of Commerce, many American industries, particularly in manufacturing, are dominated by a few large firms. When viewed as a business sector, government is closely behind the manufacturing sector. However, the overall structure of industry is quite varied, ranging from relatively atomistic industries to highly concentrated ones (Asch & Seneca, 1989).

## INSTITUTIONS OF A MARKET ECONOMY

There are various institutions of interest in a market economy. They can be the distribution function, the stabilization function, the tax system, legal systems and financial systems. This analysis investigates the allocation and stabilization functions and the financial systems of the United States and Japan as they affect the management consulting industry.

In mixed market economies like the United States and Japan the government is one of the most important institutions of allocation. Both of these countries have a significant part of the gross domestic product in the government sector. Government spending of Japan was 36.5% of the gross domestic product in 2001 (OECD, 2001). Government spending of the United States was 34.3% of the gross domestic product in 2001 (OECD, 2001). Other than Korea, these two nations have the lowest

percentage of government outlays as a percentage of GDP. Sweden spent 64.5% of GDP on government. Government activities can be classified as allocation, categorization, and stabilization processes and policies (Musgrave, 1984). The existence of market failures in allocation and stabilization suggests the need for government intervention. What about the failure of government? This occurs when the costs of government intervention is greater than any social gain. This allocation function of production of goods and regulation of businesses is common in mixed economies like the United States and Japan.

The idea that governments should be responsible for the stabilization of macroeconomic activity – the level of unemployment, the rate of inflation, and the rate of growth – is a relatively recent one (Kennett, 2004). Emphasis on government responsibility for the macro-economy reached heights in 1960. In this period much of the stabilization policy was framed as a trade-off between unemployment and inflation. Slow growth became associated with government interference in demand management as public expenditures crowded out private investment (Kennett, 2004).

The role of a financial system in a mixed capitalist economy is also important. Some economist argue that economies performs best when they are least regulated. However, in Japan, the financial systems were highly controlled in 1970s and 1980s. The economy performed well in the aggregate. Another explanation lies in the degree of central bank independence. In the United States, the central banks have constitutions and hold powers that insulate them to a high degree from government and the political system. It is their argument that central bankers' expertise allows them to make impartial decisions if politicians are prevented from influencing them. The Bank of Japan is highly controlled by the government. In this government, the members of the financial board most likely spring from the narrow financial community. They think that an independent bank might be unduly austere, placing burdens on the less well off, and hence jeopardizing political stability by pursuing its own financial rectitude (Kennett, 2004).

## **THE AMERICAN BUSINESS FORM**

Among America's most important contributions to the world economy has been the organizational form of the corporation (Rosser & Rosser, 2004). This form of business organization is very different from business organizational forms in Japan. It has distinct internal hierarchies and divisions, led by highly paid chief executive officers, with relatively little control by banks, other firms, or government. Corporations had previously existed in Britain and the Netherlands. However, they existed solely at the discretion of the government or the monarchs. In 1819, the United States Supreme Court and Chief Justice John Marshall ruled a corporations effectively a legal person distinct from its owners. During the 1920s, Alfred P. Sloan and Pierre S. Du Pont created the multidivisional M-form structure at General Motors Corporation. In this form each division is a distinct U-form, with full-time salaried managers in a decentralized line and staff hierarchy. This American-based M-form now dominate the world economy.

The United States is the premier model of a market capitalist economy. While the American economy has achieved high incomes and a good quality of life for many individuals, there is a large percentage of the population that does not enjoy this prosperity. As a matter of fact, measures of poverty in the United States are higher than most high-income nations. In the mid-1990s, 24.9 percent of children in families the United States had incomes less than the median income (Rosser & Rosser, 2004). Despite the wealth inequities, the American laissez-faire economy is superior in its ability to adapt to new situations and create new institutional forms.

## **THE JAPANESE BUSINESS FORM**

In the late 1980s, many politicians and economists regarded the Japanese economic system as a model for the world. The situation is now very different. Let's trace the development of the system to gain a little background.

The critical economic element of the development of the Japanese economy comes after the invasion of Tokyo Bay in 1853 by American Commodore Perry. This intrusion into Japanese isolation prompted economic change from the feudal system to a system of state-led industrialization and modernization and also imbued Japanese capitalism with many of its distinctive characteristics that are present today. A strong government role in the industrial development remains a characteristic of the Japanese model. This government has aggressively controlled the growth of many industries including steel, engineering and shipbuilding. The financial sector to this day is dominated by the publicly owned Bank of Japan, established in 1882. After World War II, the United States occupation authorities restructured the Japanese economy. They broke up the zaibatsu to curb future expansions. Enterprises of parent holding companies were converted into independent entities and their share capital sold off. This left little wealth in the hands of individuals. Most of the demand for the shares came from companies that were former members of the same zaibatsu. They therefore held historical allegiances and high degree of proprietary information that naturally gave them interest in each other. These zaibatsu did not dissolve. They were transformed into the keiretsu model.

## THE IRON TRIANGLE

There was rapid and sustained growth in Japan in the 1940s and 1950s. This was due to reemployment of labor after the war. Japan experienced a comparative advantage in labor intensive goods during this time period. By 1955, the output had doubled from 1930 levels. Is there an explanation for this phenomenal growth?

This period marked the evolution of the modern Japanese economic system with three points of power: the politicians, the leadership of industry, and the planning and financial technocracy, mainly in the Ministry of International Trade and Industry (MITI) and the Ministry of Finance (MoF).

## SOCIAL CHARACTERISTICS OF THE JAPANESE ECONOMY

The Japanese society also resembles the vertical and reciprocal personal obligations that characterized feudalism (Kennett, 2004). This behavior reflects Confucian thought, which stresses personal respect for authority and mutual obligation between members of society (Kennett, 2004). Consequently, while bureaucrats tend to be mistrusted in the United States, in Japan they enjoy great respect because they are the immediate embodiment of authority.

## JAPANESE INDUSTRIAL GROUPS

After the war, the United States occupation authorities radically restructured the Japanese economy. The zaibatsu and the close relationship between industry and state were considered by the Americans partly responsible for Japanese military adventurism in China and the Pacific. Because the prewar zaibatsu were considered by the United States to bear some responsibility for the aggressive nationalism that led to World War II, the U.S. occupying authorities insisted on their dissolution and, to prevent their reemergence, a ban against holding companies was written into antimonopoly legislation. The keiretsu groups emerged shortly after that. The Mitsubishi, Mitsui, and Sumitomo keiretsu were direct descendants of the zaibatsu. Each group is centered around a sogo sōsha, a major trading company. In the 1960s and 1970s, when there was fear of hostile takeover, these groups were further held together by the cross-holding of shares within the keiretsu as a defensive strategy. The Fuji, Sanwa, and DKB keiretsu were bank centered groups. This cross holding leads to closer group relationships and creates mutual interests within the group. However, this cross holding also insulates management from the market for corporate control. Shares are rarely sold and executives are safe from takeover bids.

## FINANCIAL STRUCTURE OF JAPAN

Michael Porter identified clustering as an underlying advantage in international business. He defined this phenomenon as the exchange and flow of information about needs, techniques, and technology among buyers, suppliers, and related industries (Porter, 1990). Japan is an example of well-functioning clusters. The Japanese financial structure centers on the central bank, the Bank of Japan. However, this bank functions as an arm of government policy. In addition, the commercial banks operate closely with the government. Thirdly, a high degree of functional separation between the various forms of financial intermediaries is maintained. Finally, the high savings rate (20 percent) is gathered through the postal system. It is then passed to the Bank of Japan, the central bank, to the city banks.

## INDUSTRIAL POLICY IN JAPAN

The Japanese system has historically embodied a high degree of industry policy, the active intervention of the government to promote or change the course of industrial development (Kennett, 2004). Industry policy in Japan originated with the Ministry of International Trade and Industry (MITI), which gives several rationales for intervention. The Japanese economy seemed only a decade ago to be the success story of the second half of the twentieth century. Now Japan seems to be universally regarded as the sick economy of the developed world. The close relationship between business, bureaucracy, and politics, once lauded as the key to stable and sustained long-term growth, are now decried as the basic cause of the longest recession among major developed economies in the last 50 years (Kennett, 2004). This bureaucracy has been renamed the Ministry of Economy Trade and Industry. Currently Japan's financial system, the core of its industrial policy, is compound of problems and under great pressure; most banks need refinancing; policy options are limited; and fiscal policy is problematic. In addition, Japanese investors have lost faith in the future.

## THE AMERICAN CONSULTANT IN JAPAN

The leading management consultant companies in Asia-Pacific, such as Accenture, Ernst & Young International, PriceWaterhouse Cooper, KPMG, CapGemini, IBM Global Services or Deloitte Touche Tohmatsu, are worldwide organizations

with strong brand reputation, which is important for customer retention within this highly competitive market. IBM Global Services, Accenture Ltd, Deloitte Touché Tohmatsu and CapGemini are leading management consulting companies that have learned the Japanese cultures and situated their core strengths within niche markets. Accenture is a global management consulting, technology services and outsourcing company. Accenture's success has been based on balanced and organic growth in a select number of markets. The company has more than 100,000 people in 48 countries. Accenture is well positioned in Osaka and Tokyo, Japan. Let's illustrate success in the Japanese management consulting market by highlighting a relationship they have with Neptune Orient Lines. Singapore-based Neptune Orient Lines (NOL) is an integrated transport solutions company providing its global customers with high-quality container shipping services as well as end-to-end supply chain management and logistics services. Accenture has worked with the company since 2002. The Accenture Shared Services Center in Shanghai is the physical hub of the work with NOL. But in partnering with Accenture, NOL also benefits from their long track record in finance and accounting, their outsourcing experience, and the geographic flexibility and scale offered by more than 40 delivery centers around the world (Annual Report, 2004). The time and experience needed in order to gain these reputations present significant barriers to entry for new players.

The aforementioned structural and cultural factors frame the complex entry barriers that have to be considered by an American management consultant considering entry into the Japanese markets.

There are important stages of every management consultant engagement. A consultant must arrange for an introduction to a client organization. The consultant must meet the key executives and the power structure. Finally the consultant must learn the culture of the client organization. This sensitivity is important. All consultant assignments occur within a social and political context provided by the client organization (Greiner & Metzger, 1983). It is tempting for the consultant to plunge into an analysis of the client's problem after the contract is signed. Instead, the consultant has to continually announce himself and the project to the client organization to establish a temporary relationship and gain respect. The consultant will introduce himself over and over again to relieve the tension barrier of being an outsider. The consultant must also learn the organizational ranking of the client organization and show courtesy accordingly. The Japanese client will undoubtedly be different from any of the type encountered in the United States. They will have unique rituals and modes of behavior. The consultant is somewhat an anthropologist in this context.

## **CONCLUSIONS AND AREAS FOR FURTHER RESEARCH**

The management consulting industry and successful management consultant firms have earned their keep by constantly searching for new approaches to perplexing business problems and methodically bringing about constructive change. Rosser and Rosser have suggested that there is an emerging "New Traditional Economic" system (2004). There is no such one size fits all model for management consulting. Each engagement is tailored to the organizational culture of the client organization. It was illustrated that Japan consists of tightly knit industry groups where deeply embedded insider-oriented cultures are dominant. Some of these groups are beginning to embrace the Anglo-American model to fit their local context. An American management consulting company interested in working in these companies needs, therefore, to research the culture and economic structure and develop relationships accordingly.

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# EFFICIENT MARKET HYPOTHESIS AND TECHNICAL ANALYSIS: THE IRISH STOCK INDEX

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## 1.0 ABSTRACT

*This paper tests two common indicators used in technical analysis for the Irish stock market. The first is the Simple Moving Average (SMA), and the second is the Moving Average Convergence Divergence (MACD). This paper uses 20 years of daily data and tested two technical trading rules. Our findings are mixed, we conclude that the 15-day Simple Moving Average rule could produce superior results than the buy and hold strategy but the MACD was less effective.*

## 2.0 INTRODUCTION

Andrei Shleifer (2000) declared that the Efficient Market Hypothesis (EMH) has been the central proposition in the theory of finance over the past thirty years. The Economist (7/16 2009) also supports this by saying that EMH has been a popular theory for many decades. So much so, that those who study financial markets have considered technical analysis (the method this paper is based on), as nothing more than mumbo jumbo, as astrologers, whose studies could be considered a 'fundamental analysis' of sorts, would consider astronomy. The supporters of the EMH believe that looking at historical prices is useless, and that stocks will move based on all available information in the market, which makes them unpredictable and sends them on a 'random walk'. In this paper we will show empirical evidence against the EMH in the case of Irish stock market.

## 3.0 3.0 LITERATURE REVIEW

Early studies such as Larson (1960), Osborne (1962), Alexander (1964), Granger and Morgenstern (1963), Mandelbrot (1963), and Fama and Blume (1966) show that technical analysis was not helpful in predicting U.S. stock market prices. Fama (1965) finds that stock prices indeed follow random walks and he finds no systematic evidence of profitability of technical trading strategies. Van Horn and Parker (1967) using a simple technical trading rule for 30 NYSE securities confirm the random walk hypothesis. Jensen and Benington (1970) concluded that technical analysis is not useful. However, in the late 1980s, several papers presented evidence that some simple trading rules are useful for predicting stock market returns and suggested that it is possible to make excess profits from technical trading rules. According to Shleifer . (2000), the attitude of academics towards the EMH at the end of the 1970s was indeed one of the great triumphs of twentieth-century economics.

The cornerstone of this new research on technical analysis is an article by Brock, Landonishok and LeBaron, BLL, (1992). BLL analyzed moving averages and trading range breaks on the Dow Jones Industrial Index from 1897 to 1985 and concluded that moving averages and trading range breakout rules have been successful in generating abnormal returns. Bessembinder and Chan (1995) conclude that the BBL's rules are successful in predicting stock price movement in the Asian markets. Ergul, Holmes, and Priestley (1997) using daily closing prices of 63 stocks traded on Istanbul Stock Exchange concluded that technical analysis of volume can aid the prediction of returns which cannot be predicted by the analysis of past returns in isolation. Kwon and Kish (2002), applying three popular technical trading rules to NYSE index over the period 1962-1996, conclude that the technical trading rules have the potential to capture profit opportunities over various models when compared to buy and hold strategy. Liew, Lim, and Choong (2003) examined how one might forecast the ASEAN-5 stock market returns by applying linear and non-linear time series and showed that the returns of the ASEAN-5 stock markets do not follow random walk movement. Metghalchi and Chang (2003) applied moving average trading rules to the Italian stock market and concluded that the moving average trading rules can beat the buy and hold strategy. Chang et al (2006) have used moving average trading rules for Taiwan stock market and conclude that they have identified profitable trading strategies for Taiwan stock markets over the time period of 1983 to 2002. Metghalchi et al. (2008) applied various moving average trading rules to the Swedish stock market and demonstrated that some moving average strategies could beat the buy-and-hold strategy even after accounting for transaction costs.

## 4.0 DATA AND METHODOLOGY

Technical analysis is based on the idea that prices move in trends, which are determined by the changing attitudes of traders towards various economic, political and psychological forces. The practice of technical analysis dates back for at least a century to Charles Dow, the creator of 'Dow Theory' and one of the founders of Dow Jones, Inc. As Pring (1991, p. 3) points out, "the art of technical analysis, for it is an art, is to identify a trend reversal at a relatively early stage and ride that trend until the weight of evidence shows or proves that the trend has reversed". Traditional chart patterns used for technical analysis could be considered fairly crude to the untrained eye, and are widely considered more of an art than a science. However, it has become apparent through application that patterns do occur, and that various patterns occur more frequently than others, so much so that it could not be classified as truly random events, showing useful information about future prices (The Economist, 2000). Through continued research technical analysis has become accepted by mainstream traders as a legitimate trading mechanism to earn above average returns in the market. The Washington Post published an article by Roger Lowenstein that stated, "The upside of the current Great Recession is that it could drive a stake through the heart of the academic nostrum known as the efficient market hypothesis." Siegel (2009) quoting Jeremy Grantham, a money manager and financial analyst commented, "The incredibly inaccurate efficient market theory [caused] a lethally dangerous combination of asset bubbles, lax controls, pernicious incentives and wickedly complicated instruments [that] lead to our current plight (in reference to the financial meltdown of 2007-2008)."

Technical Analysis is defined by John J. Murphy (1999) as the study of market action, primarily through the use of charts, for the purpose of forecasting future price trends. Murphy asserts that technical analysis is based on three basic tenets: market action discounts everything, prices move in trends, and history will repeat itself. Given the skepticism surrounding technical analysis, this paper will apply technical trading rules and strategies to the Irish stock market to shed addition evidence on this debate. By implementing technical trading rules and measuring the outcome against the EMH strategy, the authors of this paper will show how technical analysis may be employed to earn above average returns in the Irish stock market.

Using 20 years of historical daily index closing prices from the Irish Stock Exchange for the time period beginning October 6, 1989 through September 29, 2009, we have calculated the average daily returns of the Irish stock market and determined the rate of return of the money market. We tested two methods: 1) Moving Average 15-day rule, MA15, and 2) Moving Average Convergence Divergence, MACD.

For the first method, we estimate the standard moving average 15-day of the Irish stock index, a buy signal is emitted when the short moving average (The index level) breaks the 15-day MA from below and a sell signal is emitted when the index level breaks the MA15 from above.

As for the second method, The MACD is calculated by subtracting the value of a 26-period exponential moving average from a 12-period exponential moving average. A 9-period simple moving average of the MACD (the signal line) is then plotted on top of the MACD, or:

$$\begin{aligned} \text{MACD} &= \text{EMA}(\text{CLOSE}, 12) - \text{EMA}(\text{CLOSE}, 26) \\ \text{Signal Line} &= \text{SMA}(\text{MACD}, 9) \end{aligned}$$

Where EMA is exponential moving average and SMA is simple moving average. When the MACD line crosses the signal line from below that is a buy signal, when the MACD crosses the signal line from above, it is a sell signal.

We will be either in the market (buy days) or out of the market (sell days). We assume that a trader following these MA (MACD) strategies could presumably observe the prices a few minutes prior to the close and make the trading decision at the close. If the closing price is above the moving average 15-day (MACD is above signal line) then we will be in the market next day by buying the index at the closing price (next day will be a buy day). Next day's return will be the difference between logarithm of closing price next day and log of closing price the previous day. On the other hand, if the closing price is below the long moving average 15-day (MACD is below signal line), then we will sell the index at the closing price and will be out of the market next day (sell days). We define mean buy and mean sell returns as follow:

$$X(b) = \frac{1}{N_{(b)}} \sum R_b \quad (1)$$

$$X(s) = \frac{1}{N_{(s)}} \sum R_s \quad (2)$$

Where,  $N_{(b)}$  and  $N_{(s)}$  are total number of buy and sell days and  $R_b$  and  $R_s$  are daily returns of buy and sell days. We will test whether the returns of any moving average trading rules are greater than a buy and hold strategy and whether the mean buy is different than the mean sell. More specifically:

$$H_0 : X(b) - X(h) = 0, X(s) - X(h) = 0, X(b) - X(s) = 0$$

$$H_A : X(b) - X(h) \neq 0, X(s) - X(h) \neq 0, X(b) - X(s) \neq 0$$

Where average return of buy days is  $X(b)$ , average returns of sell days is  $X(s)$ , and average returns of buy and hold is  $X(h)$ . The test statistic for the average buy return over the average buy and hold strategy is:

$$t = \frac{X(b) - X(h)}{\sqrt{Var(b) / N_b + Var(h) / N}} \quad (3)$$

Where  $Var(b)$  and  $Var(h)$  are the variance of buy and buy-and-hold returns respectively. The above formula is also used to test the mean sell returns over the mean buy-and-hold strategy; and the mean buy returns over the mean sell returns by replacing the appropriate variables in the t-statistic formula.

## 5.0 EMPIRICAL RESULTS

For the period examined, the daily average of the buy-and-hold strategy is 0.00013 (.013 percent per day), and has a standard deviation of 0.0122. The t-value for this buy and hold strategy over 5178 days is 0.7810. (0.00013 divided by 0.0122/sqrt(5178)). The annual average over the entire period is 3.52%. In this analysis, we compare all t-statistics with 1.96, which is a critical t-value at 5 percent for large numbers observations.

**Table 1**

Results for daily data from 1989-2009. Rule is identified as standard moving average of 1 and 15 with zero band. $N_{(b)}$ and $N_{(s)}$ are the number of buy and sell signals reported. $SD_{(b)}$ and $SD_{(s)}$ are standard deviation of buy and sell signals, respectively. the numbers in the parentheses are the t-statistics testing the difference of the mean buy and mean sell from the unconditional 1-day mean, and buy-sell from zero. Asterisk means statistically significant.							
RULE	BUY	SELL	BUY-SELL	$SD_{(b)}$	$SD_{(s)}$	$N_{(b)}$	$N_{(s)}$
SMA(1,15,0)	.00088	-.00085	.0017	.0103	.0143	2944	2234
T-statistic	(2.92)*	-(2.83)*	(4.48)*				

The results of Table 1 are significant; the t-stat for the buy-sell differences (column 4) is positive and is highly significant, rejecting the null hypothesis of equality with zero. The mean buy and sell returns are shown in columns 2 and 3. The mean buy returns is positive with an average one-day return of .00088. This compares with the unconditional 1-day return of .00013 estimated above. The test statistic rejects the null hypothesis that the buy returns equal the unconditional 1-day return. For the sell days, the result is as strong as buy days. The sell return is negative with a mean daily return of -.00083. The test statistic for sell days rejects the null hypothesis that the sell returns equal the unconditional 1-day return. The standard deviation of buy days and sell days are reported in Columns 5 and 6. The standard deviations for buy days is smaller than those for sell days implying that market is less volatile for buy periods than sell periods. Columns 7 and 8 report the number of buys and sell for MA-15 days rule. Using the standard moving average trading rule we were in the market (buy days) 2944 days and out of the market (sell days) 2234 days. If technical analysis does not have any power to forecast price movements, then we should observe that the buy days returns do not differ appreciably from sell days returns. The results of Table I indicate that moving average rules do indeed have predictive power and could discern recurring-price patterns for profitable trading.

In Table 2 we summarize the empirical results of method 2, MACD. The MACD line is the plotted difference between the 12-day and 26-day exponential moving average of closing prices. The MACD line is usually compared to a signal line, which is the 9-day simple moving average of closing prices. When the MACD line crosses over the signal line from below (is greater than), then we should be in the market (buy days). When the MACD line crosses the signal line from above (is less than), then we should be out of the market. Using the MACD Crossover system we see that the average return for BUY days is .00052, where the average SELL day return is -.00026. The results of both observations are not statistically significant when compared to the buy and hold strategy. This means that we cannot reject the null hypothesis that the buy returns or sell returns equal the unconditional 1-day return. However, the difference in the mean return of buy days and sell days is .0008 with a statistically significant test statistic of 2.29.

**Table 2**

Results for daily data from 1989-2009. Rule is identified as MACD(12,26,9). N(b) and N(s) are the number of buy and sell signals reported. SD(b) and SD(s) are standard deviation of buy and sell signals, respectively. the numbers in the parentheses are the t-statistics testing the difference of the mean buy and mean sell from the unconditional 1-day mean, and buy-sell from zero. Asterisk means statistically significant.							
RULES	BUY	SELL	BUY-SELL	SD <sub>b</sub>	SD <sub>s</sub>	N <sub>b</sub>	N <sub>s</sub>
MACD T-statistic	.0005182 (1.38)	-.00026 (-1.27)	.0008 (2.29)	.0112	.01318	2622	2556

## 6.0 CONCLUSIONS

Based on the findings of our trading systems, we have concluded that our method 1 trading rule of standard moving average of 15 has worked well for the Irish stock market, the MA 15 days has generated buy and sell days that beat the buy and hold strategy. However our method 2, MACD (12,26,9) is not as good as the moving average method. Based on this result, it could be concluded that the moving average method could shed some doubt about the efficiency of the Irish stock market.

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# A SIX SIGMA CYCLE REDUCTION PROJECT

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## ABSTRACT

*This paper will provide a definition of Six Sigma and how the implementation of a Six Sigma project from the Six Sigma Baseline activities to the conclusion of the project. The Six Sigma project is using a research design that is exploratory, empirical, non-experimental, cross-sectional qualitative assessment. Data collection will consist primarily of ex post facto document review. The baseline conducted revealed that the Program's design problem resolution process was extremely time consuming, taking, on average, over 100 calendar days to provide preliminary documented solutions. This lengthy cycle-time was determined to be especially debilitating to procurement and manufacturing operations where over 1000 problems are identified annually. In fact, long problem resolution cycle-time was found to be a contributor to several of the high level undesirable waste and customer dissatisfaction issues identified during the baseline; specifically, late purchase part ordering, late internal deliveries, and late customer deliveries of spare, retrofit kit, and end-item hardware.*

*The Six Sigma project was initiated to study, characterize, and improve responsiveness of the design problem resolution process. Specifically, overall cycle-time performance can be improved by almost 70%. The project resolved of 14 days under the new project vs. a historical average resolution cycle-time of around 50 days. Solution documentation and approval cycle-times are projected to exhibit an average cycle-time of 23 days vs. a historical average of around 70 days. In addition to cycle-time improvement, the leaned problem resolution process will result in a 38% reduction in design problems entered into and distributed to program management and functional engineering support organizations by the configuration management tracking system. Rather than enter the system, these problems will be addressed and solved quickly by the collocated design team established by the new process.*

*The design problem cycle-time resolution project was conducted by a core team utilizing a variety of Six Sigma tools, observed that the long cycle-times were driven primarily by centralized decision making and the highly functional nature of the supporting engineering and management organizations. Wait, or queue time, represents 95% of total cycle-time within the problem resolution and documentation process. A series of eight major solutions, resulting in the improved performance described above, have been subsequently developed. The solutions were aimed at reducing and combining repetitive and unnecessary process steps, developing collocated cross-functional teams, providing a vehicle for direct communication between problem identifiers and problem solvers, and driving decision making to the lowest level possible. In addition, simple but useful performance metrics and new process procedures have been developed for follow on process assessment and management.*

**Keywords:** Management, Six Sigma, Logistics, Communication, Operation Management, and Production Management.

## INTRODUCTION

One of the most difficult tasks in developing a Six Sigma process change system is to get support from corporation leadership. If you are going from a decentralized free-for-all methodology of management to a quality form of management then, there is a paradigm shift. The six-sigma project for cycle-time reduction for Information flow required making major shifts in the Investigating Process (IR) and Engineering Change Process (ECP). The (IR/ECP) changes are a business Initiative, which has executive level Commitment at this company. As with a change in direction there is always resistance, if there is a belief that this new system will replace their jobs. The architectural environment has to be defined and communicated to personnel that use the system as a tool, which will aid in their work process. Education for all personnel has to involve changes that will aid in their jobs.

The standards that have to be set in the Company's information architecture are the Business views that all information can be interconnected across all departments and business units of the corporation. Here we are not discussing the networking protocols and technology, but as the industrial age lead to the idea of division of labor for mass production, then specialization of personnel. This leads to the standards that were put in place when the trades could not keep up with demand. This departmentalization of information was basically the same idea of the labor on assembly line. The idea of marketing,

manufacturing end, contract, and configuration management as different departments has lead to chaos in the IRR/ECP Process. This is the place that the IR/ECP process was at the time this Six Sigma project was started by using "The eight fundamental steps in Six Sigma." (Harry, M. and Schroeder. 2000) This project used the total system approach of John Zachman's Framework Theory and the seven critical strategies Methodology. Couple these approach's with "Michael Porter's Value Chain theory to look at the cause and effect, coupled with Herbert Simon's bounded rationality theory." (Rivers, E., 2000 p 5) By using the Kiviat charts we can visualize, all three the business, Personal, and technical position of the IR/ECP Process. Applying these theories, principles and tools we will try to explain out finding and Results in a project report as defined.

## **DEFINING THE PROJECT AND PLANNING METHODOLOGY**

A comprehensive Six Sigma baseline analysis was performed on the company's Operations using a research design that is exploratory, empirical, non-experimental, cross-sectional qualitative assessment. Data collection will consist primarily of ex post facto document review. The baseline effort consisted of data collection and waste/opportunity analysis on Operations pertaining to Customer, Marketing, Physical Processes, Knowledge Processes, Management System, Organization, and the current financial state. Initial financial and contract backlog data indicated that the Programs constituted the largest single value stream within the company, weighted heavily in the manufacture of mature designs for US and foreign customers, and touching most manufacturing and design locations.

Using Michael Porter Value Chain Evaluation, the Management Systems and Knowledge Process baseline data collection and Configuration Management systems were analysis. In particular, the volume and cycle-time associated with design problems and with design change activity was reviewed for several major programs. The IR is a form that is used by the programs to document and communicate suspected design problems discovered, typically, during hardware procurement and factory fabrication, assembly, and test. Subsequent redesigns to the technical data package resulting from IR investigations are documented and approved via the ECP form(s). The level of design change activity was found to be highest on the Program with over 1,000 problems documented via IR. A subsequent review of average cycle-time revealed that design problems required, on an average, Fifty-one calendar days to reach a technical solution, 71 calendar days to document and approve the resultant solution, and an additional 182 calendar days to update affected manufacturing process documentation. The cycle-time distributions for both IR and ECP processing exhibited a bell curve with a right-handed tail, typical of many business systems, and indicative that specific factors are likely involved in driving the non-normally distributed data points. Costs for engineering and associated support labor for the IR/ECP systems were estimated to be in the range of \$15 million annually. Reality tree and cause and effect analysis performed during the Company's Baseline effort identified a linkage between the long design resolution, documentation cycle-times and other undesirable effects (UDE's) observed throughout the Operations.

Here we used Michael Porter's Value Chain Theory to show the interrelationship between the cause and effect of the problem. In general a Six Sigma Plan should include "the sequence of implementing an application will follow the value chain of the enterprise." (Spewak, S.H., and Hill, C.S, 1993, p 2246) Just what does this mean, value chain? The Value Chain Theory was developed as a part of a restructuring process for strategic rethinking of an organization, and as part of Porter's rational that there are generic strategies. The value chain looks at the cause and effect of the Human Resources, policies and methods machines and shows the problem objectives and goals. By looking at the system we define two types of inter-relationships that create synergy. By categorizing these you can look at the company infrastructure, human resource management, technology development, and procurement. The first interrelationship is the company's ability to transfer skills, or expertise, among similar value chains, and the second is the ability to share activities. The value chain helps expose the most important concepts of The Corporate Strategy. Even though each unit has a separate value chain, knowledge about how to perform activities is transferred among the units. The ability to transfer skill leads to a competitive advantage by the different business units. This transferring of skills should meet the test of diversification when the expertise is across all units. This will allow for lower cost of barriers the same as value chain mapping will in the Six Sigma process when developing an information system. The transfer of skills can be a one-time event, or ongoing. Porter's value chain strategy has four basic concepts and each builds on the others. The portfolio management, restructuring, transferring skill and sharing activities are all part of the value chain of a corporation just as the different areas in an information system are part of the value chain. The competitive advantage for the corporation can be transferred to the goals by using the value chain. We could apply this competitor's components information system by defining future goals with current strategic capabilities and all assumptions. Porter's value chain is an important part of Six Sigma and is used when mapping cause and effect. One of the terms that Porter has brought into use that means more to the corporation is the Environmental Scan which scans all elements internally as well as externally when developing the value chain. Michael Porter's Theory of Generic Strategies, gives a low cost differentiation with internal success that can be used when looking at the value chain in the integration with the internal and external areas. In the value chain there are primary activities and secondary activities that must be looked at across the firms elements to develop the margin cost driver.

The IR/ECP process was determined to be a contributor to late purchase part ordering and receipt, assembly kit shortages, built to short assemblies, past due hardware completion in all areas and the sub-assembly, final assembly areas, scrap and rework, excessive fault documentation in all manufacturing areas, and, ultimately to late major End Items, Retrofit kit, and Spare deliveries to the customer. No slack is built into the production Material Requirements Planning MRP schedule to account for IR/ECP induced delays; hence, every design problem encountered represents the potential to cause significant schedule impact and, in turn, contributes to the need for costly and labor intensive expediting efforts by the entire supply chain organization. The cost impact of problem resolution cycle-time on the above undesirable affects as well as customer satisfaction were not estimated during the baseline effort, but is considered to be substantial. In addition to the aforementioned linkages to undesirable effects in the operations Baseline the Team found that the IR/ECP process's to exhibit several characteristics leverage points. Leverage points were major causes of waste consistently and repeatedly discovered throughout company's operations and initial project selection was aimed at choosing those processes that touched the most leverage points. It was felt that such projects would not only reduce waste and save money, but also provide inertia to move the operations toward a lean environment and lean culture faster than might otherwise be possible. Leverage points identified as applying to the IR/ECP process were:

**Multiple Handoffs:** From the point of design problem identification, parts procurement, hardware manufacture, and to the completed documentation of a solution it was found that several dozen engineers, managers, configuration coordinators, data entry clerks, and a host of other functions develop, approve, and implement the applicable design change. The handoffs are both physical and electronic and span six major business systems. Although some handoffs are necessary, it was recognized that excessive handoffs, as in the case of the IR/ECP process, were detrimental to cycle-time and efficiency. Using the Six Sigma Total System Approach we look at using both the system improvement and systems design theory to develop our system approach. "The four managerial issues requiring a Total Systems Approach are Defining the boundaries of the whole system and its environment, establishing the systems' objectives with evaluation criteria, determining program structure and the relationships between program and its agents, describing the management of the system, its subsystems, and supra system." (Rivers, E. 2000, p.5)

**Lack of Manufacturing and Design Integration:** Eighty-five percent of all documented manufacturing identified design problems discovered at the manufacturing locations in the Company were investigated by functional Engineering groups located at off-site laboratory and design facilities. It was found that little to no communication would actually occur between the problem identifier and problem investigator and solver. It was discovered that a large portion, over 60% of all documented design problems were ultimately closed without a design change solution. This was interpreted to indicate that a large percentage of the problems discovered and documented via the IR form could potentially have been solved locally without pursuing off-site engineering help via the IR form system.

**Layout:** In addition to engineering design support being located off-site from manufacturing key elements of IR/ECP process management, including Program managers and certain Configuration Management functions are also located off-site at facilities. Baseline data indicated that a typical IR and resultant ECP would travel 150 to 200 miles between the company's facilities during problem assignment. Investigation and problem documentation contribute to high cycle-time and inefficiency. "The Measure Phase includes a review of the types of measurement systems and their key features. Companies must understand the nature and properties of data collection and reporting. They must think about where errors in measurements can occur, as well as the potential impact faulty measurements can have on a project's success. In addition, companies must study the frequency with which defects occur and the process capability that governs the creation of defects." (Spewak, S.H., and Hill, C.S., 2000, p.22)

**Batch Processing:** The high volume of technical problems being investigated solutions is being documented. The data shows a backlog of several hundred at any given time. In conjunction with the handoff manufacturing and design integration and layout issues contributes to batch and queue processing and bottlenecks scenarios at many process steps. The batch and queue processing results in the overall poor flow and high cycle-time observed for even the simplest of design problems given the cursory IR/ECP cost and cycle-time data. Fit with the value stream, undesirable affect linkages, and leverage point analysis, an IR/ECP cycle-time reduction initiative was selected as one of the seven initial Six Sigma projects at the conclusion of the company's baseline analysis.

## SYSTEM, PLAN, PERFORMANCE, AND SAVINGS GOALS

The Six Sigma planning for the IR/ECP cycle-time reduction project envisioned a 6-month effort to perform detail characterization, solution development and tradeoff analysis, and solution implementation. The anticipated post-project performance goals consisted of two main categories: cycle-time reduction and documentation count reduction cycle-time:

Based on the vast potential for improvement, aggressive but achievable initial cycle-time goals were established as follows: IR problem resolution from an average of 51 calendar days to an average of 10 days; ECP solution documentation from an average of 71 calendar days to 25 days; and manufacturing data package (MDP) documentation updates from an average of 182 calendar days to 15 days. All targets are considered initial project goals with the intent to establish plans and metrics for continuous improvement after project completion. Documentation Count Reduction: As previously stated, over 60% of all IR's submitted from manufacturing and procurement operations result in no actual design change for a variety of reasons. The anticipated solutions to improving IR/ECP cycle-time would coincidentally reduce the volume of IR's through improved direct communication between problem identifier and problem investigator and solver. This volume reduction was estimated to be 1 of every 3 future IR's that historically would have resulted in no design change represented 20% of the total IR count. Based on projected IR counts of the year, the 20% volume reduction equates to approximately 600 IR. Estimated cost savings based on the anticipated problem resolution cycle-time and documentation count reductions were subsequently calculated. Based on the dramatic projected cycle-time reduction forecast, a 10% total IR/ECP engineering labor savings was estimated using recognized bid standards. In addition, engineering labor associated with the documentation count reduction was also calculated based on the volume reduction and bid standards. Significant ancillary benefits are anticipated in the areas of reduced scrap and rework in all manufacturing areas, and improved manufacturing schedule performance from procurement to end-item and kit delivery. Due to the difficulty in verifying these improvements and tracking associated savings these were not a considered.

The Leadership's endorsements develop and implement solutions, and validate target goal. Process operations analysis consisted of functional As-Is process mapping, time value analysis on the As-Is process to identify waste and variation analysis as applicable. "Analyze phase, practical business problems are turned into statistical problems. Is the problem sporadic or persistent: Is the problem technology or process related?" (Spewak, S.H., and Hill, C.S., 2000, p.22) It was agreed prior to the mapping exercise that the mapping would not include processes associated with design documentation drafting development and logistics processes as these had all ready been developed using a Total System approach. In addition, it was agreed that the team's efforts would focus on the Class 2 vs. Class 1 design change process. The data indicated that Class 1 ECP's documenting major design changes were far less prevalent than Class 2's. representing around 5% of total change documents processed, and as they were defined in the Total System Approach. Due to their known and scheduled nature, Class 1 did not play a major role in the undesirable affect previously discussed. Utilizing a cross-functional mapping technique, core team members developed the As-Is Flow for the design problem resolution process from the point of problem discovery through the IR, ECP, and the Manufacturing Data Package (MDP) update processes. The mapping exercise required four to five days to complete and was considered extremely valuable and enlightening, as most core team members previously only understood their portion of the process. Historical Cycle-time data available from the CM oracle database used to track workflow of IR's and ECP's was segregated to correspond to the major process steps and included on the completed flow. Takeaways from the As-Is Process began to explain the high top-level cycle-time observed during baseline, many process steps, many different functional organizations involved, and top-level decision making with little empowerment. Serial review and approval by many functional disciplines and relate management and separate serial distribution, review and approve efforts at three difference facilities. The completed As-Is Process was transferred from wall charts and post-it notes to a process map.

After mapping the As-Is IR/ECP process, the core group was segregated into three teams to perform detail characterization on each of the major problem resolution processes, the IR process, ECP process, and MDP update process. The three teams utilized surveys. Interviews, "walking the process", (Spewak, S.H., and Hill, C.S., 2000, p.112) and existing historical cycle-time files to construct a time value analysis profile for each process. The time value analysis for the process breaks the total process cycle-time down into those tasks, which add customer value to the product in question. In this case a documented design change task that adds no customer value to the product and wait/queue times involved between and within process steps. Please note that the entire design problem resolution process could be considered 100% wasteful in the eyes of the customer as it represents a rework process for an inadequate or non-robust design. For the purpose of the analysis, and because the customer does fund the design change activity the end product of the IR/ECP/MDP process was considered to have value. In short, the time value analysis revealed that total value added tasks associated with the IR/ECP and MDP update processes are extremely small, in the range of 4% of total cycle-time. The prime contributor to the overall cycle-time was found to be wait and queue time representing a staggering 95% of total cycle-time or about 358 days of the total 376 day process. When contrasted with the As-Is map findings, it became apparent that the vast number of process steps and functional organizations, combined with a Consistent batch and queue policy throughout the flow provided the framework for the high cycle-times observed. Other more specific findings regarding process bottlenecks backlog and staffing issues, excessive rework, travel loops, and initial suggested solutions are summarized at the conclusion of the characterization process.

## VARIATION ANALYSIS

The process mapping and characterization efforts revealed a need to understand factory contributing to cycle-time variations of overall IR and ECP cycle-times. This was found to exhibit a significant right-handed tail, leading to the question of what is driving the non-normal data points. It was discovered during process characterization that multiple different paths exist within the IR/ECP process comprising the most obvious single cycle-time variation factor. For example, five Program Managers provide direction and six major functional engineering organizations provide design and change proposal generation services to the IR/ECP process based on design problem type, its source, and the specific end item affected. To understand what the right-handed tail is one must know that Six Sigma is based on the Bell Curve. The center point is used as zero. Then each standard deviation, positive or negative, is on sigma level. If you are looking at Six Sigma plan you can see that the process is stable and has the best quality at Six Sigma. This then will lead into the capability maturity model. Additional data was needed in this area to better describe this variation factor and answer the question of who does what and how often? Non-Normal IR/ECP's used in a statistical test of the population of IR's submitted in 1998 revealed that 122 of the total sample size of 1889 (6.5%) were not normally distributed with cycle-times greater than 150 days. From the 122 non-normal data points, a random sample of 21 was reviewed in detail. The single largest cycle-time driving factor (10 of the 21) was found to be new development and design changes involving Missile Interim Specifications (MIS) and Specification Control Drawings (SCD) as a result of obsolete parts or a need to make documentation conform to as-built supplier hardware. Such design problems are the most complex of the Class 2 changes as they typically involve multiple design organization analysis and review, part procurement and physical change validation, and a time consuming drafting effort to develop the new drawing if applicable. The Major takeaways from this data include the following: 70% of design problems emanating from manufacturing involve purchased parts and in an investigation by the Parts Engineering Organization located at two facilities. The balance of IR's come from various manufacturing centers spread through the four other major design organizations, the Local organization, Advanced Manufacturing Engineering (AME) handling about 12% of all problems. ECP generation follows a similar profile with one exception, AME which is assigned the ECP generation tasks resulting from some of the other four groups IR's, subsequently plays a larger role in this activity, handling about 24% of all Class 2 ECP's. In addition to the ECP generation handoffs to AME, it was discovered that 28% of all IR's generated were handed off from one engineering organization to another between one and three times as a result of design problems requiring multi-disciplined review and analysis. It should be noted that of the five major design organizations supporting the IR/ECP process, three are located both physically and organizationally outside the Program's System Segment value stream. Parts Engineering is physically located and reports to the Applied Technology Lab within Command, Control, Communication, and Information Systems a business unit the Mechanical Engineering Lab handling Transmitter issues is physically located in one place and reports to another Business unit, and various electrical design labs.

The Manufacturing Data Package (MDP) analysis involved the cycle from ECP approval to incorporation of an ECP into all affected manufacturing process sheets, routings and process Bill of Material. From process mapping, this cycle averaged 258 days, with over 70% of this time spent with the Manufacturing Engineers responsible for updating this documentation. This same Engineering group typically originated the request for a design change (ER's) for subassemblies and final assemblies. A question arose as to why would Engineers requesting a design change require such a lengthy time to incorporate the change. Further analysis is required. A survey was conducted to this Manufacturing Engineering group with the following Major results. The first survey involved the priority for incorporating ECP's. This priority is not based on ECP approval, but on the ECP's serialized break-in requirement in relation to the actual production schedule. The majority of the Engineers would not update a specific serialized process sheet until just before production was going to run that serialized order. The ECP's serialized production break-in requirement was based on a business decision involving manufacturing lead times and the inventory of affected parts on hand. This typically added 6-18 months of queue time before actual production need. Further analysis revealed that the current MDP cycle-time report tracked ECP's not required in production for 6-18 months in the same category as ECP's due immediately in production. Thus adding to and skewing the Engineers tracked cycle-time. A second survey involved the use of localized alternative systems to update process sheets. Up to 30% of all process changes were being incorporated via the manufacturing inspection record Control forms as a means of documenting instructions to assemblers instead of updating the master process sheets. The use of Control forms allows a means of an immediate documentation of a process change to an assembler. However, master process updates would then be postponed or eliminated for some single occurrence production runs causing a delayed or open loop in the master MDP updates cycle-time tracking. A third survey involved the MDP approval loop. The current MDP approval required 3-5 signatures depending on the category of change. Engineers surveyed revealed that in most cases no one in the signature loop actually reviewed the MDP change. In some instances the Engineering Supervisor would review the change before signing. This data identified that the majority of the signature requirement was non-value added to the process. The last survey involved the hand-offs with the Engineering Document Control group, who owned responsibility for controlling the master MDP documents; distributing ECP's to Manufacturing Engineering, and coordinating the distribution of master process sheet copies to the factory. In a recent effort to

maximize manufacturing space, the Engineering Document Control group had been physically re-located out of the factory buildings and into an administration building. This new location was up to 3/4 of a mile away from the factory floor and the Manufacturing Engineers. Due to the required hand-offs between the factory and this group and additional delays discovered during the survey such as miscommunication and missing documentation. The need to collate this group back to the factory floor became apparent.

## **DEVELOPMENT AND ALTERNATED DESIGN**

With the IR/ECP and MDP update processes characterized the project effort shifted to solution development. The solutions were brainstormed over a several day period with full core team attendance. After several subsequent prioritization reviews, an initial list of 35 specific proposed solutions were documented with appropriate auctioneers and leverage point benefit assessment. In addition, the proposed solutions were mapped to the As-Is process and a Should-Be process developed. A comprehensive presentation was given to inform all affected Program managers, functional Engineering, support organizations, and factory/operations management of the proposed solutions. This communication consisted of town meetings with a question and answer period, small group meetings with process ownership and individual presentations to key business unit and functional managers. Of the 35 proposed actions. 8 major solutions emerged and are discussed in detail as follows:

The Cross-Functional Core Engineering Team noted in the characterization and variation analysis data that engineering support for IR/ECP efforts is stratified through multiple functional organizations located off-site from manufacturing operations and outside of the manufacturing hardware value stream. Each organization has unique performance metrics, staffing levels, and program function specific make-up, investigation, and documentation methods. Some of which are not consistent with expedient processing in resolving design problems. The first major solution involves the development of a cross-functional team drawing from the functional design organizations and residing in the manufacturing facility to resolve most non-purchasing manufacturing IR's. Presently, as stated, only 12% of manufacturing IR's are routed to the on-site AME Product Engineering group for analysis/resolution. With the cross-functional core team, this figure is anticipated to rise to around 50% of all manufacturing IR's or 95% of all non-purchasing manufacturing IR's. The Core Engineering team would consist of existing Product Engineers working in the facility with a rotating group of mechanical engineers representing the two groups. Based on a staffing analysis consisting of skill set review and change activity type and volume, it was concluded that the addition of three engineers to the existing 4 to 6 person group would allow for performance goals for the Hotline Floor Support Process. The recently implemented Automated Change Management System (ACMS) has allowed for IR generation and routing via e-mail, data indicates that it still takes between 1 and 3 days to route and IR from the problem identifier to an appropriate investigator. The Six Sigma principle should have been addressed in the data architecture level of the model. It may subsequently take from 1 to several days before the assigned investigator contacts the problem identifier. In addition a survey of Industrial Engineers revealed a need to develop face-to-face relations with design engineering in order to improve the link between problem identifier and solver.

The second major solution involves developing a hotline phone number that would link directly to a member of the core engineering team. A member of the core team would be on the hotline during business hours with back-up arrangements including pagers to ensure full time coverage. Upon receiving a call, an assigned core team member would physically touch the problem in question and interface directly with the problem identifier within a reasonable period of time. Based on this initial understanding of the problem the core team engineer would determine if the problem merited investigation by functional Lab Engineering due to complexity, cost, and risk. If it did not, they would proceed to resolve the problem. If it did, they would notify the problem identifier and help generate the IR and pinpoint the likely Lab recipient. The hotline, in addition to providing real time initiation of problem investigation, was also anticipated to reduce the quantity of IR's generated by providing an up-front filter mechanism for simple and non-product design related issues which would have otherwise have been documented unnecessarily via IR. It should be noted that the hotline was considered an alternative to locating the core team directly on the manufacturing floor that was deemed impractical due to the limited staffing afforded to the program specific team.

Procurement and Parts Engineering Point of Contact Commodity Matrix are the first two majors solutions described above to address manufacturing problems discovered primarily during hardware fabrication, assembly, and test. The highest volumes of IR's are documented during procurement of SCD's piece parts and assemblies. After initial review by on-site engineers, procurement IR's are typically routed to Parts Engineers located organizationally in the different business units and physically located at another business unit. Similar to the manufacturing scenario it was discovered prompt and direct communication between Supply Chain Management (SCM) and Parts Engineering was poor due to function and location barriers. In addition, a large percentage of problems involve obsolescence and other issues that do not result in design changes. In order to address these issues, the third major solution involves the development of a matrix that ties the buyers and corresponding parts engineers via a commodity. Similar to the Hotline described above, the matrix would be utilized to initiate direct contact with a

parts engineer for initial problem resolution. With the matrix commodity team approach straightforward problems can be resolved quickly without IR generation. More complex problems would be documented on IR, but problem resolution would not wait for formal IR assignment to the appropriate parts engineer. Ancillary to the matrix solution would be an effort by the MQE organization to maximize the number of purchasing problems resolved locally by developing specific technical and time based criteria and ground rules and a series of solutions to improve the internal parts engineering review and approval flow. It should be noted that initial solution discussions regarding the high Parts Engineering problem resolution cycle-time involved the co-location of 2 to 3 parts engineers within the SCM organization. Significant resistance from functional organization management resulted in the aforementioned solutions, which, it was agreed that would be pursued on a trial basis pending demonstration that cycle-time and documentation count reduction goals could be met.

Co-location of Configuration Status Accounting (CSA) performs two key tasks during, and after, formal approval of ECP's, revision assignment to affected drawings and bill of material loading for parts list changes. The MRP bill of materials is subsequently updated from a download from CSA and electronic change orders were initiated to affected purchase orders and in-house shop orders. Characterization phase data indicated that CSA activities were required. On average it takes 12 calendar days per ECP with most of the cycle-time being queue time. The CSA activities are performed at two facilities with the volume ECP work occupying the equivalent of about one full time data entry coordinator.

The fourth major solution involves the relocation of the CSA activities and one data entry coordinator to a center location. The co-location of CSA with CM personnel would resolve priority issues and eliminate a significant amount of data transmittal via fax and hand-carry. Anticipated cycle-time savings for this very simple and straightforward solution were on the order of 10 to 11 calendar days or about 10% of the entire average IR/ECP process.

The Consolidation of Post Generation, Pre-Approval ECP Activities, and Meeting Process mapping and time value analysis reveals ECP review and sign- process consisted of two separate approval meetings. One held for production impact analysis and the other in for PMO and Logistics impact analysis. Given serial distributions and liberal review periods the two meetings took an average of 14 calendar days to complete. By consolidating the approval process into a central location it was determined that the process would be reduced to around 3 days. This new approach requires signatories to periodically visit a central room to review and sign proposed changes via a visual control system within the room that organizes the flow of ECP's from discipline to discipline. The central review and sign off room was also determined to be a convenient place for posting performance metrics and standard operating procedures that describe how the new IR/ECP process operates Future implementation of an electronic workflow system for ECP review and approval will further improve this process. In addition to combining two internal review processes, local customer approval was moved to a post approval distribution saving an additional 2 days on ECP cycle-time. A customer streamlining initiative has had previously reviewed mandatory customer approval of Class 2 ECP, but serial review for proper classification (Class 1 vs. 2) had continued. Given an extremely low classification reject rate, the customer agreed to the post approval distribution arrangement.

Fast Track ECP Process mapping revealed that Class 2 ECP's require upwards of 15 signatories regardless of complexity or impact. A sample analysis of typical Class 2 changes revealed that 70% of all changes involve minimal complexity and could be processed through a limited signature cycle consisting of the Engineer, Production Control, and Program Manager without posing any technical cost or schedule risk. Based on this data, specific Fast Track criteria were developed and a procedure documented to govern its usage. All other engineering change reviewing functions not part of the Fast Track process are subsequently put on post approval distribution. By streamlining the number of mandatory signatories for the bulk of changes, the cycle-time efficiencies gained with the meeting consolidation actions, described in solution 5 are further enhanced.

.MDP Update Streamlining as a result of a value stream analysis of the entire IR/ECP/MDP cycle, the MDP cycle shifted from being directly in the value stream of this project to being an internal customer who receives the approved ECP. From the MDP variation analysis, the majority of approved Class 2 ECP's are not immediately used in all affected production area process sheets due to manufacturing lead times and current inventory levels. This can cause a break in the total cycle between ECP approval and production ECP usage of 6-18 months. Several other Six Sigma projects are in process to reduce these lead times and inventory levels through cycle-time reduction initiatives. However, for those ECP's that were immediately needed in production along with a goal of improving the entire MDP cycle-times, the following solutions were initiated. The current process sheet approval requirement of 3-5 signature disciplines was reduced to 2 signatures, the Engineer and the Engineering Supervisor. A one-approval signature option, as authorized by the Engineering Supervisor to qualified Engineers, was created. A layout plan was generated to relocate the Engineering Document Control group back to the manufacturing building. The new location will be centrally located near the various manufacturing areas and adjacent to the Manufacturing Engineers who are responsible for MDP updates. A solution specification was created with Information Technology (IT) to Modify the existing IR cycle-time reporting in the Plans. The process start trigger was changed from a push system varying

from a 1-day lead-time to an 18 month lead-time, to a production pull system with a 27-day lead-time. In addition, a solution specification was created with IT to modify the current electronic MDP control system using the Process. From the variation analysis survey, all manufacturing areas were using alternate methods for documenting immediate process changes, including ECP process incorporations without updating the master process sheets. As a result, the ability to update the master process using a fast-track method was created. This ability assures a closed loop of quick process changes to the master process and for MDP cycle-time metrics.

**Cross Functional Team Leader Appointment:** The heart of the IR/ECP cycle-time education solutions described above lie within the co-located cross-functional team and teaming arrangements. It was felt that these arrangements are particularly vulnerable to failure without a clearly defined leader to assume responsibility for the revised IR/ECP/MDP update process once the Six Sigma project analysis and solution implementation are completed. It was discovered that no one individual or organization, CM or the PM, stood out as champion and metric/performance keeper of the existing pre-Six Sigma IR/ECP process. In order to manage the various co-location and rotational assignment arrangements and monitor metric performance of the new process, an IR/ECP/MDP Value Stream Leader position was created. The PM was determined to be the logical organization to sponsor and fund the position. Unlike the functional P organization, however, the Value Stream leader would be located closest to the IR/ECP/MDP value stream. In addition to team management and metric assessment, the value stream leader job description consisted of the following additional tasks, responsibilities, assessment and maintenance of team staffing levels and skill mix, team rewards/recognition and continuous improvement, management of the IR/ECP backlog reduction effort, and management of IR/ECP budget and funding issues. The role of Value Stream leader was ultimately filled with a key IR/ECP project core team member with a broad background involving manufacturing, mechanical design and program management.

## **FORMULATED STRATEGY IMPLEMENTATION**

The implementation phase consisted of the development of eight Standard Operating Procedures, or SOP's, describing the key elements of the new process, a training effort to bring all affected organizations and cross-functional team members up to speed prior to process turn on, and the development of initial metric performance charts in addition to necessary facilities activities for personnel moves and facilitating a central location. Project goals called for technical problems, which were documented on IR, to be resolved and a solution developed within 15 calendar days of issue vs. the previous average of around 50 days. Subsequent characterization and variation analysis indicated that this goal would be challenging to achieve because the reduced volume of problems being documented on IR via the new process are typically more complex on average, as a whole, than the previous distribution, and project solutions, as previously indicated, did not fully address the subset of IR's which involve drawing releases and occupy the high cycle-time (150 days) portion of the historical IR distribution tail. It was realized that the large backlog of work-in-process IRs existing from the previous process numbering 230, in addition to the performance metrics described above, anecdotal comments from both the customers of the IR/ECP process and the personnel working within the process, indicated a strong endorsement for the changes implemented.

## **CONCLUSION**

For any Successful Six Sigma project execution is highly dependent on properly walking through the Visualize and Commit steps prior to full-scale characterization and solution development. Also key is properly scooping the project so execution can occur in a reasonable period of time. This was achieved by the IR/ECP/MDP project by asking and answering the following questions early in the process: Which Program/Location problem delivery systems are most broken? What parts of those systems are most broken? One solution may not fit all programs and may need multiple solutions within a program. This is best exemplified by the two-part solution to the Engineering support problem plaguing the pre-Six Sigma IR/ECP process. Co-location was pursued for core team mechanical design engineers, whereas a virtual teaming arrangement was chosen for parts engineers due to prohibitive budget and personnel skill-set issues. Proper communication of project status to key stakeholders, especially during solution development and implementation phases, cannot be overstressed. The degrees to which communication efforts may need to be stepped-up often depend upon the level and concentration of Leadership commitment to the project. This is one of the key elements of Six Sigma. Design support is not collocated and a problem delivery system is needed. Workflow software helps, but will likely provide only a small cycle-time improvement if the process is dependent on functional organization support. Engineering Problem collection, or input systems are automated or paper based with no human filter resulting in a large percentage of over the wall inputs and slow, sometimes ineffective solutions. As stated previously, the IR system historically closed over 50% of all problems without a technical solution. Backlogs of problems awaiting solution, documentation, or clerical processing can be comforting to those engineering, technical support, and clerical personnel working within the process but severely hamper throughput. Program Management practices can stifle lower level solution empowerment. If lower level empowerment is desired, steps must be taken to ensure that those problems do not

pose significant program cost, schedule, or technical risk, and are expedited to the appropriate level of review. Find solutions concepts that worked. Post design activity documentation and approval activities offered the lowest cycle-time improvement fruit.

Bring engineering support into the value stream and collocate. If a problem delivery system must remain, develop screens via direct communication between problem identifiers and problem solvers. If you can't co-locate, try virtual co-location with organizationally agreed upon teaming. Assign appropriate cross-functional team leadership. Communicate straightforward metrics. This study extends the research of Six Sigma systems into the area of cross-functional, organization boundary spanning, and technical management.

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# RICHNESS VS PARSIMONY: COMPARING THE EXPLANATORY POWER OF TECHNOLOGY ACCEPTANCE MODELS

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## ABSTRACT

*The use of models is widespread nowadays throughout different disciplines of research. Thus, in research replication, the most important difficulty sometimes is probably the choice between model parsimony and model richness. In IS research, the desire of the researcher is to employ the model that results in significant explanation of the phenomena under investigation. This study examines the question whether the explanatory power of the Technology Acceptance Model (TAM) is comparable to that of UTAUT. The study also examines the effect of different sample sizes known widely to affect statistical estimates. This article presents the conceptual formulation of the study and proposes a method of data collection and analyses.*

**Keywords:** Technology Acceptance Model, Unified Theory of Acceptance Model, User Acceptance of Information Technology, Model Retest, Model Replication, Parsimony, Richness.

## 1. INTRODUCTION

In attempts to understand IS usage and acceptance behaviors several important theoretical models have been developed in the past. Nonetheless, the advancement of knowledge requires the critical examination of prior studies. A model replication or re-examination has been generally conducted in a variety of research fields to assess the consistency, reliability, and validity of the measurement scales of the previous work, and to judge which models are parsimonious or rich.

In particular, parsimony has a rich history as a guiding principle for inference. One of its most celebrated instantiations, the principle of minimum description length in model selection [Rissanen, 1978], [Hansen and Yu, 2001], stipulates that within a hierarchy of model classes, the model that yields the most compact representation should be preferred for decision-making tasks such as classification. A related, but simpler, measure of parsimony in information technology acceptance seeks models that depend on only a few of the antecedents to IT acceptance (Hsiu-Li, Hsi-Peng, 2008).

Marsh and Hau (1996), however, posed a question "Is parsimony always desirable when assessing the fit of a model to some data set?". They argued subsequently that indeed, under some conditions, model parsimony is either too stiff a requirement for or irrelevant to the assessment of goodness of fit. Nonetheless, Marsh and Hau were similarly careful to qualify their assertion concerning parsimony by acknowledging that choosing the most parsimonious model is "usually good advice." They were concerned, instead, about the universal and "mechanistic" application of the parsimony standard in all research situations, particularly as it is evaluated by indices designed to be sensitive to model complexity.

The purpose of this study is to establish a means to systematically establish a level of confidence across competing IS acceptance and use models with respect to their explanatory powers. The usual practice in such situations involves devoting considerable energies to the selection of models often employed in IS acceptance and use research. Thus, based on the IS literature, the study compares TAM and UTAUT that have received great attention in their use towards explaining information technology acceptance. Against this backdrop this study examines the voluntary acceptance of Facebook. Thus, the research sought to answer the following questions: a) what are the determinant factors of Facebook acceptance and use, b) Which model (TAM or UTAUT) better explains Facebook use behaviors? c) Are there any differences in acceptance across gender, age, education, and income?

The current study follows these two steps. First, we analyze the IS acceptance research especially focusing on the model development and their replications. Second, we then apply their constructs to a different setting (Facebook use), and interpret the results of the study to compare their explanatory powers for future research in the measurement of technology acceptance and usage.

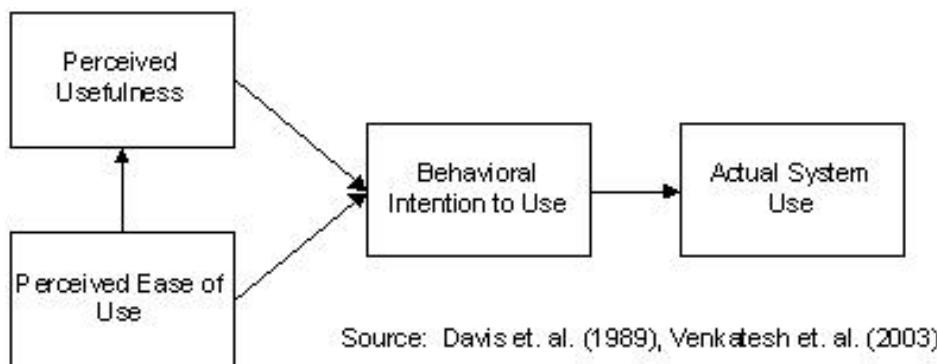
## 1.1 IS Acceptance Research

The prolific stream of research on information systems adoption and use takes a variety of theoretical perspectives. Adoption models of Rogers and Hall, for example, are marked by their descriptive (as opposed to explanatory) emphasis, and their frequent use of labeling, typing, and categorizing of various elements and participants of the change process.

### 1.1.1 Technology Acceptance Model (TAM)

Of all the theories, the Technology Acceptance Model (TAM) is considered the most influential and commonly employed theory for describing an individual's acceptance of information systems. TAM is often employed because of its parsimony and robustness, allowing the user to explain considerable variance while using only two antecedents.

TAM is an adaptation of the Theory of Reasoned Action (TRA) [Ajzen and Fishbein, 1980] to the field of IS. Originally proposed by Davis [1986], TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) determine an individual's intention to use a system with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use.



Though with its origins from TRA, researchers have simplified TAM by removing the attitude construct found in TRA (Venkatesh et. al., 2003). Attempts to extend TAM have generally taken one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining antecedents and moderators of perceived usefulness and perceived ease of use (Wixom and Todd, 2005).

For example, Venkatesh and Davis (2000) extended the original TAM model to explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. The extended model, referred to as TAM2, was tested in both voluntary and mandatory settings. The results strongly supported TAM2.

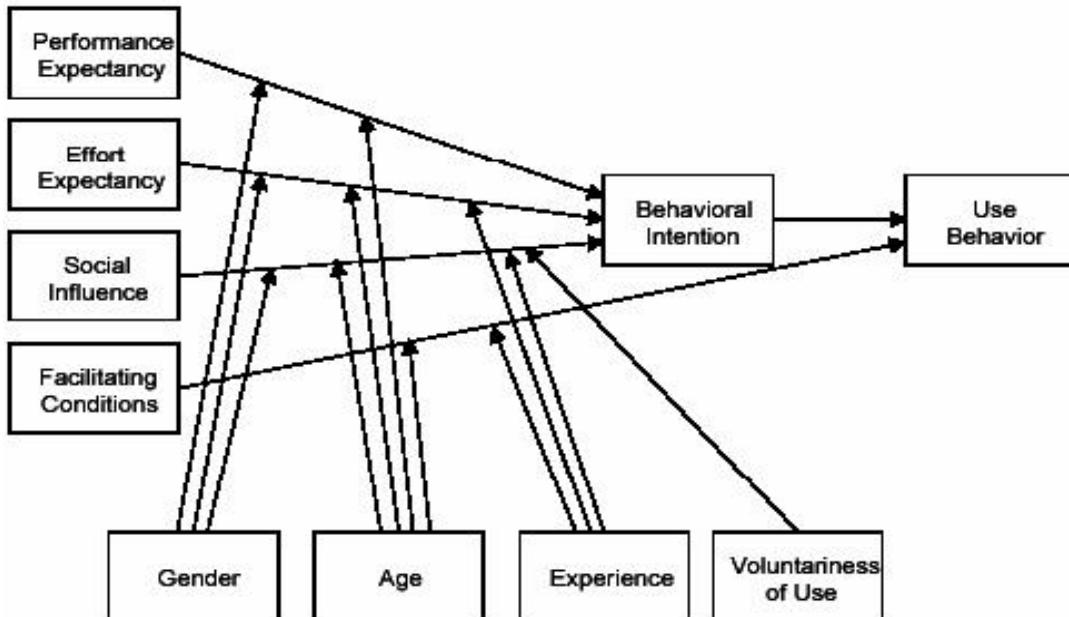
The popularity of TAM is underscored by number of citations. Venkatesh and Davis [2000] found that the first two TAM articles, by Davis [1989] and Davis et al. [1989] received 424 journal citations in the Social Science Citation Index (SSCI) by the beginning of 2000. TAM has been applied to different technologies (e.g. word processors, e-mail, WWW, GSS, Hospital Information Systems) under different situations (e.g., time and culture) with different control factors (e.g., gender, organizational type and size) and different subjects (e.g. undergraduate students, MBAs, and knowledge workers), leading its proponents to believe in its robustness.

However, TAM is not without its critiques. Criticisms of TAM as a "theory" include its lack of falsifiability, questionable heuristic value, limited explanatory and predictive power, triviality, and lack of any practical value. (Chittur, 2009). TRA and TAM, both of which have strong behavioral elements, assume that when someone forms an intention to act, that they will be free to act without limitation. In practice constraints such as limited ability, time, environmental or organisational limits, and unconscious habits will limit the freedom to act.

In an attempt to integrate the main competing user acceptance models, Venkatesh et al. formulated the Unified Theory of Acceptance and Use of Technology (UTAUT). This model was found to outperform each of the individual models (Adjusted R square of 69 percent) (Venkatesh et al., 2003).

### 1.1.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. (2003) noting the criticism of TAM published the results of a study that developed and validated a new research model, UTAUT, with seven constructs: performance expectancy, effort expectancy, attitude toward using technology, social influence, facilitating conditions, self-efficacy, and anxiety, which are hypothesized to be fundamental determinants of the user behavioral intention of information technology. These constructs derive from eight different user acceptance models. A major concern of the new unified model is its correlation and consistency among items of each variable combined from various models. The eight original models and theories of individual acceptance that are synthesized by Venkatesh et al. (2003) include the Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Model Combining the Technology Acceptance Model and Theory of Planned Behavior (C-TAM-TPB), Model of PC Utilization (MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT).



Similar to other prior research models, this model should be meticulously examined to ensure its reliability and validity. The objective of the present research is to investigate and retest the UTAUT model (against TAM) to accumulate further evidence concerning the validity, consistency, and correlation of the model scales for the assessment of the user acceptance of information technology.

## 2. RESEARCH METHOD

The quantitative phase of the current research focuses on empirically retesting TAM and UTAUT model in a different setting from newly gathered data. The discussion of survey participants, research settings, instrument administration, and research results is provided in this section.

### 2.1 Measures

*Performance expectancy:* The degree to which an individual believes that using the system will help him or her to attain gains in job performance.

*Perceived usefulness:* See the definition of performance expectancy.

*Effort expectancy:* The degree of ease associated with the use of the system.

*Perceived ease of use:* See the definition of effort expectancy.

*Social influence:* The degree to which an individual perceives that important others believe he or she should use the new system.

*Facilitating conditions:* The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.

*Behavioral intention:* The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior.

*Voluntariness:* The extent to which potential adopters perceive the adoption decision to be non-mandatory.

## 2.2 Participants and Settings

Even though, researchers adopt instruments used in prior studies, researchers must be aware that a methodological approach may be altered in a new study. The adapted instrument still needs a retest. With the research confirmation, the inaccuracy in measurement is minimal, resulting in higher confidence in the research findings. As a result, an instrument validation is vital for the replication of published research. To this end, a pretest was conducted to validate the instrument. Feedback about the layout of the questionnaire and question ambiguity was obtained from a pilot study of 40 students in a major university in the USA. Some changes were made to the questionnaires as deemed appropriate. The revised questionnaires will be distributed to undergraduate students in a business administration course at a large public university in the USA.

The subject of the questionnaire is the assessment of the students' intention to use Facebook which is a Web-based free-access social networking website that is operated and privately owned by Facebook, Inc.

## 2.3 Instrument Administration

The revised questionnaire items will be adapted from the TAM and UTAUT studies of Davis (1989) and Venkatesh et al. (2003). These items represent independent and dependent variables utilized in the current study. Appendix A demonstrates the questionnaire items to measure the behavioral intention of students to use Facebook. Other than wording modifications to fit the specific technology studied in this research, no changes are made to the user acceptance scale. All items are measured on a seven point Likert scale, where 1 = completely disagree, 2 = moderately disagree, 3 = somewhat disagree, 4 = neutral (neither disagree nor agree), 5 = somewhat agree, 6 = moderately agree, and 7 = completely agree.

## 2.4 Plan Analysis and Results

The competing models will be subject to the data analysis by employing Structural equation modeling (SEM). SEM is a statistical technique for testing and estimating causal relationships using a combination of statistical data and qualitative causal assumptions.

SEM allow both confirmatory and exploratory modeling, meaning they are suited to both theory testing and theory development.

Results of the research can be discussed in three different areas: construct validity, reliability, and correlation. Straub et al. (2004) suggested multiple validation guidelines for the information system research. For the current study, coefficient factor analysis will be used to determine the convergent and discriminant construct validity. Cronbach's Alpha will also be employed to assess the internal consistency reliability.

## 2.5 Assessment of Validity

Construct validity is an issue of operationalization or measurement between constructs. The concern on the construct validity is that instrument items selected for a given construct are a reasonable operationalization of the construct (Cronbach and Meehl, 1955). For the present research, the instrument items will be classified based on TAM and UTAUT constructs. The items are shown Table 1 below.

**Table 1:** Scales / Items

<b>Performance Expectancy (PE)</b>
– I find Facebook useful in my life.
– Using Facebook enables me to accomplish tasks more quickly.
– Using Facebook increases my productivity.
– Using Facebook increases my chances of getting a good grade.
<b>Effort Expectancy (EE)</b>
– My interaction with Facebook is clear and understandable.
– It is easy for me to become skillful at using Facebook.
– I find Facebook easy to use.
– Learning to operate Facebook is easy for me.
<b>Social Influence (SI)</b>
– People who influence my behavior think that I should use Facebook.
– People who are important to me think that I should use Facebook.
– Professors in my classes have been helpful in the use of Facebook.
– In general, my community has supported the use of Facebook.
<b>Facilitating Conditions (FC)</b>
– I have the resources necessary to use Facebook.
– I have the knowledge necessary to use Facebook.
– Facebook is not compatible with other systems I use.
– A specific person (or group) is available for assistance with Facebook difficulties.
– Facebook is somewhat intimidating to me.
<b>Behavioral Intention to Use the System (BI)</b>
– I intend to use Facebook in the future.
– I predict I would use Facebook in the future.
– I plan to use Facebook in the future.

## 2.6 Assessment of Reliability

While the construct validity is a measurement between constructs, the reliability is a measurement within a construct. The concern on reliability is how well a set of instrument items selected for a given construct measures the same construct. For this study, to analyze whether one construct is independent of and calculated separately from that of other constructs, the Cronbach's Alpha method and Inter-Item Correlation Matrix will be used. Additionally, the correlation among variables will reflect the independence of each construct. The results of inter-item correlation matrix provide more evidence to prove the reliability of the model scales.

## 3. CONCLUSIONS

IS researchers, as in other disciplines, seek to be able to explain phenomenon under investigation. To facilitate this problem, measurement models employed in research endeavors must be meticulously assessed. Analyses in this study seek to assess the explanatory powers of two competing models of information technology acceptance and use behaviors. In addition to providing a statistical basis for measurement assessment and model testing, there is a need to determine what model to choose, parsimony vs. richness, over sample size considerations.

We acknowledge that the present research has a limitation that should be addressed. The original field studies of Venkatesh et al. (2003) to measure the UTAUT model were longitudinal observational designs across industries, while the replication of the model as it is used here did not employ the same research approach. The collected information of moderators used in the original model such as experience, gender, age, and voluntariness has not been accounted for in the current research model. Future studies to retest the UTAUT model with these moderators are encouraged because these factors may better predict the usage behavior indication.

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# ENTERPRISE ARCHITECTURE AND COMPETITIVE ANALYSIS

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## ABSTRACT

*Enterprise Architecture has moved from the realm of IT into the executive suite. Business leaders and faculty see EA in terms of developing business strategy and as an organization development model. More importantly, businesses must consider competition and incorporate it into its strategies. This requires appropriate data and a view of the competitive firms and the industry. EA is characterized by organizing data frameworks, including the Zachman Framework, one of the most popular and recognizable. This paper explores the Zachman Framework in terms of its use for developing competitive business strategy. The findings show that EA needs to include constructs for modeling a firm's competitive environment. The paper speculates on some suggestions for creating and adding these constructs, e.g. Porter's competitive five forces, to EA and the Zachman Framework.*

**Keywords:** Competitive Strategy, Enterprise Architecture, Business Architecture

## INTRODUCTION

Since the modern enterprise came into existence, owners, managers, and others have been interested in the improvement of their performance. The profit motive is the strongest driver for those organizations for which this is a primary goal. A brief history of these efforts includes Scientific Management, Operations Research, Organizational Development, Total Quality Management, Strategic Planning, and most recently Enterprise Architecture (EA). Names of some historical figures include Taylor, Ackoff, Lewin, Deming, Porter, and Zachman. Each of these paradigms reflected the knowledge and technology of the day and produced results that were more or less successful depending on the multitude of factors in the myriad of organizational instances in which these methods were applied.

The current paradigm, and the one which is the focus of this paper, is Enterprise Architecture. Not surprisingly, given the overwhelming preponderance of the information technology (IT) that pervades today's enterprises, this grand model has its roots in this area. Most experts in the field credit Sowa and Zachman (1992) with the concept termed Information Systems Architecture (ISA) that was introduced while both were at IBM. This structure became the Zachman Framework (ZF), and the overall concept came to be called Enterprise Architecture. Jonkers, et al. (2006) define EA as "a coherent whole of principles, methods and models that are used in the design and realization of the enterprise's organizational structure, business processes, information systems, and infrastructure. EA captures the essentials of the business, IT and its evolution."

EA, along with those who practice it, enterprise architects, provides an overarching model and method of designing and redesigning the enterprise (organization) in order that it may translate the strategies into actions generating productive performance. EA mainly provides a holistic viewpoint from several levels of view and is concerned with alignment of the enterprises resources with the strategy. This connection to the organization's strategy has captured the attention of the CEO and executive managers. Veasey (2001) discusses the use of EA for developing and managing strategic change. A more recent discussion on EA as strategy is provided by Ross, Wiell, and Robertson (2006) in which they provide examples of several businesses, including Dell, MetLife, and Delta Airlines. They claim their book "is written for all executives who have ever wondered why some firms—and not others—achieve superior execution..."

Business leaders are interested in EA because they see it as unified way to align the organization from top to bottom, or bottom to top – to assure congruence between the mission and strategy and the internal organization, and its external inputs and outputs. This grand model attempts to encompass all aspects of the enterprise into a unified framework with different levels of view and detail. The overarching goal is to digitize the enterprise at all levels from the conceptual planning level to the actual instantiation of it and its information systems.

Yet, when these architecture frameworks, which are data models and taxonomies of the organization, are scrutinized, there appears to be some critical data missing. The frameworks include the mission and strategy of the organization as elements at a high level view, which is appropriate. But mission and strategy require knowledge of markets and competition. And frameworks say nothing about methodology and modeling process which ultimately requires a modeling language.

The rest of this paper will review the components of developing a competitive strategy and show the historical roots are intertwined with a firm's architecture. Then the best-known EA framework for data modeling, the Zachman Framework (ZF), is presented and discussed from the planning viewpoint in terms of strategy development, market analysis and competitive analysis. Speculations are presented discussing how EA data frameworks might be augmented to incorporate industry and competitive information.

## COMPETITIVE STRATEGY DEVELOPMENT AND EA

Today's enterprises are complex because of the interconnectedness of the world through the communication networks and high-speed travel and transportation. Obviously this makes modeling enterprises a complex activity as well, even those that are not multi-national, since small firms are competing via the internet and e-commerce. The goal is still the same as it has been, make a profit and stay in business. And companies must continually find and shift their position in the rapidly changing global marketplace. EA's premise is that with a digital model of the enterprise (the *as-is* version), one can more quickly and more easily determine the desired state (the *to-be* version) and agilely shift to it. This provides an advantage in terms of faster market response, use of core and key internal competencies, and lower costs, which can be translated into a strategic position. Strategic positioning according to Porter (1996) provides a "sustainable competitive advantage", based on "performing different activities from rivals, or performing similar activities in different ways."

Historically, enterprise architecture has existed for quite some time under various names, most commonly known as organizational development (OD). Not surprisingly, its purpose has been to model organizations and analyze them to determine how to change and structure them for efficiency, effectiveness, productivity, and competitiveness. Beginning in the 1950's, the force field analysis model appeared in 1951(Lewin). Others soon followed such as McKinsey's 7S Framework (Peters & Waterman 1982). Falletta (2008) provides an overview of many of the OD models from 1951 to present day. One such model is the Congruence Model (Nadler and Tushman 1978). In their book, *Competing by Design*, Nadler and Tushman (1997) discuss the "last remaining source of truly sustainable competitive advantage" in terms of "organizational capabilities" which is achieved via "organizational architecture." It is easy to conclude that business strategy and competitive position and capabilities are highly interrelated.

So the question or challenge becomes what is the to-be state of the future enterprise in order to compete and stay viable, and perhaps even achieve greatness, and how is it determined. The answers to these questions are embedded in the process of strategic planning. The firm's strategy provides the goals (ends) and the methods (means) for the firm to win at the game of business – make a profit and continue to exist. And the crux of a strategy is the consideration of the competitors in the industry.

Porter (1980, 1998) wrote the book on "competitive strategy", in fact, that is the name of his book. He defines an industry as "the group of firms producing products that are close substitutes for each other." He further states "The essence of formulating competitive strategy is relating a company to its environment... "Industry structure has a strong influence in determining the competitive rules of the game as well as the strategies potentially available to the firm." (p.2). He specifies a framework for competitor analysis which includes analyzing all significant existing competitors as well as potential competitors in terms of their future goals, current strategy, assumptions (they might make about itself and industry), and capabilities.

It is clear that a firm's strategy (as well as its mission and vision to some extent) are highly dependent on the industry in which it and its competitors operate. This then brings into focus the question of how an industry and the relevant data that describe it should be included as part of EA. In other words, if EA is utilized in the strategic planning process to determine a future state of a firm, in what manner should data and information about the industry be incorporated into EA? A partial answer is to consider data models. So next we will discuss the Zachman Framework, one of the well-known EA frameworks and data models.

## THE ZACHMAN FRAMEWORK

There are several different EA models or frameworks that attempt to capture the structure of an enterprise such as TOGAF (The Open Group 2010) and FEA(CIO Council 1999). The Zachman Framework (ZF) is one such model, which was

developed in 1992, by John Zachman, and is probably the most recognizable EA model today. The current form of the ZF (Zachman International 2010) is shown below in Figure 1.

**THE ZACHMAN ENTERPRISE FRAMEWORK<sup>2</sup>™**

THE ZACHMAN ENTERPRISE FRAMEWORK <sup>2</sup> ™						
	What	How	Where	Who	When	Why
Scope Contexts	Inventory Identification Inventory Types	Process Identification Process Types	Network Identification Network Types	Organization Identification Organization Types	Timing Identification Timing Types	Motivation Identification Motivation Types
Business Concepts	Inventory Definition Business Entity Business Relationship	Process Definition Business Transform Business Input	Network Definition Business Location Business Connection	Organization Definition Business Role Business Work	Timing Definition Business Cycle Business Moment	Motivation Definition Business End Business Means
System Logic	Inventory Representation System Entity System Relationship	Process Representation System Transform System Input	Network Representation System Location System Connection	Organization Representation System Role System Work	Timing Representation System Cycle System Moment	Motivation Representation System End System Means
Technology Physics	Inventory Specification Technology Entity Technology Relationship	Process Specification Technology Transform Technology Input	Network Specification Technology Location Technology Connection	Organization Specification Technology Role Technology Work	Timing Specification Technology Cycle Technology Moment	Motivation Specification Technology End Technology Means
Component Assemblies	Inventory Configuration Component Entity Component Relationship	Process Configuration Component Transform Component Input	Network Configuration Component Location Component Connection	Organization Configuration Component Role Component Work	Timing Configuration Component Cycle Component Moment	Motivation Configuration Component End Component Means
Operations Classes	Inventory Instantiation Operations Entity Operations Relationship	Process Instantiation Operations Transform Operations Input	Network Instantiation Operations Location Operations Connection	Organization Instantiation Operations Role Operations Work	Timing Instantiation Operations Cycle Operations Moment	Motivation Instantiation Operations End Operations Means
Released October 2008						
Normative Projection on Version 2.02						

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**Figure 1: Zachman Framework™ (Zachman International)**

John Zachman describes his framework as a schema, an ontology, a metamodel, and a basis for enterprise architecture. By schema he is referring to the fact that it is comprised of six columns and six rows. Each row provides a different view, from the high level conceptual view to the actual instantiation of the business. In between are the business view, the systems view, the technology view and the component view. The columns refer to the different information that answers the interrogatives what, how, where, who, when, and why. The intersection of each row and column is a specific model. By ontology, Zachman means that the framework is complete in specifying all of the essential elements of an enterprise. By metamodel, he means a model of a model, unifying the primitive models into a larger, overarching model. He makes the point that the framework is a data model and a structure and is not a process. He compares it to the Periodic Table of elements and any process of EA to chemical processes. The periodic table does not specify chemical processes and reactions, just the structure of the elements.

One view of interest in this paper is the planning view, which also has other labels such as Scope, Strategists, Context, Theorists. It is the highest (or most abstract) level view of the organization and describes the conceptual data about the organization in terms of the classes of things (What), processes (How), places (Where), organizations (Who), cycles (When), and objectives and motivations (Why). From a strategy standpoint it is the Why column that drives and connects the other five major columns. And at the planning view it contains the vision and mission of the firm.

The other view of interest is the Owners view which provides for the business concepts data. Together with the Planner view, these two views in the Why column contain the firm's strategy: vision and mission, organizational level goals and objectives, and high level directives and courses of actions. Hay (2006) further indicates that the Owners view contains Influencers which is "anything that can produce an effect on the enterprise without apparent exertion of tangible force or direct exercise of command." External influencers are competitors, the environment, suppliers, customers, partners, regulators and others. The as-is version of this data would provide the current strategy of the firm, that which shows the current state of affairs. This data is used in the planning process to generate the to-be or planned version of the firm's strategy.

But in order to have a mission and strategy developed conceptually, there must be recognition of the industry(ies) in which the organization operates. (We are focused specifically on enterprises that have a profit motive and must be concerned about competition.) An industry is comprised of several, if not many, enterprises (competitors) all vying for market share. It seems that this data should be part of the information necessary to craft a strategy and that it should play some role in enterprise architecture and be included with or connected to the framework that is the data model of the enterprise, i.e. the Zachman Framework. And Hay (2006) suggests this to be so. The next section discusses what type of data this might be and how it is connected to strategy and mission.

## SPECULATIONS

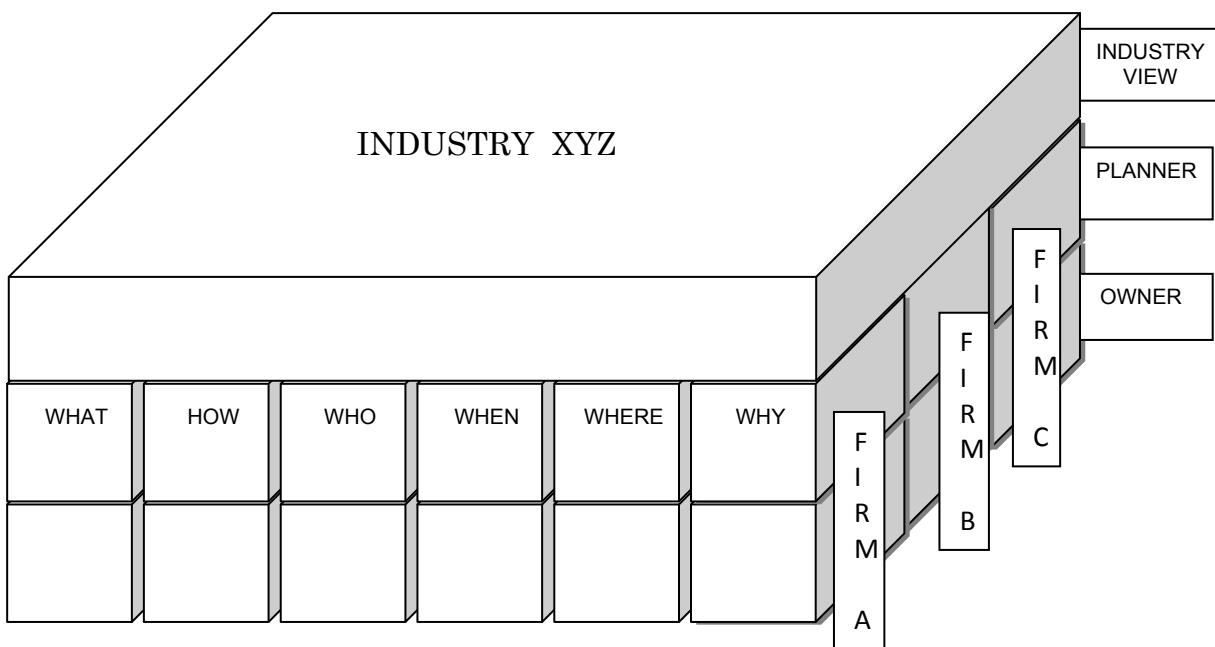
How should an industry be modeled in terms of its data, like an enterprise in the ZF? There seem to be several possible answers. There is a higher level than the Planner view, one that views the entire industry, that could be incorporated into the ZF or such similar framework. If this were to be created it might be called the Industry Analyst View. It would be of interest to those who analyze industries, mostly for purposes of financial markets analysis, and also to those enterprises in the industry. This high level view would contain the highest level of classes of products/services in the industry, and classes of things, processes, places, organizations, cycles (timings), and objectives.

Perhaps this effort should be called Industry Architecture, although we have to wonder whether it would be used specifically for architecting (planning or designing) an industry. One does not usually think there is much control over an industry. But there are professional organizations that do preside over various industries in an attempt to provide collaboration of the firm's in the industry to influence the forces that be for the best interest of the industry. Also, consider that there exists yet an even higher level of view, and that is of the world. The industry exists in the world. And that view would provide data about the environment outside the industry that affects the industry, for example related industries, and other influencers of that industry. The industry view would then contain EAs for each of the enterprises in the industry.

What data and information would be or should be contained in an IA framework? Expanding on the ZF, we can generate a three-dimensional framework, for example, as shown in Figure 2. This shows data for each of the competitive firms in the industry, with a layer on top containing data for the industry as a whole. The views of interest for competitive purposes are the Planner View and the Owner View for each firm. If Firm A were to be developing this information, it would collect and generate data about Firms B and C in these two views and would include:

- Why: current vision and mission, and possible future visions and missions
- Who: the current list of competing firms and possible entrants
- What: current set of product services of each firm and possible future changes and trends
- How: current and possible future various high level methods of activities used: marketing, production, distribution
- Where: current and possible future locations of the firms
- When: current and possible future key events and cycles of the firms

Additional information about each firm can be derived or inferred from data, such as future goals, assumptions, specific capabilities, and possible responses to changes in competitive strategies.



**Figure 2: Industry Framework**

The industry level view would include current information and possible futures and trends for the industry, such as:

- Why: the overall mission and future trends of the industry
- Who: possible mergers and acquisitions and merging or emerging companies
- What: general trends of future products and services
- How: general trends of various high level methods of activities used: marketing, production, distribution
- Where: trends for expansion
- When: key events and cycles of the industry and future trends

Also in the industry view other important information would be included, most of it based on Porter's (1980, 2008) conceptions of competitive data for strategy formulation. This includes information relating to the five competitive forces in the industry and other information pertaining to the evolution of the industry.

It is unlikely that the industry view would actually be created for the sake of the industry itself having an industry view, for there does not really seem to be any motive for anyone to do so (except for the possibility mentioned above.) But an enterprise planner, who is concerned about the strategy of his enterprise, would be motivated to create the industry view and then create EAs, or at least partial EAs of the as-is and potential to-be EAs for each competitor or potential competitor as suggested by Porter. This data would then inform the strategy of the enterprise which would then drive the remainder of the to-be EA.

## CONCLUSION

Businesses are using Enterprise Architecture in various ways, but ultimately as a key method to make the firm more profitable and competitive. EA recognizes and requires data about the firm, of which strategy is a key part. Competitive strategy requires knowledge of the competing firms as well as the industry. Current EA frameworks, e.g. the Zachman Framework, do not provide for this competitive data. It is clear that for competitive strategies to be formulated using EA, this methodology should provide for this data. Frameworks, such as the ZF, need to connect to an industry view that contains the data pertaining to the industry and the firms within it. Then the strategy of an enterprise in a given industry can be informed of the competitive aspects which will allow the strategy to include goals and objectives for success against its competition. Without this additional data model, enterprise architecture is disconnected from its industry, and enterprise architects may be misled about the need for competitive data and strategy at the planning view. CEOs and planners who embrace this call to include industry data in the framework will have a distinct advantage in generating competitive strategies that will drive the architecture of the enterprise.

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# OPINIONS OF MARKETING FACULTY ABOUT CLIENT-FINANCED REAL-WORLD PROJECTS: A QUALITATIVE STUDY USING CONTENT ANALYSIS

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## ABSTRACT

Lectures have long been a central characteristic of traditional university learning; however, increasingly marketing faculty are including client-based projects in their curricula. Even though client-based projects have been used for several years, there are gaps in our knowledge about marketing professors' opinions regarding the value of such "live-case" projects. This study empirically explores the perceptions of marketing faculty toward a specific type of client-based project: the client-financed project (C-FP). We surveyed a nationwide sample of marketing faculty at AACSB accredited schools to empirically address two questions: 1) "What are the demographics of marketing faculty who have supervised a client-financed project since September 2006?" and 2) "What are the qualitative opinions of marketing educators about client-financed projects?" Evaluation results indicate widespread support for using C-FPs because such projects provide multiple benefits for the students. Our respondents made several positive statements about the value of a C-FP such as: useful, realistic, fun and invaluable for the students, an essential component in the learning process that improves higher-order learning, and is a great learning experience that is a good way for students to apply their knowledge to a real-world issue. From our content analysis of respondents' statements, it is apparent those marketing faculties have a high opinion of the value of the client-financed project. For example, one professor wrote "for students; best return on their educational investment."

**Keywords:** Client-Financed Projects, Marketing Education Pedagogy

## OPINIONS OF MARKETING FACULTY ABOUT CLIENT-BASED, REAL-WORLD PROJECTS: A QUALITATIVE STUDY USING CONTENT ANALYSIS

Numerous scholars have expressed doubts about the effectiveness of lecturing to create long-term retention of marketing concepts and theories (Munoz & Huser, 2008; Matulich, Papp & Haytko, 2008; Peterson & Albertson, 2006). The Association to Advance Collegiate Schools of Business (2009) (AACSB) notes that passive learning, such as lectures, is ineffective and of short duration. At the same time, many marketing professors have stated their belief that experiential learning activities (ELAs), such as a client-based project, benefit students by developing a student's soft skills (critical-thinking, problem-solving, teamwork, communications, analytical thinking, reflective thinking, creativity, and decision-making (Elam & Spotts, 2004; Frontczak & Kelley, 2000; Dewey, 1938; Schee, 2007; Bove & Davies, 2009). Over 20 years ago Vincent & de los Santos (1988/1989) pointed out that the AACSB wanted students to be involved in more practical assignments in which they solve actual business problems. As educators, we must use pedagogy that improves a student's soft skills because the business world wants college graduates who possess good soft skills (Kennedy, Lawton, & Walker, 2001; Kelley & Gaedeke, 1990; Bobbitt, et al., 2000).

We begin by discussing studies that reported the opinions of marketing faculty on a variety of marketing education issues. Next we discuss our methodology and research results. The article concludes with a discussion of the study's implications for marketing education.

## LITERATURE REVIEW

None of the articles we reviewed cited empirical research to support the author's belief that an ELA is a good method to use to improve a student's soft skills. Our study was designed to fill this gap in the marketing education literature by obtaining qualitative data to determine marketing professors' perceptions of client-financed projects. Several issues in marketing education have been studied in which marketing faculty comprised the sample (journal quality - Browne & Becker, 1991; Mort, et al., 2002; the performance evaluation process - Tong & Bures, 1989; Sheperd, Carley & Stuart, 2009; controversies in collegiate business education - Pearce II & Bonner, 2000; team teaching - White, Henley & Brabston, 1998). Only one study, published slightly more than 20 years ago, measured department heads' attitudes toward real-life marketing projects (Vincent

and de los Santos, 1988/1989). These authors conducted a survey to assess student involvement in real-life marketing problems. They surveyed all 238 accredited schools and 565 nonaccredited schools using a mail questionnaire. Usable returns totaled 269 questionnaires for a response rate of 33.5%. The authors reported that in 84% of responding accredited schools at least one marketing professor uses the client-sponsored project versus 59% in the nonaccredited schools. Additionally, 58% of respondents from an accredited school indicated that clients must pay for projects. “Apparently, accredited professors make payment a test of a sponsor’s seriousness” (Vincent and de los Santo, 1988/1989, p.26). The authors concluded that “Marketing students [at accredited schools] do have a high probability of being exposed to real life assignments...” (p.28).

Our study is a first step in a planned stream of research that will be used to discover marketing faculties’ present-day opinions about client-financed, real-world projects. Our research was designed to answer two primary research questions:

- 1) What are the demographics of marketing faculty who have supervised a client-financed project since September 2006?
- 2) What are the qualitative opinions of marketing educators about client-financed projects?

## METHODOLOGY

### Sample Selection, Size and Composition

Our sample frame contained all 460 United States accredited business schools on the AACSB website (Revised July 31, 2009). We randomly selected 230 schools from the website then randomly selected 4 marketing faculty from each school for a total sample size of 920 marketing educators. We surveyed only Assistant, Associate or Full Professors (Hult, Neese, & Bashaw, 1997).

### Questionnaire Development

No previous instruments were found that measured marketing faculty attitudes toward the client-financed project. Therefore, to develop our questionnaire, we reviewed studies that surveyed marketing faculty.

Based on our review of the literature, we collected the following demographic data about our sample: 1) sex, 2) age, 3) academic rank, 4) tenure status, 5) years taught, and 6) highest degree earned (Hult, Neese & Bashaw, 1997; Polonsky, Juric & Mankelow, 2003). The primary purpose of our research was to determine marketing educators’ opinions of a specific type of client-based project, the **client-financed project (C-FP)**. Our question to collect qualitative data was straightforward: “What are your thoughts about client-financed projects?” In our cover letter and on the questionnaire, we defined a C-FP as: “A Client-Financed Project is defined as a project where the client provides funds to cover expenses incurred by the student-consulting teams.”

### Questionnaire Administration

Our questionnaire was sent to marketing faculty in 2009 and our cut-off date was six weeks after we sent the survey. One questionnaire was received after our cutoff date and this questionnaire was not included in our analysis.

## RESEARCH RESULTS

### Response Rate

Table 1 shows that we achieved a response rate of 22.7%. Our sample size and response rate compare favorably to other studies that have surveyed marketing faculty (Trocchia & Andrus, 2003, N=247, 19.1%; Simpson & Siguaw, 2000, N=47, 8.6%; Ganesh & Tripathy, 1996, N=123, 14%).

**Table 1:** Response Rate

Surveys Sent	Surveys not delivered	Surveys delivered	Surveys Returned	Response Rate %
920	34	886	201	22.7%

### Respondents’ Characteristics

Nearly three-fourths of the respondents were men and 37% were over 56 years old. The percentages who were assistant (34%), associate (30%) or full professor (37%) were similar to the percentages found 13 years ago by Hult, Neese & Bashaw

(1997). Almost 63% of the marketing faculty was tenured, which is the same percentage found by Shields (1996). Approximately 26% of the faculty has taught more than 21 years and almost every respondent possessed a doctorate (96%).

## **Marketing Educators' Experience with a Client-Financed Project**

Of the 201 respondents, 31% had supervised at least one client-financed project since August 2006. Almost 62% of the marketing faculty knew of at least one person in their marketing department who had conducted a C-FP. Sixty-one respondents indicated their age, rank, and tenure status. Of these 61 educators, 44% were tenured, older than 45 and either an associate or full professor.

## **Opinions about the Client-Financed Project – A Content Analysis**

Our general research question was "What are marketing professors' thoughts about client-financed projects?" The question was designed to collect qualitative data and we used the respondents' comments to provide a glimpse into marketing educators' opinions of the C-FP. We content analyzed the respondents' written comments. Table 2 shows the categories which evolved from our content analysis.

**Table 2: A Content Analysis of the Responses to: "What are your Thoughts about Client-Financed Projects?"**

	#	% <sup>a</sup>
1. A Client-financed or client-based project is a valuable experience for students	64	48.8%
2. Students may not be capable of participating in a real-world project	8	6.2%
3. Issues about dealing with a real-world client	32	24.4%
4. Client-financed projects are too much work for the instructor	23	17.7%
5. Using a C-FP versus using a non-financed, client-based project	23	17.7%
6. Miscellaneous Comments	15	11.4%
Total	164	

<sup>a</sup> Percentages do not add to 100% because the percentages are based on comments written by 131 different respondents. Comments from some respondents sometimes fit into more than one category.

For each category established, we now report verbatim comments written by our sample. These qualitative statements provide a first-time look at the current opinions of marketing faculty regarding the client-financed project.

Out of 201 respondents, 131 wrote a comment in response to the question: "What are your thoughts about client-financed projects?" There were very short comments such as "a lot of work," "after tenure," "great idea," and numerous statements that contained 100 words or more.

Based on our content analysis, we conclude that the marketing professoriate think about their students when asked their opinions about client-financed projects. Our conclusion is supported by the fact that out of 131 respondents who wrote a comment, 50% used the terms "Student(s)" or "undergrad" in their statement. These comments that contained "student(s)" or "undergrad" fell into the two categories listed below:

### **Category 1: A Client-Financed or Client-Based Project is a Valuable Experience for Students**

Comments like the ones listed below are representative of the type of comment placed in Category 1.

- 1) "good (sic) 'real world' experience, which tend to be missing for undergrads. Also gets them more involved."
- 2) "These are a great experience for the student."
- 3) "A good way to make the project exciting and realistic for students."
- 4) "They are an essential component in the learning process..."
- 5) "Excellent opportunities for 'real world' (sic) focus. These projects are great client resume references..."
- 6) "for students: best return on their educational investment" (sic)
- 7) "...I believe using real-world clients is absolutely an invaluable experience for students..."
- 8) I think that CFP are a very valuable tool in marketing pedagogy."

For Category 1, 64 respondents (49%) wrote a comment that indicated they believed a real-world project benefited their students. The above comments lead us to conclude that a C-FP is a great experience that motivates and excites students by adding realism to the classroom. Additionally, a C-FP is viewed as an essential component in the learning process.

### **Category 2: Students May Not Be Capable of Participating in a Real-World Project**

The second category where “student(s)” or “undergrad” was used in the statement dealt with the capability of students to effectively satisfy their client. This category contained eight comments. The following comments are representative of the statements placed into Category 2.

- 1) “I think C-FPs are great with a select group of good students (I wouldn’t want some students to give advice to a company) who are interested in the class.”
- 2) Not all students have the commitment or capacity to productively contribute.”
- 3) “Most undergrads have little/no work experiences, and do not have the skills necessary for engaging with clients successfully...younger students do not have the ‘big picture’ that enables them to convert classroom learning into real world value in an effective manner.”

The third quote brings up an interesting point. If students are not experienced enough to complete a real-world, client-based project, then marketing faculty should use a C-FP to prepare them to succeed in the real-world. The instructor needs to clearly explain to the client that the students lack experience; however, the students will bring fresh and new perspectives to the client’s knowledge base. Students may be naïve when they begin a real-world project, however; with hands-on help and advice from their professor, the students are capable of producing high quality reports. To produce quality reports, the professor must be willing to be the students’ leader, general manager and mentor for the class. One of the authors of this article has been supervising client-financed projects since 1980 and has received several student-consulting reports that are very high quality.

In a recent study, 14 past clients were personally interviewed by trained interviewers to determine the clients’ level of satisfaction with the reports prepared by junior and senior business majors (Clark, et al., 2009). The authors of the article stated the following conclusions regarding former clients’ opinions about the student-consultants’ capabilities.

*“1) Students provided clear strategic recommendations; 2) students generated valuable business information 3) clients perceived a high value for their investment and 4) clients were very impressed with the students’ professional attitude and appearance. All 14 clients stated that they would recommend participating in a client-financed student project” (p. 34).*

The research results reported by Clark, et al., (2009) support our conclusion that undergraduates are capable of producing quality reports for “paying” clients.

### **Category 3: Issues About Dealing With a Real-World Client**

In the third category, approximately 53% of the respondents wrote a comment that contained the term “client” or “C-FP.” The quotes listed below are representative of the concerns our respondents had about doing a client-based/C-FP.

- 1) “Problem: Linking client goals to class learning objectives...”
- 2) “1) Some clients have unrealistic expectations 2) All of our clients do not want to pay anything at all...4) Many clients have NO databases etc...”
- 3) “...we live in a small city and there are not a lot of available clients that might pay for our services”
- 4) “...institutions need to establish infrastructures to ‘recruit’ clients.”
- 5) “Projects tend to be vague which creates frustration...; projects rarely have a ‘champion’ in sponsoring company.”

To summarize, instructors have trouble with clients whose needs are vague and sometimes do not match a particular course’s learning objectives. Also, some clients have unrealistic expectations, plus the recruiting of clients should be the responsibility of the instructor’s institution.

### **Category 4: Client-Financed Projects Are Too Much Work for the Instructor**

The fourth category that evolved from our content analysis is discussed next. A total of 23 respondents indicated they believed a C-FP was too much work for the instructor. The quotes below are typical of instructors’ complaints about the work involved in supervising a real-world project.

- 1) “...too time consuming for an untenured faculty”
- 2) “...it is a lot of work for the faculty but there are absolutely no incentives or rewards.”
- 3) “Places a lot of pressure on ...faculty to deliver a useful and valuable product to the client.”
- 4) “They are a tremendous amount of work for the faculty member.”

To summarize, supervising a client-based/client-financed project places a lot of pressure on the instructor and requires a tremendous amount of work for the teacher with no rewards for supervising a real-world project.

#### **Category 5: Using a C-FP Versus Using a Non-Financed, Client-Based Project**

Our fifth category contains comments that compared a C-FP to a non-financed, client-based project (N-F, C-BP). Nearly 17% of the respondents wrote a statement that compared the value of a C-FP to the value of a N-F, C-BP. The discussion below illustrates how marketing faculty view the C-FP versus the N-F, C-BP. The reader will note there are diametrically opposing thoughts on the subject of the value of these two types of real-world projects.

One respondent wrote: "...I do not think these have to be 'client-financed' projects. The experiential learning is the same whether the client pays or not." In a similar vein, a different respondent wrote: "I don't see how the clients' paying vs. not paying affects the quality of the learning experience." In contrast, another instructor wrote: "I believe that the quality of [the students' work] might improve if projects were client-financed. It would mean more accountability for the students and they would take it more seriously." Another respondent wrote "...it makes sense that if the client has some skins in the game they will take a project, more seriously, which in turn should motivate students." It must be noted that a number of the comments comparing a C-FP to a N-F, C-BP indicated that what students learned from the project was not influenced by the financial characteristic of the project. However, in our experience, clients who cover expenses are more involved and the students are more motivated and serious about producing a quality report for the client.

#### **Category 6: Miscellaneous Comments**

As with any content analysis, several comments did not fall into a particular category; but were nevertheless unique and interesting enough to discuss here. One respondent wrote, "I personally finance my student projects to the tune of about \$2000/year." Clearly, this is a dedicated teacher who believes a financed project is a worthwhile experience for his students. Another respondent wrote, "I began C-FP classes 35 years ago – specifically focused on non-US marketing...Good luck on your research. Obviously I find it timely and critical." In sharp contrast, a different respondent noted: "Just another American obsession with something 'new.'" This comment was written by a tenured, associate professor with 35 years of teaching experience. We found this statement rather strange since numerous articles in marketing education have been published that have discussed real-world, client-based projects. In fact, 31 years ago Browne (1979) published one of the first articles that described how his students were working on corporate-sponsored projects. Other scholars have published similar articles over the years that have discussed how their students worked with clients on a real-world project (Humphreys, 1980; Dean, 1982; de los Santos & Jensen, 1985; Clark, 1994; Milner, 1995; Nicholson & Oliphant, 2002; Barr & McNeilly, 2002; Lopez & Lee, 2005; Bove & Davies, 2009). It is hard to imagine that any marketing professor who has taught for 35 years would think a real-world, client-based project is "something new."

## **DISCUSSION**

The quotes below empirically support the idea that C-FPs are viewed very favorably by the marketing faculty we surveyed. C-FPs are...

- 1) "useful & fun for students"
- 2) "great learning experience for students"
- 3) "Excellent opportunities for 'real-world' focus"
- 4) [able to]"add a dose of real-life experience that is invaluable"
- 5) "Great pedagogy for group work and practical experience [and] are a very valuable tool in marketing pedagogy"
- 6) "good 'real-world' experience...[that] gets [students] more involved"
- 7) "...exciting and realistic for students"
- 8) "...an essential component in the learning process"
- 9) [able to create]"higher order learning"
- 10) "the best return on [the students'] educational investment"
- 11) "a good way for students to apply their knowledge on 'real-world' issues."

A number of terms have been used to describe a project involving a "real-world client" ("client-based" - Parsons & Lekowska-White, 2009; "live-case" - Elam & Spotts, 2004; "real-life" - Gackowski, 2003; "consulting-based" - Barr & McNeilly, 2002; "hands-on" - Ruyter & Crask, 1994; "unstructured live-case" - Richardson & Raveed, 1980).

A C-FP is a unique type of project that involves students who work with a “client.” The following definition of a C-FP has been expanded and refined based on the quotes from our respondents. For students, C-FPs are useful, fun, exciting, realistic, and a great pedagogy for group work and practical experience. C-FPs create higher-order learning, are essential to the learning process and are the best return on the students’ educational investment. C-FPs are an invaluable learning experience that gets students involved and allows them to apply their knowledge to a real-world issue.

At our university the C-FPs possess a characteristic that sets a C-FP apart from other projects discussed in the marketing education literature. A C-FP requires the client to sign a formal contract that contains a budget that specifies how the money from the client will be spent to cover costs incurred by the class or the instructor. Neither the students nor the instructor receive any monetary compensation for the time and effort needed to complete a written report for the client.

## IMPLICATIONS FOR MARKETING EDUCATION

An interesting comment was made by a non-tenured assistant professor with ten years of university teaching experience “...I believe the time has come to codify and formalize C-FPs. If anything, it should count for faculty service and there should be adequate revenue to cover student expenses.” We completely agree with this respondent’s opinion and will go one step further. Faculty who do three or more C-FPs in one academic year should be granted release time the same way that faculty are granted release time to concentrate on publishing refereed journal articles. The AACSB has stressed for several years that obtaining accreditation is heavily influenced by the quantity of refereed journal articles produced by a business school’s faculty. Because of the policies of the AACSB, many business schools award release time and tenure based on the faculty member’s production of journal articles. In other words, if you want your school to be accredited by the AACSB, you need to support and reward faculty who produce journal articles. At the same time, numerous standards established by the AACSB for accreditation can be met if faculty expose their students to a real-world, client-financed project. (e.g., Standards 12, 13, 14, 15, and 17) (AACSB, revised July 1, 2009). These standards stress faculty-student interaction and the importance of students working together and contributing to the learning of fellow students. Nearly 18% of the respondents believed that supervising a C-FP was too much work for the teacher with little reward or incentive for using such a pedagogical style. Perhaps it is time for the AACSB governing body to strongly encourage the use of client-financed projects by suggesting that faculty who do a C-FP should be rewarded with release time. Let’s be blunt, what benefits a business student more, Professor X publishing an article in the JM, JMR or JCR or Professor X supervising students working on a real-world project with a client who covers all expenses incurred by the students?

Business students will learn more from real-world C-FP’s than from the traditional lecture format. C-FP’s should be included in all business school curriculums. Several marketing faculty indicated that a C-FP increases the professor’s workload. There should be an incentive based program at universities for conducting C-FP’s. Obtaining clients was mentioned by more than one respondent as a problem to be overcome if one is to conduct a C-FP. The dean’s office should develop a system to ease the workload of faculty. Our results show that real world C-FPs are a very effective way for students to learn. Using a C-FP format will make students’ business education more valuable. Faculty need to address two primary questions: 1) How can we prepare our students for the real world? and 2) How can we give students an opportunity to experience real-world scenarios? Marketing professionals are expected to possess the ability to identify problems, search for relevant information, analyze, synthesize, and evaluate information and propose solutions in a critical and reflective manner (Hunt & Laverie, 2004; Laverie, 2006; Young, 2005). C-FPs help students improve these soft skills.

Others have noted that “...many instructors will be upset to learn that high-cramming students, to whom they have given good grades, will not forget what was learned” (McIntyre & Munson, 2008, p. 236). Using a client-financed project is one method that results in students developing a deeper and longer-lasting knowledge base about marketing concepts and theories. As one respondent wrote “...actual projects with real client companies add a dose of real-life experience which is invaluable.” Another marketing professor indicated that “Higher-order learning occurs but requires active management by the professor.” A third respondent wrote that “...the benefit to students learning is enormous.” The above comments support our suggestion that all marketing majors be required to participate in at least one client-financed project as a requirement for graduating with a major in marketing.

McIntyre & Munson (2008) call for marketing faculty to use pedagogies that foster “deeper” learning and suggest that course-related projects can help promote deeper learning. These authors also note that for long-term retention, the students need to apply course material to situations that are relevant to them. Requiring marketing majors to complete a C-FP will result in deeper learning and students’ longer retention of the knowledge gained from completing a C-FP. McIntyre & Munson also suggest using pedagogical styles that force students to be active as opposed to passive learners. Our content analysis revealed that several marketing faculty hold the belief that a C-FP causes students to become more involved in the learning

process. We discovered in conversations with many students that they believed working on a real-world, client-financed project was the best learning experience they encountered in their business education. Future research should be conducted to determine how students would respond to the question: "What are your thoughts about client-financed projects?"

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# CORPORATE GOVERNANCE IN AN ETHICALLY CHALLENGED WORLD

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## EXECUTIVE SUMMARY

*In light of the recent spectacular debacles in corporate America, scholars have turned to analysis of corporate governance with renewed vigor. Past assumptions are being reevaluated, and new frameworks are being proposed. This study will examine a number of these propositions. After examining current literature on corporate governance, three key issues will be highlighted as most important in the study of corporate governance. Those issues are accountability, effective communication, and diversity of perspective. Then, a clear definition, principles, and framework for corporate governance will be suggested that seeks to adequately answer each of the three key issues facing corporate governance. The framework will then be compared to data collected in the form of a case study of UAL Corporation, more commonly known as United Airlines. The case study will reveal the merits of the proposed framework in corporate governance today.*

## INTRODUCTION

As we embark upon the twenty-second century, the issues of corporations in respect to their responsibilities to the community, consumers, employees and shareholders have become a point of grave concern. In light of the unethical behaviors recently displayed by large corporations such as Enron, Global Crossing, Tyco etc, one must consider and determine the root cause of these ethical problems. It is our belief that the absence of good ethical conduct in Corporate America today is as a result of the failure of ineffective corporate governance.

In essence, corporate governance from our perspective is a system of body of directors within a corporation who work independently of the chief executive officer (CEO) and his management team. The essential role would be that of monitoring, overseeing and evaluating the performance of upper level executives, but fundamentally ensuring that executives are in compliance of security and exchange commission and New York stock exchange regulations and also held accountable to stakeholders. In other words, professional managers should fulfill not only the will of shareholders, but that of employees, suppliers, customers, environment and the community (Sutton 1993). This form of governance, however, would not suffice without the help of an independently appointed board of directors.

For Charan (1998) effective governance is about the board and CEO acting as one with collective wisdom to achieve business success. This would ensure active participation and sharing of knowledge between the CEO and board.

However, we believe that the key to effective governance lies in the total independence of the board. The collective wisdom of these highly educated, highly dedicated and experienced individuals would enhance the creditability of financial statements and bring back excitement to the capital market. Independence would also ensure a more rigorous evaluation of the two fundamental functions of the CEO – managing the business and managing earnings.

Board members would then have the need to listen, study proxy statements, ask tough questions, make strong intellectual judgments, but fundamentally add value by overseeing the execution of corporate strategy. Quests for effective governance should start with the ability of shareholders to not only nominate representatives to the board, but to make individual members of the board accountable to shareholders through making available their voting records. For example, we suggest that the Chairman of the board be a Certified Public Accountant (CPA) and must be a representative of the major shareholder. The knowledge, skills, abilities and royalty of the Chair is critical in maximizing value.

The responsibilities of the board should not be restricted to monitoring, evaluation and overseer. It should include a strategic insight to the business's external, competitive environment. Within the externals, a company's competitive environment should be examined and create a balance of interests. In essence, collective wisdom and collective responsibility should lead a company down the right path.

## DISCUSSION AND ANALYSIS

According to Charkham (1994) the way a business is managed matters because everyone wants firms that operate within its borders to flourish and grow in such a way as to provide employment, wealth, satisfaction, improvement of standards of living and social cohesion. However, for market economies to function effectively, Charkham (1994) suggests that government must provide what government alone can do in regard to education, economic infrastructure, and macroeconomic management. These individually or collectively may be more important than systems of corporate governance (Charkham 1994).

To understand corporate governance in the United States, Charkham further argues that one must understand the relationship between the CEO and shareholders because shareholders are more interested in the actions and the strategic execution of CEOs, in terms of making their projected financial numbers and not necessarily the actions of the directors. Therefore, the tendency of over reliance on the CEO by shareholders we think has necessitated the need to manipulate proxy statements in the vain attempt to meet targets.

A balance of power we suggest is needed between a CEO and board members where each individual board member is accountable to the accomplishment of financial goals. When CEOs and board members are responsible for financial results a more professional relationship would develop and boards would be more careful in CEO selection.

We believe that an effective corporate governance framework is a board, which comprises the CEO, a board chair, and other representatives appointed and approved by majority stockholders. All bonuses, audits, and compensation decisions should be a human resources department decision and not that of a compensation committee. We propose that each board member have an accounting, finance, or law background and be independently chosen and in return made accountable to shareholders. The educational or skill set of the individual board member is so important as it prevents social loafing. Furthermore, the board must have term limits and would be held as much responsible as the CEO for any financial malfeasance. This would ensure individual commitment, loyalty and devotion to the process of governance.

According to Cutting (2000) a Trinitarian division of power represents the solution to poor governance. The underlying assumption driving this thought process is that constraint or effective accountability is in most cases missing from the decision-making process in organizations. In addition, Cutting believes that decision-making at the highest levels of large corporation is very political. These problems can however be overcome using three principles: First, CEOs must be free to drive their companies forward. Second, operations freedom is required for effective accountability and thirdly, an effective distribution of power between the CEO and the board is necessary. This would provide on-going learning experience for the executive board (Cutting 2000).

Given the underlying assumptions and principles of Cutting's research, it may be asserted as we have suggested that effective governance would need the division of power between three distinct entities - executive, board, and shareholders. However, Cutting proposes the formation of a fourth entity, which he labels the non-executive director of assessment.

The director of assessment, which we would rather label the director of ethics, would exist to challenge the information presented by the CEO and the decisions of the Chairperson (assumed to be two different people). The new position would hold the devil's advocate-type powers and responsibilities. This would, in Cutting's opinion, provide checks and balances necessary in a political arena, which he assumes the large corporation to be.

Nevertheless, the more critical issue that needs immediate resolution we believe is the common practice in Corporate America in vesting in one person the dual responsibilities of chief executive and chairman of the board. This blurs the differences in responsibility and accountability of the two positions. When one draws the distinction between the responsibilities and accountability of the board and the chief executive, the value of separating the office of chairman and of chief executive becomes more obvious.

Donaldson (2000) is of the opinion that one all important reason for the decline in board oversight and intervention is the total disappearance of recognized voices of authority besides the chairman. It is a common practice today for boards according to Donaldson, to be composed of a minority of inside directors and some outside members predominately former CEOs who are normally more sympathetic than non-CEOs.

To solve the problem of lack of rigor, Donaldson (2000) suggests the formation of a strategic audit committee of the board composed primarily of and chaired by outside board members. This committee would direct the gathering and presentation of the information needed to map past performance upon which informed judgments can be made. The Board in its role as

oversight is meaningless unless it includes willingness to engage the executive management team in a serious dialogue on strategic planning, direction, and execution and if necessary to confront an unresponsive CEO and intervene if need be in initiating change ( Donaldson 2000).

However, the biggest challenge is whether the modern large-scale publicly owned corporation, such as United Airlines, has the capacity for self-discipline to adapt to environmental change in a timely and effective manner. For example, the differences between Southwest Airlines and United Airlines is in the process by which change is accomplished and in the leaders of change, but most important, in the time frame or pace of change, which can have profound consequences for the business organization. Like Peter Drucker, Donaldson (2000) asserts that most corporations these days are now shifting away from the traditional, top-down managerial paradigm. Therefore, corporate governance is a means to an end, not a thing to be admired in and of itself (Bowen 1994).

Nonetheless, we believe that the relationship between shareholders and the board as well as the CEO need transparency and accountability, which are essentially missing in Corporate America. Shareholders have failed to exert much influence over boards. Basically, directors do not know what shareholders want, and shareholders do not know what directors do. We are of the opinion that directors must be made to provide executive performance feedback to shareholders, and shareholders should communicate their operations, strategic and organization preferences to boards.

## **CONCEPTUAL FRAMEWORK**

Any conceptual framework of corporate governance (see figure 1) must clarify a working definition of corporate governance, state the general principles important in responding to key issues of governance, and offer a basis through which corporate governance might be better understood and communicated. Each of these will be examined in turn.

### **Definition**

Few of the studies examined earlier (Donaldson, 1994 and Cutting 2000) addressed the important issue of defining corporate governance. For this reason, a working definition will be offered and explained. Corporate governance we believe is the system of relationships between the shareholders, the executive management team represented by the CEO, and the Board of Directors. The relationship between these entities is defined by shared responsibility for the long-term success of the corporation's constituencies. Constituencies include shareholders, suppliers, customers the environment, employees of the corporation, the surrounding community, and the overseeing local and national government.

Each component of the definition is important in suggesting a model that adequately deals with the issues facing corporate governance. First, corporate governance is the system of relationships between shareholders, the executive team, and the Board of Directors. The term relationship is deliberately chosen because no relationship, corporate or personal, can exist without consistent and effective communication. Furthermore, relationship connotes a mutual interdependence; one entity cannot survive or thrive without the others. Recent debacles such as the collapse of Enron Corporation and Tyco illustrate the lack of interdependence between management team and the board.

The second component is equally important. In an effective system of corporate governance, no one entity is solely responsible for the corporation's success. Each group shares responsibility for the corporation. Success is not merely defined by a high stock price at a particular point in time. Rather, consistent great performance and profitability is the goal, and this must occur over the long-term. Short-run profits are necessary, but management must always balance between short-term revenues and long-term profitability. This balance is the shared responsibility of all involved in the corporation's governance.

Thus shared responsibility demands multiple lines of accountability. The Board must hold the CEO and his or her team accountable for the long-term success of the company. Likewise, the CEO must hold the Board accountable for adding value to the company. Shareholders must also act to keep the Board accountable to them. Thus a matrix of accountability should exist rather than the traditional hierarchical tiered structure common in corporate America (Cutting 2000).

The third component of the proposed definition is the need for servant-hood. This would broaden the scope of corporate governance by encouraging directors and managers to see themselves as part of a larger community rather than a self-indulging unit. The lack of servant attitude in corporate America is well illustrated by the actions of former CEO of Sunbeam, Albert Dunlap, who completely neglected the valid concerns of Sunbeam constituents namely employees (Perkins 2000). As a consequence, we are of the opinion that representatives from each one of these named constituents should serve in some capacity on the Board, which would ensure a diversity of perspective that is sadly lacking on many Boards in America. Diversity

of perspectives would protect the concerns of all constituents and would also provide an advantage over competitors who lack such representation. It is in the Board and corporation's best interest to implement this multi-dimensional structure.

## Principles of Corporate Governance

It is common practice for organizations to have a unique expression of corporate governance based on some guiding principles that are transferable regardless of the corporation. It is to that task which we now turn.

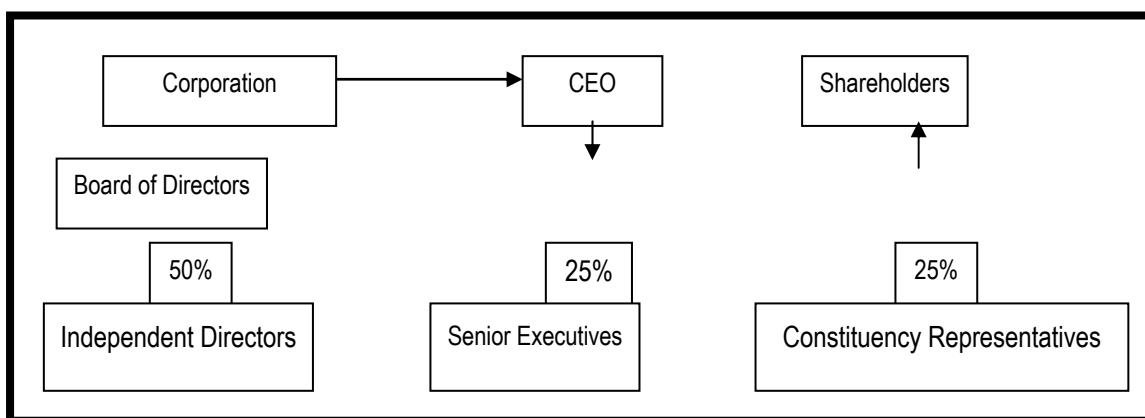
Much literature has been devoted to the issue of whether or not the CEO should also serve as the Chairman of the Board. Any attempt to postulate guiding principles must therefore address this issue. Historically, most corporations have operated with the CEO and Chairman as one person. This is by no means a general rule as exceptions abound. Opinions on the matter are numerous and fierce, but practice reveals that both structures have in some cases been very successful, but most times in our opinion disastrous. Since the office of Chairman is primarily an operational function, it is therefore recommended a separation of both functions. The Chairman must have no previous association with the company and should be appointed by institutional shareholder.

The most significant issue at stake is the appointment and monitoring of the performance of the CEO. The Board has the primary responsibility to select the chief executive officer. The selection process must be made on the basis of the nominee's character, particularly moral and spiritual devotion. For us, personal integrity is the single most important factor for selection as CEO. Regardless of who is appointed, the Board has the singular responsibility to hold the CEO accountable for accurate reporting of the corporation's financial health.

The next important principle that must be dealt with by all Boards is that a board of directors is fundamentally responsible for measuring the effective execution of strategy by the executive team. Board members are expected to ask penetrating, difficult questions that go beyond the information presented by management. This is the primary tool by which accountability occurs on a day-to-day basis and effective three-way communication (management-board-stakeholders) is ensured. Furthermore, the development of a culture of positive conflict between the board and the executive team needs to be developed. If not the benefits of diverse perspectives will be wasted as members seek conformity. We strongly advocate a culture of positive confrontation as the foundation upon which to build an effective corporate governance system. This is by no means an exhaustive list of principles of corporate governance.

## Framework of Corporate Governance

From the definition and principles already laid out, we sought to conceptualize a framework for corporate governance. This framework serves as an overview providing a reference point that connects each part with the whole. Figure 1 illustrates the proposed conceptual framework.



**Figure 1:** Framework of Corporate Governance

From Figure 1, it can be delineated the interdependence of each part of the corporation, thus ensuring that a system of accountability exists. Constituency representatives are appointed from the ranks of employees, business partners and the community. The senior executive team would comprise of the CEO, COO, CFO and the executive vice president of human resources. These executives would be accountable to the Board of Directors.

The Board of Directors is then held accountable to shareholders. Independent directors would be chosen on the basis of technical and industry specific knowledge and skills and would be appointed by the stakeholders. We suggest that the entire board not be more than 12 people in total for efficiency and effectiveness in deliberations of company business. We further advocate three committees- Audit, Compensation, which would be based at the Human Resources department and Strategy. This process of accountability and responsibility we believe is essential for effective corporate governance.

However the maintenance of ethics, the close monitoring of company performance as defined in the strategic plan rests on how accountable the Board of Directors is to shareholders. Therefore, the makeup of the board is of monumental importance to the survival of organizations. The first key member of the board is the chief executive officer. The CEO is chosen by the board and is responsible for managing the operations of the corporation and accurately reporting the corporation's financial and operating status to the board.

The next key member of the board is the Chairman of the Board. The choice of these two individuals determines the efficacy of corporate performance as it relates to increased revenues, profits and the reputation of the firm. Care should be taken in determining these two key players before the rest of the board members are considered.

It is the assertion of this study that a proposal of effective corporate governance must provide for diversity of perspective. This should be the underlying assumption behind the selection of the rest of the board members. One half of the board members as stated earlier should be independent of the organizations operations. They should be representatives appointed to the board by stakeholders. These members should be selected for their skills, knowledge and abilities in specific areas of importance to the corporation's success – finance, accounting, technology operations, law and industry-specific knowledge. After nomination, they should be approved by shareholders before taking office.

The other members of the board should be the senior executives of the company. For example, we recommend these following officers: The chief financial officer, chief operating officer, senior vice president of business ethics and senior vice president of human resources. This representative Board of Directors will be suited to ensure the long-term success of the entire corporation. The paper would through the use of a case study demonstrate the in-adequacy of prevailing corporate governance frameworks.

## **UNITED AIRLINES CASE STUDY**

### **Background and Financial Analysis**

UAL Corporation (UAL) is a holding company, whose principal subsidiary is United Airlines, Inc. United Airlines was established on March 28, 1931. United is a major commercial air transportation company, engaged in the transportation of persons, property and mail throughout the United States and abroad. In December 2002, United filed a voluntary petition for protection under Chapter 11 of the United States Bankruptcy Code.

After an in-depth analysis of the UAL Corporation and Subsidiary Companies Report for the year ended December 31, 2002 the following operating failures were identified:

United's financial results for 2002 were abysmal. For example, they downsized their network by an additional 6 percent over and above the initial cutbacks following the events of 9/11 – to a total of 24 percent. Workforce was reduced from more than 100,000 employees in 2001 to about 72,000 employees today ([www.united.com](http://www.united.com)). Furthermore, passenger revenues decreased \$1.9 billion (14%) due to a 6% decrease in revenue passenger miles and an 8% decrease in yield. Overall operating expenses decreased by \$1.5 billion (8%) and United's cost per available seat mile (unit cost) increased 0.8% from 11.24 cents to 11.33 cents, excluding special charges.

Other non-operating expense amounted to \$534 million in 2002 compared to \$450 million in 2001 compared to \$271 million in 2000, excluding special charges, gains on sales and the airline stabilization grant.

Liquidity represents the firm's ability to pay its current liabilities. All the events described in this section relate to future events or expectations:

- UAL's total of cash, cash equivalents and short-term investments, including restricted cash (both short-and long-term), was \$1.9 billion at December 31, 2002, compared to \$2.6 billion at December 31, 2001.

- Property additions, including aircraft and aircraft part, amounted to \$887 million, including \$730 million of vendor-financed purchases.
- Financing activities during 2002 included principle payments under debt and capital lease obligations of \$1.3 billion and \$220 million, respectively.

The Company's business is very intensive, requiring significant amounts of capital to fund the acquisition of assets, particularly aircraft. United in the past, funded the acquisition of aircraft through outright purchase, by issuing debt, or entering into capital or operating leases. As a result of the financial debacle, United is not permitted to make any payments on its pre-petition debt and therefore, the amounts have been excluded. Capital resources in the UAL's 2002 annual report include: The DIP financing, which consists of two facilities - Bank One Facility for \$300 million and the Club Facility for \$1.2 billion. Clearly, UAL Corporation faces many challenges in attempting to return to profitability. One major strategic issue for the corporation is the relevance of its corporate governance structure. It is to this issue that we now turn.

## UAL Corporation's Governance Structure

In years past, UAL Corporation made bold and innovative changes in their governance structure. In July of 1993, pilots, flight attendants, and machinists unions agreed to salary and benefit concessions in exchange for majority ownership of UAL Corporation. As the 20<sup>th</sup> century drew to a close, United Airlines began implementing pivotal changes throughout the company. One of the most important changes was the establishment of the Employee Stock Ownership Plan (ESOP), creating the world's largest majority employee-owned company in the world. On Dec. 22, 1993, the UAL board approved a proposal for 54,000 employees to exchange portions of their salaries and benefits for UAL stock.

On July 12, 1994, Stephen Wolf and two key officers of UAL Corporation, along with United Airlines President John Pope, stepped down from their positions. Also on that date, Gerald Greenwald was elected chairman and CEO of UAL Corporation and United; and John Edwardson was named airline president.

Greenwald's first steps were a managerial drive to transform the corporate culture from a command-and-control, military style environment to one based on high employee involvement, with emphasis on cross-functional communication. To facilitate this transition several workplace initiatives were quickly adopted. For example, telecommuting, elimination of the furlough policy and introduction of casual dress codes in non-public areas.

However, in July 25, 1994, a historic move was made by United's stockholders. For the first time in the airline's history, representatives from the International Association of Machinists and the Air Line Pilots Association were added to the board of directors. Salaried and management employees also selected an outside director to sit on the board.

## The Failure of Governance at United

United Airlines began to realize that it was headed for Chapter 11 in December of 2002. In April 2003, Machinists union members and Flight Attendants ratified a 6-year giveback contract that may likely see United emerge from bankruptcy. Before United Airlines filed for Chapter 11 bankruptcy, they appointed Glenn F. Tilton as Chairman, President, and Chief Executive Officer. Tilton succeeded John W. Creighton who came to United Airlines in 1998. Tilton's priorities were to:

- Restore Employee Trust and Customer and Investor Confidence
- Address Near-Term Financial Issues
- Develop Long-Term Plan for Renewed Growth

The United Airlines company information quotes one of the directors as saying Tilton was "the man that could guide the company through major global transitions with a sharp focus on financial responsibility" ("UAL Corp. Announces"). Although Mr. Tilton had an extensive background that includes working at Texaco and serving on numerous boards, he was not able to stop the company from filing for Chapter 11.

Maynard and Wong (2003) suggest that one of the many managerial failures at United was the lack of attention to corporate governance. This is also evidenced by a recent comment by Douglas Hacker, United's executive vice president for corporate strategy: "clearly, we have to sort the issue of corporate responsibility out. In addition, the corporate environment had immense hostility between workers and management than at any other airline, and management never developed a culture in which employees were treated like owners (Maynard and Wong, 2003).

As of March, 2003, UAL Corp.'s Employee Stock Ownership Plan (ESOP) has been given the go ahead to sell an additional 3.9 million shares of stock, which could end employees' nearly nine years of majority control at the bankrupt airline within just a few weeks. The sale of the 3.9 million shares would leave the UAL Employee Stock Ownership Plan with roughly 16 million shares and put employee ownership in the company benefit plans below 20 percent. Dropping below that threshold would trigger provisions, which include:

- Eliminating the 55 percent shareholder voting power of the ESOP.
- Eliminating board, board committee and shareholder votes on acquisitions, divestitures and CEO appointments.
- Possibly changing board members, other than the two members who represent the Air Line Pilots Association and the International Association of Machinists unions and the one member who represents salaried and management workers.

Maynard and Wong suggest (2003) are of the view that down the road, the United unions could lose their board seats if creditors call for an overhaul of UAL's corporate governance, or if employee ownership of the airline drops below 20 percent.

Although UAL Corporation's corporate governance structure may undergo dramatic changes, it is important to note the makeup of the existing Board of Directors. Information regarding the Board of Directors comes from the "Form 10-K filed 31 December 2002" to the Securities Exchange Commission. The board members and a brief description of their expertise are as follows:

***Glen F. Tilton***

Director since September 2002. Mr. Tilton has been Chairman, President and Chief Executive Officer of since September 2002. From October 2001 until August 2002, he served as Vice Chairman of Chevron Texaco Corporation (global energy). From January 1997 until February 2001 he served President of Texaco's Global Business Unit

***W. James Farrell***

Director since 2001. Mr. Farrell has been Chairman and Chief Executive Officer of Illinois Tool Works Inc. (Manufacturing and marketing of engineered components) for the past five years. Mr. Farrell also currently serves as Director of Allstate Insurance company, Kraft Foods, and Sears, Roebuck and Company.

***James J. O'Connor***

Director since 1984. Mr. O'Connor has been retired Chairman and Chief Executive Officer since 1998 and served as Chairman and Chief Executive Officer of Unicom Corporation from 1994 to 1998 and its wholly owned subsidiary, Commonwealth Edison Company. He serves as Director of Corning Incorporated, Smurfit-Stone Container Corporation and Tribune Company.

***Paul E. Tierney, Jr.***

Director since 1990. Mr. Tierney has been a General Partner at Darwin Capital Partners since 1999 and as a Managing Member of the Development Capital, LLC since 1997. He is also a Director for Liz Claiborne Inc.

***Richard D. McCormick***

Director since 1994. Mr. McCormick has been Chairman Emeritus since 1999 and served as Chairman of US West Inc. 1992 to 1999. He serves as a Director for Wells Fargo and Company and United Technologies. He was also nominated by the Independent Director Nomination Committee and elected in 2002, pursuant the terms of a stockholders agreement by the holders of UAL Class I stock (the Company, ALPA and IAM).

***Hazel R. O'Leary***

Director since 1999. Ms. O'Leary has been President of O'Leary and Associates since 2002. She serves as a Director of the AES Corporation and Scottish Annuity & Life Holdings Ltd. Ms. O'Leary was nominated by the Independent Director Nomination Committee and elected in 2002 pursuant to the terms of stockholder's agreement.

***John K. Van de Kamp***

Director since 1994. Mr. Van de Kamp serves as President of the Thoroughbred Owners of California and is Of Counsel for Dewey Ballantine both since 1999. Mr. Van de Kamp was nominated by the Independent Director Nomination Committee and elected in 2002, pursuant to the terms of UAL's Class I Stock.

**John H. Walker**

Director since 2002. Walker has been Chief Executive Officer since 2001 and from 2000 to 2001 has been President and Chief Operating Officer of Weirton Steel Corporation. He also served as President of Operations of Kaiser Aluminum Corporation. He was nominated by the holders UAL's Class I Stock.

**Paul R. Whiteford Jr.**

Director since 2002. Captain Whiteford has served as Chairman since 2002 and was Vice Chairman from 2000 to 2001 of ALPA-MEC (labor union). He has been a United B767 Captain since 1990. Captain Whiteford was nominated by ALPA-MEC.

**Stephen R. Canale**

Director since 2002. Canale has served as President and directing Chairman since 1999 and was Assistant General Chairman in 1997 to IAM District Lodge 141 (labor union).

Mr. Canale was nominated by the IAM and elected by the International Association of Machinists and Aerospace Workers, the holder of UAL's Class IAM stock.

**W. Douglas Ford**

Director since 2002. Mr. Ford served as the Chief Executive of refining and marketing in 1999 and as the Executive Director from 2000 to 2002 of BP p.l.c. He serves as a Director for USG Corporation. Mr. Ford was nominated by a System Roundtable, a body of salaried and management employees of United and was elected in 2002 by the holders of UAL's Class SAM stock

An overview of the board reveals many innovative and interesting features. For example, seven of the eleven members were independently nominated and approved by shareholders. Two members were nominated by the labor unions for pilots and machinists and aerospace workers. One member was nominated by employees through a process entitled "System Roundtable." The eleventh member is the CEO and Chairman. UAL Corporation's governance structure appears to have been structured in an attempt to provide accountability, communication, and diversity of perspective to their executive board.

**Analysis of UAL Corporation's Corporate Governance**

UAL Corporation offers a dramatic case study of corporate governance. An overview of the current governance structure seems to indicate that specific actions were taken to provide accountability, communication, and diversity of perspectives. Most notably, UAL Corporation departs from traditional governance structures by giving employees ownership in the company and representation on the Board of Directors. On the surface this appears to be exactly what is proposed in this study.

However, closer analysis reveals some stark differences between the two although they are indeed some similarities. For example, both frameworks attempt to deal with the issues of accountability, communication, and diversity of perspective by giving representative rights to all stakeholders.

Both advocate strong employee involvement in the executive board decision-making. It is here, however, that the two frameworks part ways. UAL Corporation gave majority ownership, 55% of the company to employees, and as a consequence, employees have the right to veto the decisions of the CEO. Thus employee representatives on the board had a lot of power. This in our opinion compromises the true nature of diversity of perspective when one body has more than an equal amount of latitude in decision making. Whilst our framework seeks to provide for employee representation, it does not advocate the shifting of power to employees. Rather, we propose multiple balances of power between the constituencies with a majority of opinion representing the decision of the board.

This provides accountability to shareholders. At the same time, it provides multiple lines of communication from all of the corporation's constituencies. UAL Corporation made some valuable moves in this direction but made the costly mistake of merely shifting power to employees instead of truly diversifying it.

**CONCLUSION**

A perfect system of corporate governance surely cannot exist in the dynamic environment within which corporation does operate. However, recent governance shortcomings heighten awareness to the need to constantly innovate in all areas of a corporation's existence not just its product lines. These innovations must deal with the three key issues governance through accountability, communication, and diversity of perspective. Secondly, governance that involves the selection of the CEO,

monitoring, evaluation, direction and dismissal of the CEO. Thirdly, governance must be achieved through the effective composition of the board with membership should be limited to 12 in total.

UAL Corporation's innovations and failures provide important lessons to future corporate governance work. In addition, UAL Corporation further reveals the merits of the framework proposed in this study. Perhaps more research and innovative implementation in the area of corporate governance will prevent future debacles from marring the history of the American corporation.

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# MANAGING ORGANIZATIONAL WRONGDOING: A DIAGNOSTIC APPROACH

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## ABSTRACT

*Wrongdoing is a problem for many organizations. High-profile examples include Enron, Quest, Bernie Madoff and Global Crossing. The public and government have demanded that organizational wrongdoing be addressed. In response, managers often struggle to cope with managing both individual and corporate wrongdoing. This paper attempts to help managers find better solutions by describing a research-based diagnostic approach to understanding the dynamics and nature of wrongdoing in order to better understand how to manage it more effectively. The process helps identify the source of wrongdoing; the dynamics of wrongdoing including the degree of wrongdoing; the extent to which the organization has been or could be affected, and the most probable direction the wrongdoing will spread in the organization; the speed with which unchecked wrongdoing may engulf the organization; and finally, potential solutions are presented. Applications of how to use the diagnostic process are also provided.*

**Keywords:** Ethics, Wrongdoing, Managing Ethical Behavior, Evil

## INTRODUCTION

Enron, Quest, Tyco, Global Crossing, Adelphia, WorldCom, Bernie Madoff, and now Toyota are an impressive list of firms that have mismanaged organizational wrongdoing (some may use the term corruption). With the exception of Toyota, who is still in the investigation stages, the wrongdoing in the other organizations has had serious negative consequences for all stakeholders. In addition, it is probable that no organization is completely exempt from some degree of wrongdoing. The need to understand, control, and manage wrongdoing is a concern for both academics and practitioners. Academics have responded by devoting great effort to understanding the structure, antecedents, initial conditions, and dynamics of organizational wrongdoing (e.g. Ashforth, Gioia, Robinson, & Trevino, 2008). Academic conclusions, however, have been somewhat inconsistent and inconclusive (e.g. Pinto, Leana, & Pil, 2008). Many practitioners have responded by successfully managing wrongdoing, but too many others have struggled and even failed as evidenced by the list of firms given above. This paper attempts to help alleviate the manager's struggle to understand and manage organizational wrongdoing by presenting a research-based diagnostic approach that bridges both the academic and practitioner worlds.

The diagnostic approach is based on a process that includes identifying the source of wrongdoing; the dynamics of wrongdoing which includes the degree of wrongdoing; the extent to which the organization has been or could be affected; the most probable direction the wrongdoing will spread in the organization; and the speed with which unchecked wrongdoing may engulf an organization; and finally, potential solutions are presented. Working through the diagnostic process will help the manager understand the nature and dynamics of organizational wrongdoing allowing for more informed management decisions. The remainder of the paper will be devoted to developing the process and illustrating how the process can be applied.

## DEVELOPING THE PROCESS

The first difficulty encountered is one of definition. For this paper, the term wrongdoing is used to describe actions that are in violation of organizational norms, organizational policies, societal norms, and legal standards. As will be described later, the definition includes varying degrees of harmful behavior. These degrees of behavior include a range of activity from a simple appearance of harmful activity to widespread corporate corruption or even corporate evil. Therefore, wrongdoing is considered an all-inclusive term.

The diagnostic process is a three phase assessment. Phase 1 is to determine the source of the wrongdoing. Phase 2 is to assess the dynamics of the wrongdoing including the severity of the wrongdoing, the extent of organization involvement, and the potential for spread of the wrongdoing throughout the organization. Phase 3 is to determine the plan of attack to manage the wrongdoing and its effects. The following will detail each phase of the process.

## **Phase 1: Determine The Source Of Wrongdoing**

The literature has identified that wrongdoing is either initiated by an individual actor or by the organization (Pinto, Leana, & Phil, 2008). Knowing the source is critical to understanding the nature of organizational wrongdoing. If wrongdoing is a result of individual(s) action, then the solutions will involve a human resource approach to either change or eliminate the behavior. On the other hand, organization wrongdoing must be approached from an organizational structure or strategy approach. In other words, organizational factors that drive the wrongdoing must be altered or eliminated.

Who receives the primary benefit from the wrongdoing is the determining factor that distinguishes between whether the individual or the organization is the initiating force. The primary beneficiary of the wrongdoing is the actor (individual or organization) deriving the most direct benefit from the wrongdoing (Pinto, Leana, & Phil, 2008). If the individual is the primary beneficiary, then the probable source is the individual. If the organization is the primary beneficiary, then the wrongdoing is most likely initiated by the organization. While it is true in all cases that individuals actually carry out the wrongdoing, the direct benefits can be received by either the individual or the organization (Pinto, Leana, & Phil, 2008).

The most common and telling benefit to an individual is financial gain (Pinto, Leana, & Phil, 2008). Examples of common actions that result in direct, personal financial gain are stealing, embezzling, accepting bribes, and misreporting hours worked or expenses. In all these situations, the direct benefit is to the individual.

Actions that result in organizational gain include producing unsafe products, falsifying documents, pollution, and bribery (e.g. Baucus, 1994; Pinto, Leana, & Phil, 2008; Schrager & Short, 1978). In all these examples the benefit clearly goes to the organization.

Therefore, the first step in the diagnostic process is determining the source by asking the question, "Who benefits from the wrongdoing; individual(s) or the organization?"

## **Phase 2: Assess The Dynamics Of The Wrongdoing**

Four critical factors that must be determined to fully describe the dynamics of the wrongdoing: 1) identify the degree of wrongdoing, 2) determine the extent it has engulfed the organization, 3) describe the most likely direction that the wrongdoing will spread in the organization, and 4) assess how fast the wrongdoing will spread to other parts of the organization. Each factor will be critical in formulating a strategy to manage the impact of wrongdoing.

### ***Identify The Degree Of Wrongdoing***

Perceptions about what constitutes wrongdoing as well as the extent of wrongdoing are often areas of debate in organizations (Miceli & Near, 1994). There is no standard definition of wrongdoing. In a study of whistle-blowing in one organization, Near et. al. (2004) developed seven types of wrongdoing: stealing, waste, mismanagement, safety problems, sexual harassment, unfair discrimination, and other legal violations. This list is not designed to be a comprehensive list that is applicable to all organizations, but it does show varying levels of wrongdoing in one organization. It is fairly obvious that waste does not rise to the same severity level of wrongdoing as stealing. Therefore, for this paper, it is suggested that a 10-point Likert scale be used to measure the level of wrongdoing severity. Point 1 would indicate an action that is minimal or even questionable as to whether it is considered to be wrongdoing. The action may not even be a clear violation of company policy or organizational norms. For example, an employee uses a company computer to create a personal letter and the company policy is company equipment can be used reasonably for personal purposes. Since the company policy does not define reasonably, this action may or may not be wrongdoing. It would be up to the supervisor to determine any wrongdoing and the action would be rated 1 on the scale. It is suggested that the midpoint, a rating of 5, would be that point when the action could have civil or legal ramifications for the individual or firm. For example, severe safety problems (mentioned in the Near et. al. (2004) list) could have legal implications and would receive a rating near 5. A rating of 10 would be reserved for actions that could be considered evil. Evil actions have the following characteristics: they produce extreme harm, the actions are not justified by any instigation or provocation, and they persistent in producing great harm (Staub, 1999). An example of a 10 rated action would be the persistent and very harmful actions of Bernie Madoff. In the Madoff situation, many people were severely damaged financially by systemic wrongdoing which could be classified by many as evil. The actual rating given an action would be a judgment call by the manager making the assessment and would depend on his/her experience and knowledge.

### ***Determine The Extent Wrongdoing Has Engulfed The Organization***

Regardless of whether the source of wrongdoing is the individual or the organization (individuals doing wrongdoing for the benefit of the organization), there is a potential for it to spread to others in the organization (e.g. Baker & Faulkner, 1993;

Chang & Lai, 2002; Pinto, Leana, & Phil, 2008). How far wrongdoing has spread would be a judgment call by the assessing manager. Obviously wrongdoing would most often be done in secret to avoid detection making an accurate determination of spread throughout the organization difficult. Investigation, however, would likely produce at least some indication of how much of the organization is involved. As a visual aid, the manager could mark a scale ranging from 1 person to 100 percent of the organization. The scale could be divided by percentage with scale points at 10, 20, 30, etc. up to 100 percent. This would give the manager a method to visually express the extent of organizational involvement. For example, a small group may be only a small percentage of the total organization, say from 2 – 3 percent, while something as widespread as the wrongdoing at Enron could involve a much larger portion. An example of how to use such a scale will be given later in the paper.

### **Determine The Direction That The Wrongdoing Will Spread To Other Areas Of The Organization**

The direction of spread involves two assessments. The first assesses how much of the organization could eventually become involved in the wrongdoing. The second assesses the rate of increase in the severity of the wrongdoing. Kozlowski and Klein (2000) posit that wrongdoing is amplified as individuals interact with each other. Using the concept of social learning (Bandura, 1986), people in organizations can model the negative behavior of others. In fact, unchecked wrongdoing can spiral to such a critical point that it is considered normal (Ashforth et al., 2008) or negatively characterize the organization as a whole (e.g. Andersson & Peterson, 1999; Pinto, Leana, & Phil, 2008). Therefore, it is critical to understand the potential for wrongdoing to spread to other parts of the organization.

The severity of wrongdoing can also escalate. What can start out as a minor infraction can escalate into something that has major consequences (Ashforth et al., 2008). Therefore, the manager must make a realistic assessment of how severe the wrongdoing can become if left unchecked. A graphical representation of the direction of spread and the potential to increase in severity will be presented later in the paper.

### **Determine The Speed In Which Wrongdoing Can Spread**

The final assessment is to estimate the speed at which the wrongdoing could spread throughout the organization. Wrongdoing will spread if unchecked (Pinto, Leana, & Phil, 2008), but how quickly it will spread is another consideration. The manager must decide how quickly corrective action should be taken in order to control and limit the effects of wrongdoing. Currently no definitive method exists to estimate speed of the spread, but the manager can use personal judgment based on his/her knowledge and experience to make an educated estimate. A simple but useful system is to rate the speed as slow, medium, or fast. While this approach is in no way a precise measure, it will provide some guidance as to how quickly action should be taken.

## **Phase 3: Determining The Plan Of Attack For Managing The Wrongdoing**

The final phase is to determine how to manage the wrongdoing. The two primary questions to ask in this phase are: "How should the wrongdoing be addressed?" and "How quickly should action be taken?" The answer to the first question depends on the source of the wrongdoing. The actions to manage the wrongdoing will be different based on whether it is individual-caused or organization-caused. Suggested actions are discussed below.

In both cases, urgency of action is determined by the speed and direction (i.e. involving more and more individuals or increased severity) that wrongdoing spreads throughout the organization. Actions that have the potential to quickly involve increased numbers of organizational members and/or increase the severity of impact on the organization should be undertaken quickly. Example illustrations are provided for clarification purposes.

The individual as the source of wrongdoing can be addressed with standard human resource practices and procedures or by redesign of organizations policies and practices. DeCenzo and Robbins (2009) provide a standard set of human resource practices that describes escalating actions of discipline. The process could involve increasingly punitive steps including verbal warnings, written warnings, counseling, suspension, termination, or ultimately criminal or civil complaints. Actions of wrongdoing that primarily benefit individual organization members but involve groups of organization members could be addressed with actions designed to change group behavior including such measures as policy changes, training, systems redesign, removing certain individuals from the group or workplace, and individual discipline as described above.

Poorly designed or poorly implemented organizational structures, policies, systems, practices, and procedures can also ultimately lead to individual wrongdoing. For example, the author is aware of a firm that has put so much emphasis on getting tasks done at any cost that supervisors often authorize overtime to make sure work is completed on time. Employees quickly learned that if they slowed down during normal work time, they could get substantial amounts of overtime. Employees even

pressure their peers to slow down. Therefore, the firm got what it rewarded but did not want - high overtime cost. This is a classic example of a company policy that encourages employees to misuse overtime. Consequently, the manager must not only look to individual human resource practices to manage individual wrongdoing, but must consider organizational factors as well.

Wrongdoing for the benefit of the organization is more difficult to manage because the organization itself is the cause of the wrongdoing. In addition, unchecked individual wrongdoing can even develop to the point where it is considered normal and accepted organization behavior (e.g. Ashforth & Anand, 2003). Because this type of wrongdoing is caused by the organization, managers must look to organizational characteristics and norms that may lead to wrongdoing in order to correct it. In fact, it is often not helpful to assess personal blame in these situations (Catino, 2008). Balch and Armstrong (2010) developed a very useful conceptual model that provides insight into the organizational pressures that can lead to wrongdoing. The following five variables may provide the catalyst for wrongdoing.

- The culture of competition is pressure to break rules, defy convention, and encourage marginal ethical behavior to avoid conceding competitive advantage.
- Ends-based leadership is leadership which focuses so strongly on ends (chiefly financial) that insufficient attention is paid to the means by which the ends are achieved, thus displaying tolerance for wrongdoing.
- Missionary zeal is an exaggerated commitment to mission, regardless of side effects.
- Legitimizing myth is a narrative (internal or external) that justifies why an organization behaves as it does.
- Corporate cocoon is an encapsulated or isolated frame of reference which accepts as normal some behaviors that would be regarded unethical by societal standards. (Balch & Armstrong, 2010, p. 301)

The manager should use these variables to pinpoint possible areas where the organization is exerting pressure on organizational members to carry out wrongdoing. For example, a misguided missionary zeal for environmental concerns has convinced some environmental extremists that illegal activities, like arson, are justified. Ends-based leaders have put so much pressure on organization members to make quarterly numbers that financial reports are often falsified. Both are examples of organization factors that encourage wrongdoing. Each organization is unique, however, and each manager needs to carefully scrutinize his/her particular organization using the five variables as a guide.

As a final comment, whether the wrong doing is individually or organizationally caused, the urgency of management corrective action is determined by the speed the wrongdoing could spread in the organization and the potential for increasing severity of consequences. The following section provides examples of how to use the diagnostic process.

## **APPLICATION ILLUSTRATIONS**

### **Application Illustration 1: Hooters**

In the recent Hooters of America episode of the CBS television program *Undercover Boss* (Studio Lambert, 2010), the Chief Executive Officer (CEO) of Hooters of America went undercover and worked various positions at different Hooters Restaurants locations. While working at one location, the CEO observed a store manager requiring the female wait staff to play a game called "reindeer games" to see who could go home early. The women were required to bend over and eat food off a plate sitting on a table without using their hands. The fastest eater could go home. The CEO was appalled at this humiliating event. What complicated the situation, however, was the fact that the manager had a good performance record with the firm. The diagnostic process described in this paper can be used to analyze the wrongdoing. In fact, the process can be graphically represented (see Figure 1).

#### ***Phase 1: Determine The Source Of The Wrongdoing***

The source of the wrongdoing for this example is an individual manager. It is clear that the primary benefit is gained by the manager. Yes, the winner can go home, but this "reward" is offset by the humiliation of the activity.

#### ***Phase 2: Assessing The Dynamics Of The Wrongdoing***

The degree of wrongdoing is borderline illegal. Several conditional tests would have to be made to see whether a legal problem actually exists. There is no doubt, however, that the activity is a violation of social norms and probably company policy. The current severity is indicated by a rating of 4 on the Degree of Wrongdoing Scale in Figure 1.

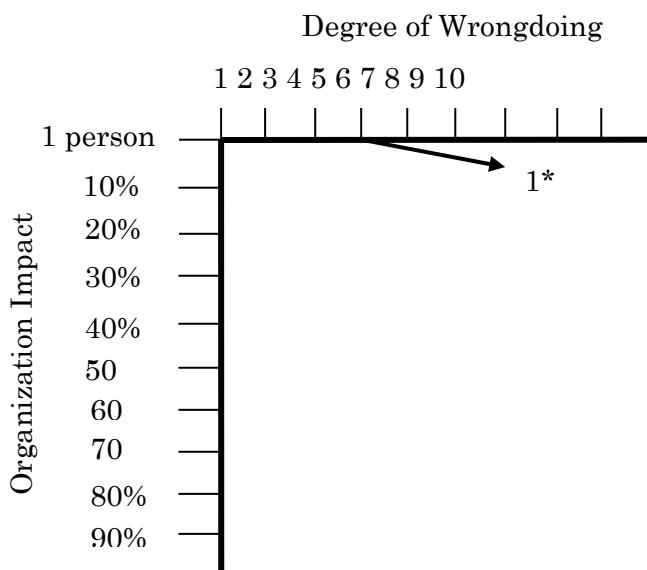
So far, the extent of wrongdoing is limited to one individual as indicated by the start point of the arrow at 1 person on the Organization Impacted Scale in Figure 1.

Most managers would find this practice offensive and consequently the potential to engulf the organization is limited. This assessment is indicated by an arrow that is short and shows a probable maximum of 5 percent (an educated estimate) would ever be involved (see Figure 1).

The severity of the organization wrongdoing has the potential to escalate into real problems for the organization. A sexual harassment case could be filed and the potential legal implications could be substantial. This is represented by the tip of the arrow pointing to a 7 rating on the Degree of Wrongdoing Scale (see Figure 1).

Finally, the speed by which the behavior could spread throughout the organization is rated as slow. Unless other managers come in contact with the offending manager or the wait staff talks about it, there is little opportunity for others in the organization to see it. In fact, most managers would find the “reindeer games” offensive (especially after seeing the television program) and would be unlikely to adopt this behavior. Therefore, a rating of 1 indicating a slow speed is placed by the arrow (see Figure 1).

**Figure 1: The Dynamics of Wrongdoing – Hooters Restaurant**



\*Speed of spread ratings are: 1 - slow, 2 - medium, 3 - fast

In summary, the wrongdoing is initiated by an individual, is not likely to spread rapidly to the entire organization, but is likely to quickly escalate in its severity of consequences. This diagnostic assessment can now be used to guide how the manager manages the situation.

### **Phase 3: Determine The Plan Of Action For Managing The Wrongdoing**

The fact that the wrongdoing could quickly increase in severity calls for prompt action from the manager. Because the wrongdoing was initiated for the benefit of an individual and not the organization, human resource type actions are likely the best solution. Changes in the organization's policies, processes, procedures, etc., however, should not be ruled out. Fortunately, there is little chance that the wrongdoing would spread to other parts of the organization.

According to the broadcast, the offending store manager was counseled about the inappropriateness of the activity as well as exposed on national television, but he was not terminated. The broadcast indicated that as a result of the corrective actions, the store manager had changed his behavior and was doing well. Maybe this situation turned out well since the wrongdoing was corrected and a high performing manager was retained in the organization.

### **Application Illustration 2: The Auto Company (Fictitious Example)**

It was recently discovered that safety test records at one of the firm's test sites had been manipulated by various employees to make the safety tests appear a little better than they really are. While not completely fraudulent, the records were misleading. When questioned about the situation, employees responded that everyone had “an understanding” that management did not want to hear “bad news.” After all, the industry was very competitive and the company's sales had been flat. Bad news about

safety concerns was the last thing the firm needed. In addition, the records did not show major concerns, but they did not tell the entire story. No one would want to really jeopardize the safety of the customer.

### **Phase 1: Determine The Source Of The Wrongdoing**

The source of the wrongdoing was the organization. The pressure to be competitive had created an atmosphere where stretching the truth was considered "expected." Keeping any negative information was clearly a benefit to the firm.

### **Phase 2: Assessing The Dynamics Of The Wrongdoing**

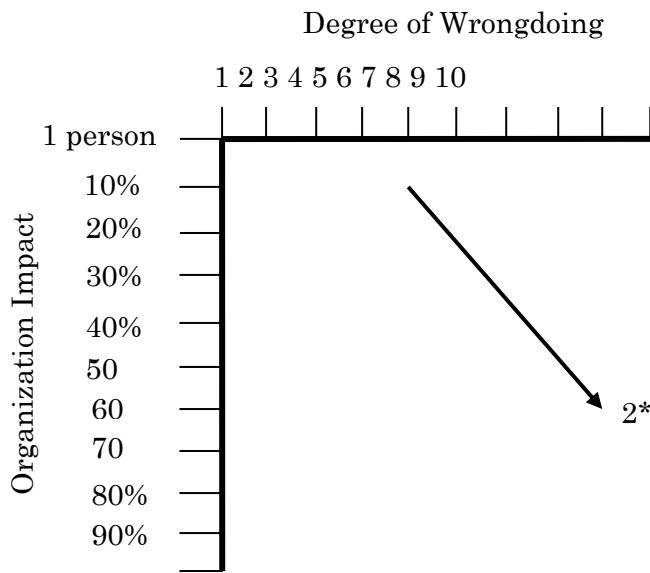
The degree of wrongdoing is definitely unethical and is borderline illegal. If serious safety issues do surface, the legal issues could seriously escalate. The current rating would be 5 on the Degree of Wrongdoing scale in Figure 2.

The extent of the wrongdoing is currently limited to the one test site, but the notion of limiting or avoiding the delivery of "bad news" could spread to a large portion of the organization. It is estimated that the current exposure is 10 percent of the firm, but could spread to 60 percent.

The speed of the spread of the wrongdoing throughout the organization is estimated to be moderate. This type of wrongdoing is like a cancer that can eventually spread throughout the firm. It will not destroy the organization overnight, but left unchecked, it will eventually cause great harm.

The graphic in Figure 2 illustrates the dynamics of the wrongdoing. The arrow begins at 5 on the Degree of Wrongdoing scale and ends at 9 indicating the potential seriousness of the questionable actions. As indicated, approximately 10 percent of the firm is currently involved, but could become as much as 60 percent, if left unchecked. Finally, it is estimated that the wrongdoing could spread at a medium speed as indicated by the 2 next to the arrow. The graphical representation will help the manager better understand the dynamics of the wrongdoing.

**Figure 2: The Dynamics of Wrongdoing – Auto Company**



\*Speed of spread ratings are: 1 - slow, 2 - medium, 3 – fast

### **Phase 3: Determine The Plan Of Action For Managing The Wrongdoing**

The organization receives the primary benefit of the wrongdoing. Thus, actions aimed at changing the organization's practices, policies, procedures, and so forth is the primary emphasis for making corrections. Actions involving individual organization members are not out of the question, however, and may be part of the final solution strategy. Several variables from the Balch and Armstrong (2010) list may be in play. A culture of competition that encourages breaking rules and engaging in marginal ethical behavior may be a factor. In addition, ends-based leadership is putting pressure on organization members to deliver "good news." Finally, the legitimizing myth that no one in the firm would do anything to actually harm customers is used as a justification for the wrongdoing. Changing the basic culture, processes, procedures, etc. of an organization is difficult, but there are accepted methods available which can be found in any organization behavior textbook (e.g. Robbins & Judge, 2009).

Management can select the methods that best fit the firm. Unlike the Hooters Restaurant example, this situation is not about any particular firm and, therefore, the results of any corrective intervention are not available.

## CONCLUSION

Organizations are under attack to “clean up their act.” The corporate scandals of recent years have put pressure on organizations to better manage wrongdoing. The diagnostic process outlined in this paper is an attempt to provide managers with a tool to help better understand the nature and dynamics of wrongdoing. The diagnostic process is research-based and reflects our current understanding of wrongdoing. Extensive research studies continue, however, and over time the process can be better refined as more is learned about the dimensions and nature of wrongdoing. Finally, the process is not designed to specify particular solutions, but just to give managers a better understanding of wrongdoing that will help them make better decisions about selecting specific solution strategies.

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# THE FUTURE OUTCOME FROM A DISCRETE DISTRIBUTION

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## ABSTRACT

The problem of predicting the future outcome based on the information available from a past sample has always concerned researchers. The classical meaning of the frequentist prediction is based on the frequency that the prediction will be wrong, which in a long run should not exceed some error probability determined beforehand. Typically, the error probability is calculated under the assumption that the distribution of the past and future sample is known. In this paper, we introduce an algorithm for obtaining the optimal frequentist prediction limits for a future observation from a discrete distribution. First a Poisson example is considered and next, the method is extended to the whole class of discrete distributions that satisfy regularity conditions. Limits are derived with respect to some error probability  $\alpha$ . The probability of wrong prediction is calculated numerically based on the joint distribution of past and future samples. We utilize a pivotal approach. No knowledge of the distribution is assumed other than it satisfies regularity conditions. An example is included to illustrate the algorithm. Our results show that prediction limits derived using the general algorithm did not differ from the ones derived when the distribution was considered known.

**Keywords:** Frequentist; Exponential Family; Future Sample; Prediction Limits.

## 1. INTRODUCTION

Literature on prediction goes as far back as Weiss who developed an approximate prediction interval [1] ("parameter-free confidence set") by utilizing the approximation to normal distribution. Weiss also looked at the prediction problem from the decision theory point of view [2]. There have been various approaches to the prediction problem. In [3] the predictive distribution function is derived based on asymptotic considerations. Related issues on statistical prediction intervals and their predictive likelihoods are addressed in [4, 5]. In [6] predictive distributions are estimated using simulation based methods. Predictive inferences are found in the Bayesian framework in [7-10]. Probability distributions related to Poisson prediction problems are discussed in [11-15].

In this paper we consider prediction limits for discrete distributions that satisfy the regularity conditions or belong to the exponential family (hereafter we will use these terms interchangeably). Specifically, we develop exact frequentist prediction limits by fixing the probability of a wrong prediction. The joint probability distribution of a single future observation  $(Y)$  and the observed sample  $(X)$ , both from a discrete distribution within the exponential family, is used to assess the probability of a wrong prediction. This paper is organized as follows: an example of predicting the frequentist prediction limits of a future observation  $(Y)$  from the Poisson distribution is presented in section 2. In section 3 a general algorithm for constructing exact frequentist prediction limits of a future observation  $(Y)$  based on a past sample  $(X)$  whose distribution is not known is introduced. A brief discussion is given in section 4. At the end of the paper, in section 5, different mathematical derivations (appendices A1-4) and SPLUS codes (B1-2) are listed.

## 2. CALCULATING PREDICTION LIMITS FOR A POISSON DISTRIBUTION

Independent random variables  $(X)$  and  $(Y)$  conditioned on some parameter  $\lambda$  follow Poisson distributions described, respectively, by equations

$$p(x|\lambda) = \frac{(\lambda x)^x e^{-\lambda x}}{x!} \text{ and } p(y|\lambda) = \frac{(\lambda y)^y e^{-\lambda y}}{y!} \quad (2.1)$$

The lowest upper bound  $u^*(x)$  of the future outcome  $Y$  is constructed with respect to some error probability  $\alpha$ . Any integer valued function  $u(x)$  that satisfies  $u(x) \geq u^*(x)$  and has probability of a wrong prediction less than  $\alpha$ , would be an upper limit.

The algorithm for constructing  $u^*(x)$  follows by first calculating the joint probability function of  $X$  and  $Y$ ,

$$p(x,y) = \left[ \frac{(2s+2t)^r e^{-(2s+2t)}}{r!} \right] \left[ \binom{r}{x} p^x (1-p)^{r-x} \right], \quad (2.2)$$

where  $r = x + y$ ,  $p = s/(s+t)$ , and  $x \in \mathbb{Z}^+$ ,  $y \in \mathbb{Z}^+$ . The second term in the product (2.2) is independent of the parameter  $\lambda$ , and defines the conditional distribution of  $X$  given  $X + Y = r$  as binomial,  $Bin(r,p)$ . Denote the cumulative distribution of  $X|X + Y$  by  $F(r,p,x)$ .

The probability of the wrong prediction for an upper limit  $u(x)$  is given by  $Pr\{Y > u(x)\}$  and it should not exceed  $\alpha$ . For any function  $u(x)$ ,

$$Pr\{Y > u(x)\} = \sum_r \left\{ \frac{(2s+2t)^r e^{-(2s+2t)}}{r!} \Delta_r \right\}, \quad (2.3)$$

where  $r \in \mathbb{Z}^+$  and  $\Delta_r = \sum_{\substack{y > u(x) \\ x+y=r}} \binom{r}{y} p^y (1-p)^{r-y}$  depends on both  $r$  and  $u(\cdot)$

*Lemma:* If we take  $u^*(x) = \max\{r: F(r,p,x) > \alpha\} - x$ , for every integer  $x \geq 0$ , then  $\Delta_r \leq \alpha$ , for every  $r \geq 0$ .

The proof of the lemma follows from the fact that the set of points over which  $\Delta_r$  is calculated agrees with the set of points satisfying the inequality  $F(r,p,x) \leq \alpha \{ (x,y): x+y=r \text{ and } y > u^*(x) \} = \{ (x,y): x+y=r \text{ and } r > x+u^*(x) \}$ . Note that the range of summation may be empty for some values of  $r$  causing  $\Delta_r = 0$ .

For the observed  $x \in \mathbb{Z}^+$ , we find the upper limit of  $Y$  using numerical methods by calculating first the maximum value of  $r$  ( $r_{max}$ ), such that  $F(r,p,x) > \alpha$ . For every  $r > r_{max}$ ,  $F(r,p,x) \leq \alpha$  since  $F(r,p,x)$  is a non increasing function on  $r$ . The smallest upper limit for a given  $x \in \mathbb{Z}^+$  would be  $u^*(x) = r_{max} - x$ . Then, for all nonnegative integers ( $u(x)$ ) greater than  $u^*(x)$ ,  $F(r,p,x) \leq \alpha$ . Hence the inequality  $\Delta_r \leq \alpha$  is true (from the lemma) and therefore, based on (2.3), we conclude that  $Pr\{Y > u(x)\} \leq \alpha$ . The following example illustrates the calculations for the upper prediction limit using the algorithm described above [15].

*Example 1:* We take  $s = 10$ ,  $t = 5$ , the observed value  $x = 4$ , and  $\alpha = .05$ . The maximum value of  $r$ , such that  $F(r,p,4) > \alpha$ , is calculated numerically to be  $r_{max} = 10$ ;  $F(10,p,4) = .077$  (Figure 1). All the values of  $F(r,p,4)$  for every  $r > 10$ , are less than .05. Take  $u^*(4) = r_{max} - 4 = 6$  at  $x = 4$ . Values of  $r_{max}$  and  $u^*(x)$ , for  $0 \leq x \leq 13$ ,  $y \geq 0$ , and  $\alpha = .05$  are shown in Table 1 and  $r_{max}$  is denoted by “ ” in Figure 2. The values of  $\Delta_r$  for the function  $u^*(x)$  and all  $r$  are calculated in appendix A1. The optimal upper prediction limit is represented by the triangles in Figure 3. The probability of making a wrong prediction is the sum of probabilities  $p(x,y) = P\{X = x, Y = y\}$  evaluated over all points with integer coordinates of the area ABC above the line of triangles in the  $(x,y)$  space (Figure 3).

**Table 1:** The calculated values of  $r_{max}$  and  $u^*(x)$  for the observed  $X = x$ , when  $n = 1, s = 10, t = 5$

$x$	0	1	2	3	4	5	6	7	8	9	10	11	12	13
$r_{max}$	2	4	6	8	10	12	4	15	17	19	21	22	24	26
$u^*(x)$	2	3	4	5	6	7	8	8	9	10	11	11	12	13

$y \setminus x$	0	1	2	3	4	5	6	7	8	9	10	11	12	13
[0, ]	NA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
[1, ]	0.333	0.556	0.704	0.802	0.868	0.912	0.941	0.961	0.974	0.983	0.988	0.992	0.995	0.997
[2, ]	<b>0.111</b>	0.259	0.407	0.539	0.649	0.737	0.805	0.857	0.896	0.925	0.946	0.961	0.973	0.981
[3, ]	0.037	<b>0.111</b>	0.210	0.320	0.429	0.532	0.623	0.701	0.766	0.819	0.861	0.895	0.921	0.941
[4, ]	0.012	0.045	<b>0.100</b>	0.173	0.259	0.350	0.441	0.527	0.607	0.678	0.739	0.791	0.834	0.870
[5, ]	0.004	0.018	0.045	<b>0.088</b>	0.145	0.213	0.289	0.368	0.448	0.524	0.596	0.661	0.719	0.769
[6, ]	0.001	0.007	0.020	0.042	<b>0.077</b>	0.122	0.178	0.241	0.310	0.382	0.453	0.522	0.588	0.648
[7, ]	0.000	0.003	0.008	0.020	0.039	<b>0.066</b>	0.104	0.149	0.203	0.263	0.326	0.391	0.457	0.521
[8, ]	0	0.001	0.003	0.009	0.019	0.035	<b>0.058</b>	0.088	0.127	0.172	0.223	0.279	0.339	0.399
[9, ]	0	0.000	0.001	0.004	0.009	0.017	0.031	0.050	<b>0.075</b>	0.108	0.146	0.191	0.240	0.293
[10, ]	0	0.000	0.001	0.002	0.004	0.009	0.016	0.027	0.043	<b>0.065</b>	0.092	0.125	0.163	0.206
[11, ]	0	0.000	0.000	0.001	0.002	0.004	0.008	0.014	0.024	0.038	<b>0.056</b>	<b>0.079</b>	0.107	0.140
[12, ]	0	0	0	0	0.001	0.002	0.004	0.007	0.013	0.021	0.033	0.048	<b>0.068</b>	0.092
[13, ]	0	0	0	0	0.000	0.001	0.002	0.004	0.007	0.012	0.019	0.028	0.042	<b>0.058</b>

Figure 1: Cumulative probability matrix of  $X|X+Y$ ;  $x$  changes through columns while  $r$  changes through diagonals.

$P(10, p, 4) = .077 > .05$ , and  $P(r, p, 4) < .05$  are less than .05, for every  $r > 10$ . The values of the upper limit are typed in bold.

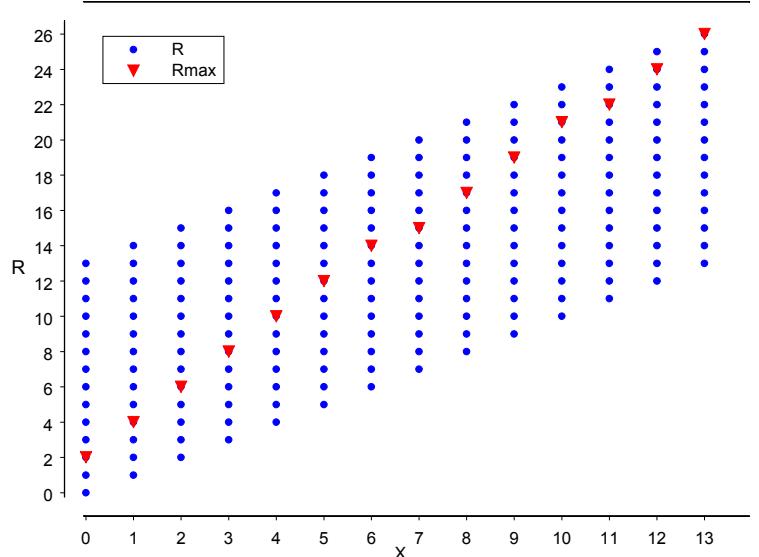


Figure 2: Graph of the space  $\{(x, r), x + y = r\}$  and the maximum value of  $r$  such that  $\Delta_r \leq \alpha$  for each value of  $x$ .

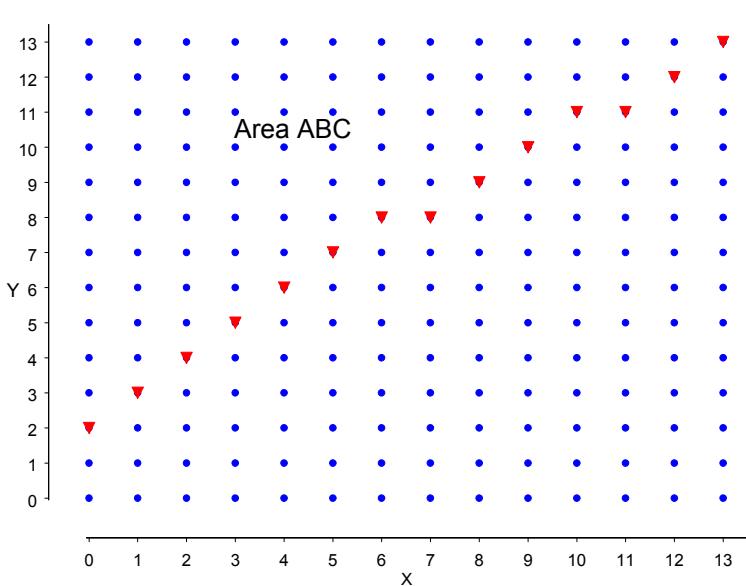


Figure 3: Set of upper prediction limits for the future outcome  $Y$  of the Poisson process, when  $n = 1, s = 10, t = 5$

### 3. AN ALGORITHM TO CALCULATE PREDICTION LIMITS FOR A DISTRIBUTION FROM THE EXPONENTIAL FAMILY

We now consider two independent random variables  $\mathbf{X}$  and  $\mathbf{Y}$  that conditioned on some parameter  $\theta$  follow discrete distributions that belong to the exponential family

$$p(x; \theta) = h(x)c(\theta)e^{w(\theta)x} \text{ and } p(y; \theta) = h(y)c(\theta)e^{w(\theta)y} \quad (3.1)$$

where  $h(\cdot)$  is a nonnegative real valued function that does not depend on  $\theta$ , and  $c(\theta)$  is a nonnegative real valued function of  $\theta$ , that does not depend on  $x$  or  $y$ . We describe the method of constructing the lowest upper bound  $u^*(X)$  of the future outcome  $\mathbf{Y}$  with respect to some error probability  $\alpha$ . Any integer valued function  $u(X)$  that satisfies  $u(X) \geq u^*(X)$  and has a probability of wrong prediction less than  $\alpha$ , would be an upper limit. The algorithm for constructing  $u^*(X)$  follows by first calculating the joint probability function of  $\mathbf{X}$  and  $\mathbf{Y}$

$$p(x, y; \theta) = [[c(\theta)]^2 e^{w(\theta)\tau}] [h(x)h(y)], \quad (3.2)$$

where  $\tau = x + y$  (A2). The distribution function of the random variable  $\mathbf{T} = \mathbf{X} + \mathbf{Y}$  belongs to the exponential family. Completing the first term of (3.2) into a probability distribution function of  $\mathbf{T}$ , we can write

$$p(x, y; \theta) = [H(\tau)[c(\theta)]^2 e^{w(\theta)\tau}] \left[ \frac{h(x)h(y)}{H(\tau)} \right], \quad (3.3)$$

where  $H(\tau)$  is a real valued function of  $\tau$  that does not depend on  $\theta$ . The function  $H(\tau)$  is theoretically known (as long as we know the representation of  $h(x)$  and  $h(y)$ ) and can practically be calculated, using numerical methods, as a cumulative sum of terms  $h(x)h(\tau - x)$  over all points  $x$  in the space  $S_X$ ,  $H(\tau) = \sum_{x \in S_X} h(x)h(\tau - x)$ .  $H(\tau)$  is defined and the sum  $\sum_{S_X} h(x)h(\tau - x)$  is numerically calculated even in the cases when the space  $S_X$  is unbounded (A3).

The probability of wrong coverage is calculated over the set  $\{(x, y) | y > u(x), x \in S_X\}$ . For any function  $u(X)$ , we can write:

$$\Pr\{Y > u(X)\} = \sum_{\tau} [H(\tau)[c(\theta)]^2 \exp(w(\theta)\tau)] \Delta_{\tau}, \quad (3.4)$$

where  $\Delta_{\tau} = \sum_{y > u(x)} [h(x)h(y)/H(\tau)]$  and  $x + y = \tau$ .

The sum  $\Delta_{\tau}$  can be interpreted and calculated in terms of the cumulative distribution function of the random variable  $\mathbf{X}$  everywhere  $\mathbf{X} + \mathbf{Y} = \tau$ .  $\Delta_{\tau}$  depends on  $\tau$  and  $u(\cdot)$ . If  $u(\cdot)$  exists (is constructed in some way), then  $\Delta_{\tau} = \sum_{x < \tau - u} [h(x)h(\tau - x)/H(\tau)]$ , where  $u$  stands for some fixed value of the function  $u(\cdot)$ . The sum (3.4) gives the probability over all points  $(x, y)$  that satisfy the condition  $x < \tau - u$  for every  $\tau - x + y \in S_T$ .

For the inequality  $\Pr\{Y > u(X)\} \leq \alpha$  to be satisfied, it is sufficient that  $\Delta_{\tau} \leq \alpha$  for every integer  $\tau \in S_T$ . Therefore, we need to find an integer valued function  $u(\cdot)$  that makes  $\Delta_{\tau} \leq \alpha$ , for all  $\tau \in S_T$ . Among all integer valued functions  $u(X)$  that satisfy the latter condition, we are interested in the function  $u^*(X)$ , which gives the smallest upper bound for  $\mathbf{X}$  that satisfies  $\Pr\{Y > u^*(X)\} \leq \alpha$ .

In order to generalize the rule to the case where the equality cannot be achieved we take for every value  $x$ , as the smallest upper limit  $u^*(X)$  to be the largest integer value of  $y$  satisfying  $\Delta_{\tau} = \sum_{x < \tau - u} [h(x)h(\tau - x)/H(\tau)] > \alpha$ , yielding  $x + y = \tau$ .

$\Pr\{Y > u(X)\} \leq \alpha$ . Then, for all other integer values of  $\mathbf{Y}$  greater than  $u^*(X)$  and for a fixed  $\tau \in S_T$ , the inequality  $\Delta_{\tau} = \sum_{x < \tau - u} [h(x)h(\tau - x)/H(\tau)] \leq \alpha$  is true. In an analogous way, we take for every value  $x$ , as the largest lower

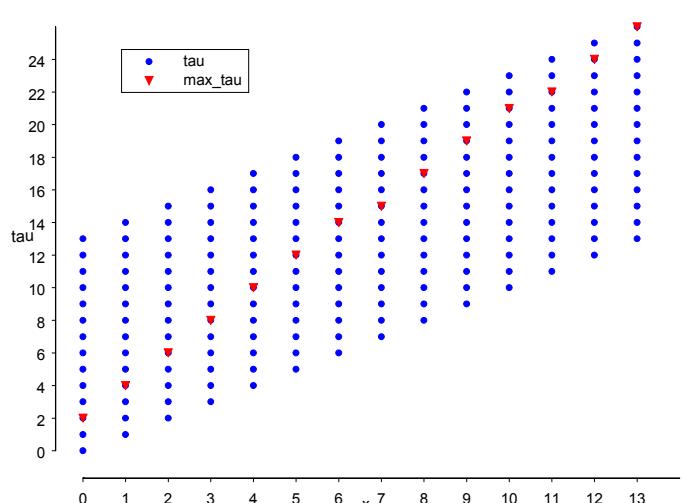
limit  $l^*(X)$  to be the smallest integer value of  $y$  satisfying  $\Delta_\tau = \sum_{x>\tau-y} [h(x)h(\tau-x)/H(\tau)] > \beta$ , then  $\Pr\{Y < l^*(X)\} \leq \alpha$ .

Following are presented the values of the optimal upper limit  $u^*(X)$  calculated using the general algorithm described above. The observed value of  $X = x$  is from the Poisson distribution discussed in section 2 ( $n = 1$ ,  $s = 10$ , and  $t = 5$ ). The fact that the observed values come from the Poisson distribution is not used in derivations. Numerical methods were used to calculate  $H(\tau) = \sum_{x \leq \tau} h(x)h(\tau-x)$ , and  $\Delta_\tau = \sum_{x < \tau-u(x)} [h(x)h(\tau-x)/H(\tau)]$ . The maximum values of  $\tau$  chosen for each value of  $x$ , such that  $\Delta_\tau \leq \alpha$ , are presented in table 2. They are graphed in figure 4. The set of upper prediction limits for the future outcome  $Y$ , derived using the general algorithm is graphed in figure 5.

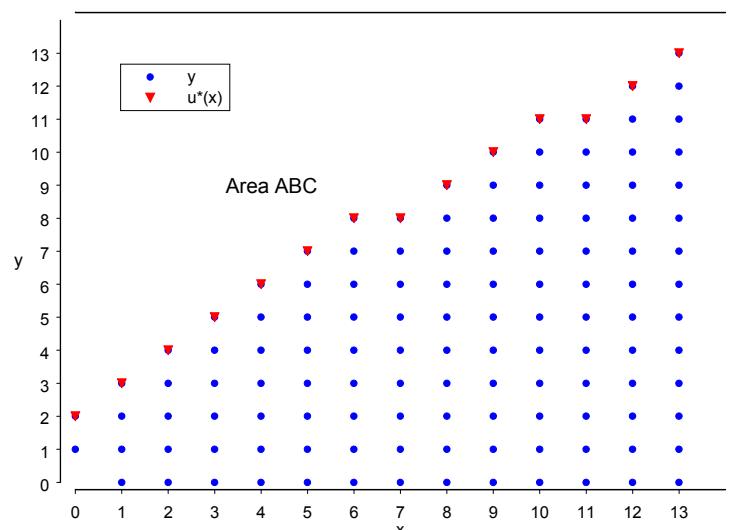
**Table 2:** The calculated values of  $\tau_{max}$  and  $u^*(x)$  for the observed

$X = x$ , when  $n = 1, s = 10, t = 5$

$x$	0	1	2	3	4	5	6	7	8	9	10	11	12	13
$\tau_{max}$	2	4	6	8	10	12	14	15	17	19	21	22	24	26
$u^*(x)$	2	3	4	5	6	7	8	8	9	10	11	11	12	13



**Figure 4:** Graph of the space of  $(X, \tau)$  and the maximum value of  $\tau$  for each value of  $x$  such that  $\Delta_\tau \leq \alpha$ .



**Figure 5:** Set of upper prediction limits for the future outcome  $Y$  of the Poisson process, derived using the general algorithm.

## 4. SUMMARY

This paper introduced an algorithm of how to construct the optimal (smallest) frequentist upper prediction limit for a future observation from a discrete distribution that satisfies regularity conditions. The algorithm for calculating the lower prediction limit for a single future observation from a discrete distribution follows similar to the upper limit case. Conditions on  $\mathbf{X}$  and  $\mathbf{Y}$  will remain the same, the only difference stands on defining the probability of wrong coverage. In this case the probability of the wrong coverage is given by  $\Pr\{Y < l^*(x)\}$  and it should not exceed  $\beta$ . In an analogous way, we take for every value of  $x$ , as the largest lower limit  $l^*(x)$  to be the smallest integer value of  $y - r - x$ , such that  $\alpha_r = \sum_{y=r+1}^{\infty} h(y)h(r - y)/H(r) > \beta$ . Hence,  $\Pr\{Y < l^*(x)\} \leq \beta$ .

The algorithm performed very well when used to derive the exact frequentist prediction limits for the Poisson distribution. Its general technique allows us to use the algorithm for any discrete distribution under the assumption that it belongs to the exponential family. An interesting problem would be to extend the algorithm to the case of continuous distributions that satisfy regularity conditions.

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## APPENDIX A

A1: Values of  $\Delta_r$  for the function  $w^*(X)$  and all  $r$ , for  $x = 4$

$y \setminus x$	0	1	2	3	4	5	6	7	8	9	10	11	12	13
[0, ]	NA	0.667	0.444	0.296	0.198	0.132	0.088	0.059	0.039	0.026	0.017	0.012	0.008	0.005
[1, ]	0.333	0.444	0.444	0.395	0.329	0.263	0.205	0.156	0.117	0.087	0.064	0.046	0.033	0.024
[2, ]	0.111	0.222	0.296	0.329	0.329	0.307	0.273	0.234	0.195	0.159	0.127	0.100	0.078	0.060
[3, ]	<b>0.037</b>	0.099	0.165	0.219	0.256	0.273	0.273	0.260	0.238	0.212	0.184	0.156	0.130	0.107
[4, ]	0.012	0.041	0.082	0.128	0.171	0.205	0.228	0.238	0.238	0.230	0.214	0.195	0.173	0.151
[5, ]	0.004	0.016	0.038	0.068	0.102	0.137	0.167	0.191	0.207	0.214	0.214	0.208	0.196	0.181
[6, ]	0.001	0.006	0.017	0.034	<b>0.057</b>	0.083	0.111	0.138	0.161	0.179	0.190	0.196	0.196	0.191
[7, ]	0.000	0.002	0.007	0.016	0.030	0.048	0.069	0.092	0.115	0.136	0.154	0.168	0.178	0.182
[8, ]	0	0.001	0.003	0.007	0.015	0.026	0.040	0.057	0.077	0.096	0.116	0.133	0.148	0.159
[9, ]	0	0.000	0.001	0.003	0.007	0.013	0.022	0.034	0.048	0.064	0.081	0.099	0.115	0.130
[10, ]	0	0.000	0.000	0.001	0.003	0.007	0.012	0.019	0.029	0.041	0.054	0.069	0.084	0.100
[11, ]	0	0.000	0.000	0.001	0.002	0.003	0.006	0.011	0.017	0.025	0.035	0.046	0.059	0.072
[12, ]	0	0	0	0	0.001	0.002	0.003	0.006	0.009	0.014	0.021	0.029	0.039	0.050
[13, ]	0	0	0	0	0.000	0.001	0.001	0.003	0.005	0.008	0.012	0.018	0.025	0.034

Matrix 1. Probability density matrix of  $X|X+Y$ ;  $x$  changes through columns while  $r$  changes through diagonals.

$\Delta_0 = \Delta_1 = \Delta_2 = 0$  as these probabilities are calculated over an empty set; i.e.  $\Delta_r$  is calculated over the set,

$$\{(x, r) : x + y = 1 \text{ and } y > w^*(X)\} = \{x + y = 1 (x = 0 \text{ or } 1) \text{ and } y > w^*(X)\} \\ = \{x + y = 1, (0, y > 2), (1, y > 3)\} = \emptyset$$

$$\Delta_3 = P\{(x, r) : x + y = 3 \text{ and } y > w^*(X)\} = P\{(0, 3)\} = .037 < \alpha$$

$$\dots \\ \Delta_9 = P\{(x, r) : x + y = 9 \text{ and } y > w^*(X)\} = P\{(0, 9), (1, 8), (2, 7), (3, 6)\} \\ = .000 + .001 + .008 + .042 < \alpha$$

$$\Delta_{11} = P\{(x, r) : x + y = 11 \text{ and } y > w^*(X)\} = P\{(4, 7), (3, 8), (2, 9), (1, 10), (0, 11)\} \\ = F(11, p, 4) \leq \alpha$$

$$\Delta_{12} = P\{(x, r) : x + y = 12 \text{ and } y > w^*(X)\} = P\{(4, 8), (3, 9), (2, 10), (1, 11), (0, 12)\} \\ = F(12, p, 4) \leq \alpha$$

Similarly,  $\Delta_{13} = F(13, p, 4) \leq \alpha$ ,  $\Delta_{14} = F(14, p, 4) \leq \alpha$ , ..., and  $\Delta_{17} = F(17, p, 4) \leq \alpha$  (Matrix 1).

A2: The joint probability function of  $X$  and  $Y$

$$p(x, y) = [h(x) c(\theta) e^{w(\theta)x}] [h(y) c(\theta) e^{w(\theta)y}]$$

$$p(x, y) = [h(x) h(y)] [c(\theta)]^2 [e^{w(\theta)[x+y]}] \quad (1)$$

After substituting in (1)  $x + y = r$ , we write

$$p(x, y) = [[c(\theta)]^2 e^{w(\theta)r}] [h(x) h(y)] \quad (2)$$

A3: Calculating  $H(r)$

$$\sum_{x, y} p(x, y, \theta) = 1$$

Changing variables from  $x$  and  $y$  to  $x$  and  $r$ , we can write

$$\sum_{x, y} p(x, y, \theta) = \sum_r \sum_{x+y=r} \left\{ H(r) [c(\theta)]^2 \exp[w(\theta)r] \left[ \frac{h(x) h(r-x)}{H(r)} \right] \right\}$$

$$= \sum_{\tau} \left[ H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau] \left[ \sum_x \left[ \frac{h(x)h(\tau-x)}{H(\tau)} \right] \right] \right]$$

Thus,

$$\sum_{x,\tau} p(x, \tau - x) = \sum_{\tau} [p(\tau) [\sum_x p(x|\tau)]] = 1, \quad (3)$$

where  $p(\tau; \theta) = H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau]$  and  $p(x|\tau) = h(x)h(\tau-x)/H(\tau)$  are respectively the probability distribution functions of  $T$  and  $X|T$

For every fixed  $\tau = x + y$  from  $S_T = \{\tau: p(\tau; \theta) > 0\}$ , the inside sum in (3) ( $\sum_{x \in S_X} p(x|\tau)$ ), is evaluated over all space of  $X$ ,  $S_X = \{x: p(x; \theta) > 0\}$ , hence it will be equal to one. Thus, for every given  $\tau = x + y$ ,  $\sum_x [h(x)h(\tau-x)/H(\tau)] = 1$ . Therefore,  $H(\tau)$  is calculated as a cumulative sum of terms  $h(x)h(\tau-x)$ , over all points  $X$  of the space  $S_X$ .

$H(\tau)$  is defined and the sum  $\sum_{x \in S_X} h(x)h(\tau-x)$  is numerically calculated even in the cases when the space  $S_X$  is unbounded. First, for the observed  $x$  and a very small  $\epsilon$ ,  $0 < \epsilon < 1$ , choose  $\tau_{\max}$  such that  $1 - \sum_x [h(x)h(\tau-x)/H(\tau)] < \epsilon$ . Then, we have to out far enough to make sure that all possible terms are included in  $H(\tau)$ ; choose  $x_{\max} = \max\{x: x_{\text{obs}} \leq x \leq \tau_{\max}\}$ , such that  $[h(x)h(\tau-x)/H(\tau)] < \epsilon$ . Therefore, we calculate  $H(\tau) = \sum_{x \leq x_{\max}} [h(x)h(\tau-x)]$ .

A4: Calculating the probability of the wrong coverage considering a pivotal approach

For any function  $u(X)$  the following equalities are true:

$$\begin{aligned} \Pr\{Y > u(X)\} &= \sum_{y > u(X)} \left[ H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau] \left[ \frac{h(x)h(\tau-x)}{H(\tau)} \right] \right] \\ &= \sum_{\tau} \left[ H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau] \left[ \sum_{y > u(X)} \left[ \frac{h(x)h(\tau-x)}{H(\tau)} \right] \right] \right] \\ &= \sum_{\tau} \left[ H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau] \left[ \sum_{x < \tau-u} \left[ \frac{h(x)h(\tau-x)}{H(\tau)} \right] \right] \right] \end{aligned} \quad (4)$$

The last equality is true because of the fact that the expression  $H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau]$  is independent of both conditions  $y > u(X)$  and  $\tau = x + y$ .

Denote the inside sum in (4) by  $\Delta_{\tau}$ ,

$$\Delta_{\tau} = \sum_{\substack{y > u(X) \\ \tau = x + y}} \left[ \frac{h(x)h(\tau-x)}{H(\tau)} \right] = \sum_{x < \tau-u} \left[ \frac{h(x)h(\tau-x)}{H(\tau)} \right]$$

Then,  $\Pr\{Y > u(X)\} = \sum_{\tau} [H(\tau) [c(\theta)]^2 \exp[w(\theta)\tau] [\Delta_{\tau}]]$ .

Numerical methods were used to construct  $u(X)$  for the observed  $x$  and calculate  $\Delta_{\tau} = \sum_{x < \tau-u} [h(x)h(\tau-x)/H(\tau)]$  for all  $\tau$ . Distribution of of  $X|T = x + y$  is estimated by  $h(x)h(\tau-x)/H(\tau)$ . Cumulative probability matrix (Matrix 2) of  $X|T$  is given below.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	NA	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0
1	0.333	1.000	0.000	0	0	0	0	0	0	0	0	0	0	0
2	0.111	0.556	1.000	0	0	0	0	0	0	0	0	0	0	0
3	0.037	0.259	0.704	1	0	0	0	0	0	0	0	0	0	0
4	0.012	0.111	0.407	0.802	1.000	0.000	0.000	0	0	0	0	0	0	0
5	0.004	0.045	0.210	0.539	0.868	1.000	0.000	0	0	0	0	0	0	0
6	0.001	0.018	0.100	0.320	0.649	0.912	1.000	0	0	0	0	0	0	0
7	0.000	0.007	0.045	0.173	0.429	0.737	0.941	1	0	0	0	0	0	0
8	0	0.003	0.020	0.088	0.259	0.532	0.805	0.961	1.000	0.000	0.000	0	0	0
9	0	0.001	0.008	0.042	0.145	0.350	0.623	0.857	0.974	1.000	0.000	0	0	0
10	0	0.000	0.003	0.020	0.077	0.213	0.441	0.701	0.896	0.983	1.000	0	0	0
11	0	0.000	0.001	0.009	0.039	0.122	0.289	0.527	0.766	0.925	0.988	1	0	0
12	0	0	0.001	0.004	0.019	0.066	0.178	0.368	0.607	0.819	0.946	0.992	1.000	0.000
13	0	0	0.000	0.002	0.009	0.035	0.104	0.241	0.448	0.678	0.861	0.961	0.995	1.000
14	0	0	0.000	0.001	0.004	0.017	0.058	0.149	0.310	0.524	0.739	0.895	0.973	0.997
15	0	0	0.000	0.000	0.002	0.009	0.031	0.088	0.203	0.382	0.596	0.791	0.921	0.981
16	0	0	0	0	0.001	0.004	0.016	0.050	0.127	0.263	0.453	0.661	0.834	0.941
17	0	0	0	0	0.000	0.002	0.008	0.027	0.075	0.172	0.326	0.522	0.719	0.870
18	0	0	0	0	0.000	0.001	0.004	0.014	0.043	0.108	0.223	0.391	0.588	0.769
19	0	0	0	0	0.000	0.000	0.002	0.007	0.024	0.065	0.146	0.279	0.457	0.648
20	0	0	0	0	0	0	0	0.004	0.013	0.038	0.092	0.191	0.339	0.521
21	0	0	0	0	0	0	0	0.000	0.007	0.021	0.056	0.125	0.240	0.399
22	0	0	0	0	0	0	0	0.000	0.000	0.012	0.033	0.079	0.163	0.293
23	0	0	0	0	0	0	0	0.000	0.000	0.000	0.019	0.048	0.107	0.206
24	0	0	0	0	0	0	0	0	0	0	0	0.028	0.068	0.140
25	0	0	0	0	0	0	0	0	0	0	0	0.000	0.042	0.092
26	0	0	0	0	0	0	0	0	0	0	0	0.000	0.000	0.058

Matrix 2. Cumulative probability matrix of  $\mathbf{x}|\mathbf{T} = \mathbf{x} + \mathbf{y}$ ,  $\mathbf{x}$  changes through columns while  $\mathbf{T}$  changes through columns.

## APPENDIX B

### B1. Frequentist Lower and Upper Limits for a Discrete Distribution from Exponential Family

```

h<-function(c, x){c^x / factorial(x)}
u_function(xmin, xobs, ce, cf, alpha, epsilon=.01)
{
  ymin_xmin
  thetahat_(xobs/ce)+.001
  # for xobs=0 thetahat=.001
  param_thetahat*(ce+cf)
  rmx_qpois(.99999999, param)
  sum<-0
  g_rep(0, rmx-xobs+1)
  ratio <- rep(1, rmx-xobs +1)

  for(x in xobs:rmx)
  {
    num <- h(ce, x)*h(cf, (rmx-x))
    g[x-xobs+1] <- num+sum
    sum<-g[x-xobs+1]
    ratio[x-xobs+1]<-(num/g[x-xobs+1])
  }

  xmax <- max((xobs:rmx)[ ratio > epsilon] )
  ymax_xmax
  rmax_xmax+ymax
  mx_(1-xmin)
  my_(1-ymin)
  mxy_(1-xmin-ymin)
  up_rep(0, xmax+mx)
  lw_rep(0, xmax+mx)

  Fun_matrix(rep(0, (xmax+mx)*(xmax+ymax+mxy)), xmax+ymax+mxy,xmax+mx)

  for(r in (xmin+ymin):(xmax+ymax))
  {
    index = 0
    for (x in max(xmin, r-ymax):min(r-ymin, xmax))
    {
      Fun[r+mx, x+mx]<- h(ce, x)*h(cf, r-x)+index

      # ce and cf will be different for different distributions considered
      # for binomial distribution ce=xmax and cf=ymax
      # for Poisson distribution ce=time s of the informative experiment
      # and cf=time t of the future experiment

      index <- Fun[r+mx, x+mx]
    }

    Fun[r+mx,]<- Fun[r+mx,]/Fun[r+mx, min(r-ymin, xmax)+mx]
  }

  for(x in xmin:xmax)
  {
    up<- max((ymin:ymax)[ Fun[xobs:(xobs+ymax)+mxy,xobs+mx]>alpha ])
  }
}

```

```

lw<- min((ymin:ymax)[ Fun[xobs:(xobs+ymax)+mxy,xobs-1+mx]<1-alpha])
}
list( fun=Fun, upper = up, lower = lw)
}

```

## B2. Frequentist Lower and Upper Limits for Poisson

```

poiss_function( xobs, n, s, t, alpha, epsilon=.01)
{
  thetahat<-(xobs/(n*s))+.001
  # xobs stands for total nr of occurrences during time interval s
  # for xobs=0 thetahat=.001

  param_thetahat*(n*s+t)
  rmx_qpois(.99999999, param)+1
  prob_((n*s)/((n*s)+t))
  ymax_rmx-xobs

  up<- max((0:ymax)[ pbinom (xobs, xobs:(xobs+ymax), prob) > alpha])
  lw<- min((0:ymax)[ pbinom (xobs-1, xobs:(xobs+ymax), prob) < (1-alpha)])]

  list( maxr=rmx, upper = up, lower=lw)
}

```

# THE RELATIONSHIP BETWEEN DIVERSITY AND ORGANIZATIONAL PERFORMANCE

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## ABSTRACT

*Organizations are increasingly using diversity programs due to the change in nature of demographics within the organization and in the external business environment. Companies are realizing that having successful diversity programs is imperative for organizational effectiveness. In this paper, we review the literature on the relationship between diversity management efforts and organizational performance. The review suggests that there is a strong relationship between diversity and organizational performance. The literature also suggests that this relationship is not automatic and but requires concerted effort on the part of managers at all levels and commitment from top management to promote and support diversity management programs.*

## INTRODUCTION

Organizations in the USA are increasingly adopting diversity management practices. Some reasons why an organization should embrace diversity management practices are: 1) Changing marketplace demographics. By 2025, the Hispanic population in the United States will grow to nearly 17% from 10%, African Americans will increase to 14% from 12%, and the Asian American population will have more than doubled to 7.5% of the total. (US Census Bureau). 2) Globalization. Borders are becoming increasingly more irrelevant in terms of international trade. IBM for instance, does business in more than 160 countries with virtual teams spanning the globe. (Leader & Leader, 2005). 3) The War for Talent. Competition for talent among organizations means that companies must actively recruit talent from every demographic available.

## WHY COMPANIES ADOPT DIVERSITY MANAGEMENT PROGRAMS?

In this paper, we review empirical studies that examined the relationship between diversity management practices and organizational performance. First we discuss why organizations may embrace diversity management practices. Organizations adopt diversity management practices for several reasons. First, having a diverse workforce, offers companies competitive advantage. Creative solutions are more likely to be approached when there is a diverse group attacking the problem. To bring that goal to fruition, diversity management should enhance personal effectiveness, social networking, and interpersonal communications among employees. Second, a diverse workforce may be in a better position to understand a demographically diverse customer base. When addressing a multicultural marketplace, having a multicultural team will often lead to an appreciation of the target audience. Managing diversity should make the company more responsive to social and demographic changes and give the company opportunities for global expansion. Third, having a diverse workforce at workplace may improve employee productivity by reducing employee absenteeism and turnover. Effective diversity management leads to increased job satisfaction in diverse groups and decreases the turnover and absenteeism often found to be higher in diverse organizations. A climate of fairness and equity supports job satisfaction. The end result is reduction of personnel costs. Fourth, companies with good diversity programs are viewed positively by potential employees and thus these companies may be at an advantage in recruiting and retaining talented people. Companies with a favorable reputation in managing diversity attract the strongest candidates among diverse groups. Having the most talent leads to increased sales, revenue, and profits. Fifth, diversity programs in companies help unlock excellence of their employees across demographic barriers. When cultural walls are removed through diversity management and all the tools, resources, and opportunities are provided, a gender, racial, or ethnic minority will feel more motivated for higher achievement and star status. The result is greater productivity on complex tasks. Sixth, diversity programs in organizations help diverse group of employees to work together as a team and thus improving team and organizational productivity. When diverse group of employees shed their inhibitions and misgivings about people who are different from one another, they tend to work together more closely and achieve team and organizational goals more effectively.

## **RELATIONSHIP BETWEEN DIVERSITY AND ORGANIZATIONAL PERFORMANCE**

Diversity management starts with recognizing other people's standards and values are as valid as your own. One must let go of any ideas of universal rightness of his/her own values or way of doing things and accept that there other cultures have validity. In international business, one is immediately subjected to these shifts in norms. Developing multicultural skills in the workplace often translates to better global leadership skills that further improves the company's reputation and offers a distinct competitive advantage. The best way to measure effectiveness is 360 degree feedback. By measuring diversity performance values with organizational performance values, the effectiveness of the organizational diversity plan can be related to organizational performance. Just as upper managers' compensation is tied to organizational performance goals, they should also be linked to how well cultural diversity is managed and used effectively to support company goals.

There is a positive correlation between management practices and organizational performance. According to IDM, Diversity management is defined as the leadership, culture, climate, strategy, and human resource practices that are undertaken in order to optimize organizational performance and provide a context for equitable and culturally competent care. Organizational performance can be defined by the outcomes such as career experiences and accomplishments, workplace perceptions, employee and patient satisfaction, group task performance, inter-group conflict and communication, recruitment and retention/turnover, absenteeism, productivity, profitability, and quality of care. When the two principles are linked together it is evident one is a product of the other. There are three areas within an organization that is impacted by effective diversity management. These are: 1) communication, 2) creativity, and 3) turnover and absenteeism.

Communication is the most beneficial element to a company; activities such hiring, reporting, training, learning, and the like would not be accomplished without it. However, miscommunication (non-verbal included) across cultures is quite common in many companies. For example, some white Americans typically consider raised voices to be a sign that a fight has begun, while some black, Jewish and Italian Americans often feel that an increase in volume is a sign of an exciting conversation among friends (DuPraw and Axner, 2004).

Research indicates that groups composed of members with dissimilar characteristics are more creative than homogeneous groups. It is believed that members from different backgrounds bring multiple perspectives to a group. When creating a problem solving team, it is best to combine individuals from many different areas of the organization. This will help bring creativity and will greatly effect the performance of the organization.

If effective management practices are not in place, companies may experience high turnover and absenteeism. According to our text, *Understanding and Managing Diversity*, the turnover rate for blacks in the U.S. workforce is 40 percent higher than the rate for whites and the turnover among women is twice as high as for men (DuPraw and Axner, 2004). These high figures can be contributed to unfair and unjust practices that take place in a company. Absenteeism, like turnover, exist in companies who do not have practices in place for managing diversity.

It is evident that diversity practices are highly related to company performance. An employees' perception of being valued and cared about by their organization positively relates to their performance. Management must set up principles that manage diversity in the three areas of concern-communication, creativity and absenteeism and turnover to ensure employees engaged in their full potential.

According to a study commissioned by the London Central Learning and Skills Council and the London Human Resource Group, a more diverse workforce improves business performance. Their study found that diversity produced numerous benefits like employee retention, reduced recruitment costs, enhanced customer satisfaction, access to a wider customer base, better supply chain management, and access to innovative ideas on process and product improvements. The two obstacles the study found were attitudes displayed by individuals different from their managers and the culture of long working hours that make it difficult for women to reach top- level positions. The study concluded that diversity company performance when it has the support of the senior management and is linked with a business strategy.

In a longitudinal study of 100 firms to test hypotheses related to the effects of diversity reputation and top management team racial diversity on product and capital market outcome, Roberson and Park (2005) found positive relationship between diversity reputation and book to market equity, and between top management team diversity and revenue growth.

In another study that examined the relationship between diversity and financial performance in top 50 firms, Bushor (2009) found those firms with a strong commitment to diversity outperform their peers on average. For commitment to diversity to become ingrained in corporate culture there must be visible and ongoing support from senior management, a clear articulation

of the business case for diversity, line manager accountability, and training programs directed at communications, conflict resolution and team building. ( Bushor, 2008)

It appears that diversity does play a significant role in enhancing performance for an organization and can be a significant competitive advantage. Often times the benefits to having a diverse workforce isn't tangible nor does it provide a direct or instant financial advantage. For instance, Weigand (2007) assert that opinions generated in a forum of culturally diverse employees lead to higher quality decision, creativity, and innovation. With a different set of backgrounds and life/work experiences, a diverse group certainly can come up with newer, better ways of solving a problem relative to a group of similar thinkers. Furthermore, by hiring a diverse set of employees, an organization can attract and understand the demands of a new customer base that it has never targeted. This is especially valuable in today's global economy. Studies have shown that a close match between employee and customer demographics may improve performance by reducing communication costs among people from the same racial, ethnic, or age group (Shipper, Hoffman, Rotondo 2007)

Diversity management practices when done properly attract a larger talent pool and thereby allowing the organization to be more selective and pick out the best talented and higher qualified employees. One can argue that by being very selective, the organization contradicts its diversity management strategies and puts itself in a situation where it only selects one type of employee it considers to be talented or qualified. However, if that "prototype" employee increases the bottom line of a company, it has achieved its goals of increasing performance by increasing diversity. The key to achieving optimal performance benefits from diversity management initiatives is to make sure the program is instituted properly. Often times organizations have a token diversity program in place that doesn't have much substance. On the contrary, Google serves as a good model for how a company should carry out its diversity plans. Google starts by having a community outreach plan that aims to reach out to the community to encourage girls and under-represented minorities to pursue studies in math, science and engineering. This underlying program serves Google's diversity initiative to have more women in the IT industry and in the Google Corporation (Weigand, 2007). Google has a distinguished women engineers and women in technology programs that have garnered impressive results. The percentage of engineers in senior positions within the organization is higher than males. Other companies such as Accenture are pushing for a diverse workforce because they see the positive results in having such initiatives. Accenture implemented the "Great Place to Work for Women" program in 1999 to attract and promote more women into the organization has seen a steady decline in turnover in key areas staffed by female employees (Jehn, Northcraft, and Neale, 1999).

Diversity programs give firms a strategic and competitive advantage, while having many implicit positive consequences on the firm's commitment to social responsibility. Diversity management ideals can lead to talented employees, novel innovations, new-found customers, and greater profitability.

Diversity practices can provide firms with the expertise to regularly develop and market competitive new products by enhancing organizational creativity and problem solving. Thus, prospectors may benefit from a more formal, extensive diversity program than other strategic types by improving their responses to new market opportunities. Additionally, prospectors have less concern for inefficiencies of increased employee coordination and turnover. In fact, turnover may enhance the creative process through the external recruitment of new employees with fresh ideas (Richard and Johnson, 177). In stark contrast to prospectors, defenders produce a limited set of products directed at narrow market segments. This goal necessitates creating a stable environment and defending against intrusions by competitors. Production and service delivery efficiency remains a primary objective. Communication functions to organize task performance and to clarify rules and regulations. Human resource practices for defenders should stress limited recruitment above entry, level and selection based on weeding out undesirable employees (Richard and Johnson, 177).

In conclusion, actively promoting diversity is not just the right thing to do in terms of equal opportunity to everyone but it is also the right thing to do to achieve sustainable growth, competitive advantage and organizational success.

Although research indicates that there is a relationship between diversity and company performance, it is important to note that simply having a diversified workforce does not automatically guarantee a positive outcome in business performance. In one comprehensive study (Kochan, 2003) conducted by Diversity Research Network, researchers conclude that there are few direct positive or negative effects of diversity alone on company performance after in-depth studies of four large Fortune 500 companies in different industries (two information processing companies, one financial service firm and one large retail company). Instead, a variety of different aspects such as organizational culture, business strategy, human resources practices, group and managerial processes, working environment, employee makeup and their job functions all tie together to determine whether diversity will boost or hurt the overall company business performance.

In summary, from the above review of the relationship between diversity and organizational performance, it can be concluded that there is overwhelming study data to indicate that diversity is a reality in today's business world and corporations need to develop specific winning strategies that are tailored to their own business objectives in order to realize the potential values and benefits of diversity initiatives, while minimizing negative effects. Long-term commitment and systematic approaches such as supporting experimentation and evaluation, ramping-up of training programs and developing analytical methods for measuring performance should be adopted to enable corporations to build supportive cultures and implement effective frameworks, which will undoubtedly help corporations realize positive returns on their investment in diversity.

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# SUPPLY CHAIN MANAGEMENT TECHNOLOGIES AND STRATEGIES

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## ABSTRACT

*The widespread utilization of the Internet and information technology is creating a shift in what it means for a corporation to be competitive. With respect to logistics and supply chain management these new technologies have shifted what it means for a company to be effective and or efficient. Corporations are able to utilize real time business-to-business software applications to reduce the need for business functions to be co-located. Further, these new technologies, when properly utilized, reduce the need for capital to be invested in inventory. Instead, inventory is replaced with information. Teaming with external corporations replaces some capital equipment requirements. These changes result in lessening the front loaded life cycle costs associated with manufacturing. Companies without an internal competency in manufacturing can compete because “bricks and mortar” are no longer barriers to entering the marketplace. On the contrary, outdated business processes, bureaucracy and cash consumed by capital equipment can be a detriment for large vertically integrated organizations trying to compete with smaller nimbler firms. This paper will; 1) present the technologies and tools making this change possible, 2) define what competencies corporations must execute to remain competitive, 3) illustrate how four different types of companies are executing, and 4) conclude with suggestions for a means of combining the advantages held by mature corporations with the new rules of competition. The technologies and strategies of Supply Chain Management will be examined using a research design that is exploratory, empirical, non-experimental, cross-sectional qualitative assessment.*

**Keywords:** *Supply Chain Management, Logistics Management, Communication, Operation Management, and Six Sigma/Lean Management.*

## TECHNOLOGIES AND STRATEGIES

The technologies and strategies of Supply Chain Management will be examined using a research design that is exploratory, empirical, non-experimental, cross-sectional qualitative assessment. Data collection will consist primarily of ex post facto document review.

Information technologies and numerous communication tools are removing the barriers to entry in many manufacturing markets. “Technology frees coordinated operations from time, place and organizational boundaries” (Chandrashekhar, Schary, 1999) Corporations that once held competitive advantage due to large vertically integrated infrastructures are being challenged by organizations utilizing new technologies. It is not the use of these technologies alone that create a new competitive environment. Rather, a new corporate strategies, philosophies and competencies associated with the proper application of these technologies are creating competitive value. The emergence of the Internet, Electronic data interchange, email, videoconferences, and software packages that manage business processes have created the ability to “loosen” organizational structures. It is now possible for an accounting organization to bill for product shipped from a different state while a raw material vendor gets real time information to ship more products. “Electronic Data Interchange (EDI) and the Internet have enabled partners in the supply chain to act upon the same data, i.e. real demand, rather than be dependent upon the distorted and noisy picture that emerges when orders are transmitted from one step to another in an extended chain.” (Martin, Towill, 1997) In short, many advantages of vertical integration are lessened, or in some cases eliminated, by information technology.

There can be some gains in efficiency associated with real time data sharing and economies of scale associated with outsourcing some support functions. However, this is not sufficient to reshape the competitive landscape. Today, organizations are gaining margin and market share through new strategies focused on “agility”. “Agility is a business-wide capability that embraces organizational structures, information systems, logistics processes and, in particular, mindsets.” Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile marketplace. (Martin, Towill, 1997)

Wilding suggests, "The tool identified for introducing agility in the supply chain is Virtual Teaming." (Wilding, 1999) Today, many industry analysts, authors, and academics utilize the terms virtual organization, virtual teaming, virtual supply chain, and a number of other similar terms. The virtual enterprise (also known as virtual integration) is changing the entire concept of what it means to be a company. (Hammer, 2000) The word "virtual" suggests the use of technology as a means to replace vertical integration, inventory, collocation and rigid organizational structures. For an organization to be "virtual" means it is fluid or agile as a result of well thought out strategies that utilize new information technologies. A virtual supply chain often encompasses much more than electronic links. It represents an organization structure that facilitates efficient and effective flows of both physical goods and information in a seamless fashion. What distinguished the virtual chain from the traditional supply chain is its inherent flexibility to quickly adopt and adapt to changes in the business environment. As a result, new members can be continually added and old members deleted, or have roles reassigned to them within the chain. " (Chandrashekhar, Schary, 1999)

## **VIRTUAL INTEGRATION**

In the past companies would vertically integrate in order to gain efficiencies and control. In today's high tech business environment linking the information networks of separate organizations can reproduce many of the benefits of vertical integration. "The key to successful virtual integration is to enable all companies involved, each of which is performing only certain processes, and to work together as smoothly as they would if they were all one enterprise." (Hammer, 2000) Both vertical and virtual integration allows for efficiencies that could not be otherwise realized. However, virtual integration brings some unique benefit. The unique benefits associated to virtual integration are those associated with agility. This agility comes from that fact that an organization can effectively coordinate with another organization as well as two departments within a single organization can communicate. This means a new competency can be introduced into a supply chain without the need for capital investment or the introduction of risk. Likewise when business conditions change and the competency is no longer needed, the relationship between the organizations can be disbanded or redefined.

## **INVENTORY REDUCTION**

Information technologies make possible many strategies that reduce the need for inventory, which is created to compensate for uncertainty. That uncertainty can be associated to demand for a product or of a resource. "A major problem in most supply chains is their limited visibility of real demand. Because supply chains tend to be extended with multiple levels of inventory between the point of production and the final marketplace, they tend to be forecast driven rather than demand driven." (Martin, Towill, 1997) In either case the need for inventory would not exist if there were perfect knowledge of future demand. Likewise, if the process time associated with the production of a product were zero there would be no need for inventory. Of course, it is not possible for information technologies to create perfect knowledge of the future or for process times to reach zero. However, information technologies can give real time data from the market place. Further, strategies utilizing this real time data can reduce the need for inventory used to compensate for process time. Shared information between supply chain partners can only be fully leveraged through process integration. (Martin, Towill, 1997) "In a fully integrated network, production and delivery schedules, inventory, order tracking and drawing and design files become open to view and thus transparent to authorized supply chain members." (Chandrashekhar, Schary, 1999) The negative effect of delayed information from the market place has been understood long before information technologies were utilized in industry. "In 1961, Forrester showed that medium-period demand amplification was a system dynamics phenomenon, which could be tackled by reducing and eliminating delays, and the proper design of feedback loops." (Towill, 1996) "The supply chain needs to transmit value and demand information up the chain, and cost and supply information down the chain with sufficient detail and timeliness to avoid instability." (Wilding, 1999)

## **CO-LOCATON NEEDS REDUCED**

The benefits of co-location are numerous and are in some cases complimented with information technology. However, often the benefit is mainly attributed to the sharing of information. In this case information technology can negate the need to for members of a team to be co-located. There are two major forces allowing for the dispersion of members of an organization; electronic computer mediated communication and the network of organizations. (Chandrashekhar, Schary, 1999)

Fast track, synchronous group messaging systems such as audio and video conferencing, and possibly shared applications, allow the team to meet at very short notice to handle emerging exceptions and problems "Groups of people who work closely together even though they are geographically separated and may reside in different time zones in various parts of the world. Cross-functional workgroups brought together to tackle a project for a finite period of time through a combination of technologies. Members may occasionally meet face-to-face, but this is clearly the exception due to the physical separation of their home location." (Wilding, 1999) Technology alone will not guarantee a successful team. Often team members are

employed by different organizations. In order for members of different organization to develop synergies “there can be no boundaries ...of trust and commitment must prevail.” (Martin, Towill, 1997)

## COMPETENCIES

The emergence of virtual teams and virtual organizations both “formal” and “informal” are creating the opportunity for corporations to expand their product lines beyond the traditional. Corporations will be able to leverage their brands to market new types of products and services. Competitive advantage will be increasingly reliant on product design, innovation, marketing, and agility. All corporations young and old will require entrepreneurship. There are four common scenarios where corporations are leveraging their ability to create value in the market place.

Small entrepreneurial firms are utilizing the virtual organization concept to compete with larger more established organizations. In this situation the small organizations are realizing the potential of their intellectual properties. These companies partner with other organizations to design, manufacture and distribute new products.

Large well-established corporations are expanding into new product lines. In this scenario the corporation can leverage their brand, capitalize on established distribution channels, and take advantage of the front end life cycle cost reduction created by virtual teaming.

Corporations are improving business process maximizing both the agility and efficiency of their existing operations via the use of cutting edge supply chain management. These corporations are driving the efficient use of resources by replacing investment with information.

Corporations are developing themselves to be “partners” to other organizations. Contract manufacturing firms and third party logistics providers are focusing their core competencies on being efficient in their respective fields. These corporations are experiencing a maturing of their industries. They are becoming major players and in some cases can offer their services to a client more cheaply than the client's competitors are currently doing these things for themselves.

## VIRTUAL SUPPLY CHAINS

Throughout the 1980's vertically integrated Japanese conglomerates dominated electronics manufacturing and design. However, during the late 90's and 2000's small American corporations have been stealing market share. Teaming with contract manufacturers and establishing “virtual” supply chains, these organizations are able to compete based on innovation, technology, and effective supply chain management. These companies no longer need to “go-it-alone” “Competition lies between supply chains as much or more than between individual firms. The concept of the supply chain places a premium on partnership and inter-organizational management. It asks firms to share or even relinquish decision power in favor of an overlying system.” (Chandrashekhar, Schary, 1999)

A small firm can design and have chips fabricated in Taiwan, manufactured in Northern Ireland, and ship the products for sale in the United States just as quickly as a Japanese company can. (Takahashi, 2001) “The start-ups we're seeing don't want any fixed costs.” (Porter, March 2000)

There are many examples of small corporations with few fixed assets out maneuvering larger corporations in the sale of electronics goods. The Japanese Corporation Sharp dominated the hand held organizer market for years. Sharp's market dominance is a distant memory. Palm inc. (formerly a business unit of US Robotics) is a big player the industry (Takahashi, 2001) Palm manufactures none of its own products. Instead Palm avoids spending on capital equipment relies on contract manufacturers.

Sony has long dominated the radio market with home stereos, portable “boom box” radios, car stereos and the popular line of Walkman personal headphone systems. Over the last few years Sony has lost considerable market share to organizations that own no manufacturing resources. 3Com is challenging Sony's dominance in the home stereo market by being first to market with their Kerbango Internet radio. If 3Com is not successful they will easily retreat without the burden of having invested in manufacturing resources. SonicBlue's Diamond division is challenging Sony's Walkman line in the personal headphone market. Diamond's Rio line is the leader in portable MP3 players.

It is a common adage that television and VCR's were both developed in the United States, but an American company manufactures neither product. Replay TV and TIVO personal video recorders are now challenging the market for these

products. Both lines are from American companies that utilize a virtual supply chain and contract manufacturing to bring the products to market. "The folks at Sonic Blue, "makers" of all kinds of products, from Replay TV, Rio MP3 players to DVD players, use several contractors. "Our focus is on creating unique technologies - 100 percent of our manufacturing is done by other people." (O'Brien, 2001)

The examples illustrated in the above paragraphs show that competitive advantages are beginning to lean more heavily towards innovation than on infrastructure. Companies such as SonicBlue are learning to play two critical roles. The first is that of developer/inventor. The second is that of enabler/broker. "The role of the broker organization as leader is critical in virtual organizations. This role includes selecting and recruiting partners, defining tasks and managing the process." (Chandrashekhar, Schary, 1999) In all of these situations, it is difficult to determine where one company begins and another ends; the members of a virtual enterprise are tightly woven together. No single company can point to a final product and say, "We did that." Companies perform processes rather than produce complete products. (Hammer, 2000) "This type of freedom is going to drive innovation as well as force large corporations to focus on becoming agile themselves. The threat of a start-up company making a nimble sneak attack will become more prevalent in the future. North American contract manufacturers like Solectron and Celestica enable countless startups to outsource manufacturing and focus on design. (Takahashi, 2001) These startup companies will buy technology when needed and create supply chains for short and long-term projects. "These chains will have the freedom to change form and partners in order to achieve flexibility. These chains will be governed through pre-arrangements as latent networks, to be called into operation for specific tasks." (Chandrashekhar, Schary, 1999)

Small firms and entrepreneurs do not monopolize the assault on established corporation's market space. Today, large corporations are looking for areas to diversify their product lines in order to boost revenue and create stability in the fear that their market space will be under attack. Nike was a pioneer with respect to outsourcing manufacturing and operating a virtual organization for the manufacture of clothes and shoes. Nike is now taking the concept one step further by marketing portable MP3 players combining the new technology with their powerful brand. (Takahashi, 2001) The interesting twist to Nikes MP3 player is that Nike was using SonicBlue as a supplier for the product. However, SonicBlue does no manufacturing. So they must in turn outsource the manufacture of their product design. SonicBlue was able to offer enough value to win the contract from Nike.

Perhaps the most publicized example of a large corporation expanding into new markets was Microsoft's entrance into the home gaming console market, "Challenging Sony and Nintendo's game empires with the XBox game console." (Takahashi, 2001) "The real wonder of the XBox launch is how a software publisher that has never operated a single factory has come to challenge the world's leading manufacturer of consumer electronics - Sony - at its own game." (O'Brien, 2001) The answer lies in the fact that Microsoft has all the benefits of a multinational electronics corporation without the burdens of bureaucracy that can be found in the companies with which they will compete. Japanese consumer electronics companies have their bureaucratic cultures, their health, and their age working against them. They are slow to embrace change. (Gravitz, 2001) These traits are anything but agile. Today, agility and time to market are critical for market success. Time compression is an equally powerful business driver along the product innovation channel. (Towill, 1996) "We are now entering the era of "network competition" where the prizes will go to those organizations which can better structure, co-ordinate and manage the relationships with their partners in a network committed to better, closer and more agile relationships with their final customers." (Martin, Towill, 1997)

Nintendo introduced the console, Game Cube, to the US a few days before the XBox launch. The electronics industry is possibly the most vulnerable to newcomers. "There's no other industry with faster requirements for time to market or more pressure to take investment dollars out of low-return activities such as manufacturing. The objective in electronics is to get to market fast with the smallest possible investments in both the front and back ends of the company." (Porter, March 2000) All the value heads to innovation and marketing, allowing entrepreneurial firms and those outside the electronics industry to compete head-on with industry leaders. A Microsoft spokesman explained that they never could have met their time to market requirements if they had chosen a less competent supplier. Microsoft completed their product development cycle in 14 months while Sony's PS2 was 30 months from conception to delivery. (O'Brien, 2001)

## **IMPROVED BUSINESS PROCESS**

Supply Chain Management (SCM), manages the flow of transactions as "the extended enterprise". SCM includes both software, and communication via the Internet plus connections to suppliers and customers. (Chandrashekhar, Schary, 1999) Manufacture's that maximize supply chain efficiency are market takers. In some instances information technology is utilized to coordinate with functions outsourced to third parties, in other cases it is utilized to manage in house processes. In more progressive corporations the technologies are offered to enhance the business process of customers. In all instances the

consumption of resources is replaced with information. Thanks to efficiencies created, in part, by Dell's Web-based supply chain, the company can remain profitable even while it launches a bloody PC price war." (BW, May 2001)

High tech manufacturers and Japanese automakers do not monopolize effective supply chain management. The apparel industry faces similar market conditions, as does the PC industry. Models of personal computers have short lifecycles due to rapid advancements in technology, while apparel companies have similar pressures on product lifecycles due to the dynamic nature of fashion trends. Both industries must compete on low margins. Benetton revolutionized the fashion sport and casual wear business in the mid-1980s by creating the ability of its US retailers to replenish their shelves with a made-to-order garment from Italy in three weeks. (Towill, 1996)

Similarly Zara, a competitor of Benetton stocks shops on a twice-weekly basis. For Zara the whole production cycle takes only two weeks. In an industry where lead times of many months are still the norm, Zara has reduced its lead time gap for more than half of the garments it sells to a level unmatched by any of its European or North American competitors. Zara's manufacturing systems are similar in many ways to those developed and employed so successfully by Benetton in Northern Italy, but refined using ideas developed in conjunction with Toyota. Only those operations, which enhance cost-efficiency through economies of scale, are conducted in house. (BW, May 2001)

It is not enough for large corporations to squeeze their suppliers for better costs. If waste is not eliminated, suppliers will suffer or degrade in the services they offer. Dell has recognized the need to optimize the entire value creation process. Dell has hooked 90% of its suppliers into its factory floors via the Web so they can see up-to-the-minute information on orders and replenishes Dell's supplies only when necessary. Dell does not look in only one direction of the supply chain. Dell is also influencing customers to streamline their processes by creating custom web pages for corporate customers and influencing them to automate their ordering process. Dell influences customers to adopt Web-based procurement systems. This produces timesaving and gives Dell more insight into its customers' needs. Litton Industries' PRC Inc. cut the average to submit an order from 21 days to less than two, and gave the technology contractor an annual savings of more than \$200,000. (BW, May 2001)

It is not difficult to understand how automating non-value added process could enhance a company's efficiency. With some basic understanding of inventory control and forecasting models it is also easy to understand the benefits of real-time information will have on a company's operations. However, for world-class operations like Dell and Benetton it is not enough to improve existing business models. Maintaining a competitive position requires a company to continuously adapt their business process to take full advantage of current technology and market trends. Today, manufactures are changing the way products and processes are designed in order to maximize benefits that can be realized from current information technology. A strategy that is being adopted in many industries is "postponement". This strategy is exactly what it sounds to be. The idea is to postpone the final configuration of a product as far down the supply chain as possible. By doing these companies are able to hold fewer inventories, increase cash flow, increase customer choice, and reduce risk of obsolescence. "Inventory can be held at a generic level so that there will be fewer stock-keeping variants and hence less inventory in total. Secondly, because the inventory is generic, its flexibility is greater, meaning that the same components, modules or platforms can be embodied in a variety of end products." (Martin, Towill, 1997) The product family approach can be combined into a variety of products. This approach creates flexibility with minimal lead-time, at the expense of holding component inventory.

Companies in all industries will only maintain a competitive advantage by concentrating on reducing the cost associated with the supply chain. This is different than looking for local optimization of profit. The process is greatly improved by concentrating on the streamlining of material, information and cash flow, simplifying decision-making procedures and eliminating as many non-added-value operations/delays as possible. Companies that are reaping the most benefits are not just purchasing technology and using tools. Instead progressive companies are redefining strategy and business processes around the new tools of information technology. "Agile competitors are competitors who understand how to remain competitive by means of proactive amassing of knowledge competency." (Schonsleben, 2000)

## PARTNER ORGANIZATIONS

Contract manufacturers and third party logistics providers (3PL's) are playing a more robust role in today's manufacturing environment. These companies are capitalizing on the opportunity to service startup companies, large corporations expanding product lines, and helping large corporations maximize their business processes. In the past contract manufacturers were utilized as a form of insurance against demand overrun. (Jaffe, 2001) Flextronics is a leading electronics contract manufacturer; CEO Michael Marks is quoted as having said: "It used to be a really crappy business; we used to try to convince purchasing agents how we're going to do things cheaper. Now we're talking to CEOs. We're defining global manufacturing strategy. That's fun." (O'Brien, 2001) 3PL's are becoming an integral part of the supply chain process itself. For example

Celestica Inc. employs three 3PL providers-Menlo Logistics Inc., FedEx, and Ryder Logistics Inc.-to help lower inventory levels through the use of vendor-managed inventory (VMI) hubs, says Paul Blom, vice president of global supply-chain management at the Toronto-based contract manufacturer. (Coia, 2001) Likewise, Dell allows computers from one location and monitors from another source to be merged-in-transit by a third-party logistics provider. (Chandrashekhar, Schary, 1999) Although the computer and monitor are shipped in separate boxes, this is in effect completing customization while a product is in transit. (Martin, Towill, 1997) These are all illustrations of how a contract manufacturer or 3PL can apply their competencies in a way to create value.

Partner organizations have had some very large successes. For example, Cisco systems do none of its own manufacturing. A contract manufacturer assembles Cisco products from parts made by suppliers, and a materials-management company ensures the right amount of inventory is on hand, and then delivers assembled products to customers. In most cases, Cisco never sees the products its customers receive. (Hammer, 2000) With this type of service available for higher companies like Cisco must compete purely on cutting edge innovation.

Flextronics is in many ways a leader in its industry. While there are other larger contract manufacturers, Flextronics has been receiving the most press. Flextronics is trying to add more value to the development process. Flextronics has positioned itself for more business through its enhanced front-end offerings. (Serant, 2000) In the long term this will surely add margin. One effort to increase the value contribution is offering design services. Flextronics' works with clients on product design to decrease the number of parts - and thus manufacturing expense. (O'Brien, 2001) Flextronics helped design the X-Box and will assemble, package, and ship it. The only thing the company won't do is market the game machine. (Jaffe, 2001) CEO Michael Marks. "If guys like us didn't exist, guys like Microsoft wouldn't ever do a hardware product. The risk would be too high." (O'Brien, 2001) Taking a similar route, Celestica Inc., a competitor of Flextronics, has signed on more than a dozen optical networking clients in the past year. Jabil Circuit Inc. has expanded its global design operations, and Plexus Corp. is offering advanced design services to OEMs in the industrial, medical, and telecom sectors. (Serant, 2000)

## **CONCLUSION**

There is a great deal of positive talk regarding the outsourcing trend. The stock market rewards corporations that release manufacturing to an outside source. The common theme is that manufacturing is low margin and a commodity. A common belief is that; "U.S. manufacturers will begin to look less like manufacturers and more like powerhouses in design, supply management sales and marketing and customer service." (Porter, March 2000) Sometimes manufacturing is referred to as a distraction "For the typical OEM, the act of assembling components is a distraction - diverting brainpower from innovation - and a cash drain." (O'Brien, 2001) However, a more astute observer can notice some contradiction in all the praise for outsourcing.

Supply chain management is about reducing costs across all organizations with the chain or network. A central theme is to expend effort towards reducing expense and maximizing value within, as well as between organizations. The idea that outsourcing can inherently improve financial performance only holds true if volumes are too low to realize economies of scale, or if a company does not have the necessary expertise. It is popular for companies to outsource business functions in the name of cost savings. Popular opinion expects this to be the dominant business model of the future, "Virtual integration lets companies concentrate on processes in which they can be world-class, and rely on someone else to perform the rest." (Hammer, 2000) In many cases it appears the cost savings are not from economies of scale. Rather, the outside organizations are more effective due to competent management and a streamlined business process. One author praising the outsource model stated, "For the typical OEM, the act of assembling components is a distraction - diverting brainpower from innovation - and a cash drain. PC manufacturers have known this for years. HP for example, doesn't make any of its personal computers. The manufacturing is handled by Flextronics competitor SCI Systems. (O'Brien, 2001)

The problem with this statement is that Hewlett Packard is losing money on their computer division. Further, rival Compaq following the same philosophy is not making a profit. While these two organizations "focus on core competencies" Dell computer is still profitable keeping computer assembly in house as a strategic advantage. Dell makes a profit each quarter and undercuts HP and Compaq on price. There are two possible explanations for Dell's ability to offer lower prices while maintaining higher margins. The first would be that Dell manages to keep costs lower through effective management of the supply chain. The second is that Dell does not need to share as much of the margin with suppliers. Likely Dell's competitive position is created by both these possibilities. While Dell, HP, and Compaq cut prices, only Dell retains the margin associated to manufacturing. Compaq and HP leave the only margin to be realized by contractors such as Flextronics.

Another, industry contradiction is that while analysts praise companies for releasing their manufacturing to vendors they also praise companies like Flextronics, Soletron, and Celestica for being in a high growth business. On one hand industry Analysts

State; the future of gadget making is not about making gadgets; it's about imagining them. Someone else makes the imaginary real. (O'Brien, 2001) This statement hardly supports the investment communities' outlook for Flextronics's stock. Dell is not the only company that takes a more level approach to outsourcing. The CEO's of both Nokia and Siemens have made statements disagreeing with the wisdom of Ericson's decision to outsource all manufacturing. Siemens, which outsources about one third of its cell phone manufacturing, said that flexibility was the only reason to let another company produce its phones. "We can manufacture our phones at the same low cost as our outsourcing," said Jung, but he added that outside contractors enabled the company to adjust output. (Grinsven, 2001) Further, effective product design requires knowledge of the manufacturing process. The two functions are not exclusive of one another. This is supported by the recent thrust Flextronics and Solelectron have made in the efforts to offer design services. Nokia prefers to keep design in-house, a spokesman for the Finnish company said. "We feel we do it better than anyone else." Nokia is known for its evolutionary design work, Solelectron's DePalma said. "They make a phone inside a phone, which means they can personalize it for different markets rather than go through a separate design cycle," he said. "It's going to be hard to convince them [to outsource] because at this point they have all those benefits." (Serant, 2000)

The success of companies like Dell, Nokia and Siemens should not be attributed to blind vertical integration. Similarly, the adoption of new supply chain tools and virtual integration should not be considered a fix all for business performance. Clearly corporations will need to incorporate new business process and partnerships into their supply chain strategy in order to compete against the new competition. The successful companies will be those that make sound business decisions based on financial models and long term strategic planning. As shown by Dell and Nokia choosing to keep manufacturing in house can be a power competency when market pressures force serious cost competition. Corporations will need to make decisions on what processes to keep in house and for which to find a partner. Toyota has always made the decision based on economies of scale. If their business requires volumes that realize economies of scale the process is done in house. Business managers must make these decisions with respect to the short and long term based on the individual circumstances surrounding each case. For example, the CEO's of Nokia and Siemens did not agree with the decision made by Ericson. However, Ericson may have been in a situation such that their internal competencies were so inadequate that the rate of money being lost would not allow the company enough time to reengineer itself. In this case the short-term need would dictate immediate action. For many established corporation it is likely that some vertical integration will allow them to create greater barriers of entry for "would be" competitors. Companies like Dell and Nokia have more places to sacrifice margin than competitors such as Hewlett Packard and Ericson respectively. Technology creates many possibilities for redesigning the supply chain. However, corporation should not change for the sake of technology. This study extends the research of supply chain management systems into the area of cross-functional, organization boundary spanning, and technical management.

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# MANAGEMENT SYSTEM USING 7-S'S MCKINSEY MODEL CASE STUDY IN CERAMIC IN THAILAND

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## ABSTRACT

Currently, Ceramic Industry in Thailand is unsystematic management system that led to less competitive in foreign countries. The main objective of this study is to develop as a way of thinking more broadly about the problems of organizing effectively in the SME ceramic industries. The McKinsey 7-S Model is a widely chosen strategy to a variety of activities that views culture as a function of seven variables: strategy, structure, systems, style, staff, skills and shared values. Almost the ceramic industries in Thailand especially in souvenir products are SME. As a result, using the McKinsey 7-S model are: these SME ceramic industries do not have the strategy for systematic action and structure; do not have the organization structure and maintains a harmony between the authority-responsibility relationships. In addition, these comprises several systems including forecasting, tracking, communication, accounting and financing, quality assurance, Enterprise Resource Planning and CRM. The leadership approach of the control management styles involved with the way the organization operates and collectively works to achieve its company's goods and services. Some have special skills to sustain the distinctive capabilities of an organization. Almost the staff is labor-intensive in the enterprise and some concerns the values that are shared by the concept of wisdom.

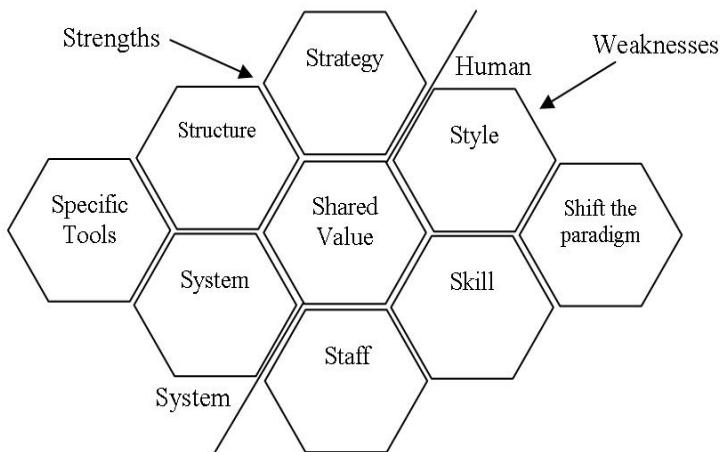
**Keywords:** The McKinsey 7-S Model, SME Ceramic Industries, Souvenir Products, Competitiveness

## 1. INTRODUCTION

Originally developed as a way of thinking more broadly about the problems of organizing effectively, the 7-S framework provides a tool for judging the "do ability" of strategies. The McKinsey 7-S Model is viewing the interrelationship of strategy formulation and implementation. It helps to focus managers' attention on the importance of linking the chosen strategy to a variety of activities that can affect the implementation of that strategy (Waterman, R., et al, 1980). The framework suggests that it is not enough to think about strategy implementation as a matter only of strategy and structure, as has been the traditional view. The conventional wisdom used to be that if you first get the strategy right, the right organization follows. And when most people in Western cultures think about organization, they think structure. To find in practice, however, that these notions are too limiting. To think comprehensively about a new strategy and the problems with carrying it out, a manager must think of his company as a unique culture and must think about the ability of the company to get anything really fundamental (i.e., not tactical) accomplished as a matter of moving the whole culture (Pascale, R.T. and Athos, A.G., 1980). The McKinsey 7-S Framework should be thought of as a set of seven compasses as following strategy, structure, system, style, staff, skills and share: values as showed in figure 1.

Previously, technology sources for the ceramic industry in Thailand can be divided into three types; i.e. local experience, imported turnkey machines and multinational companies. Technology transfer from experience is widespread in small- to medium-sized factories. However, because of limitations in funding and personnel, technology from experience has yielded only modest improvement. Secondly, very popular among medium- to large-sized industry is technology transfer by turnkey imported machines. Although very convenient to start production, in the long run turnkey machines inevitably lead to high-level technology dependence and costly import of machine know-how (S. Wada, T. Hattori and K. Yokohama, 2001).

Generally, Thai technical staff could proceed, maintain and adjust production plans without assistance from technology owners (Statistics from [www.customs.go.th](http://www.customs.go.th)). Some industry could replace original parts with local ones (Seawong P., et al, 2000). However, most of the industries struggles maintain product quality to specifications, not to mention quality improvement. Finally, some 'advanced' technology could be transferred to Thailand via geographical movement of multinational companies. This know-how is hardly ingrained locally because it moves with the factories from one country to another (Peters, T. and Waterman, R., 1982)



**Figure 1:** The McKinsey 7-S Framework

The overall technological capability of Thai ceramic industry has been improved at an unsatisfactorily slow rate. The size of the conventional ceramic household sector has stayed rather constant but its competitiveness has seriously decreased. Thus, the main objective of this study is to develop as a way of thinking more broadly about the problems of organizing effectively in the SME ceramic industries.

## 2. MATERIAL AND METHODOLOGY

In this study, to do the experimental design; using criteria selection to do the representative of ceramic industries i.e. geography divided into 5 parts (northern, northeastern, central part, west and south), questionnaires is the tool to define the parameters of running a business, field observation and in-depth interview. The steps of this study as following:

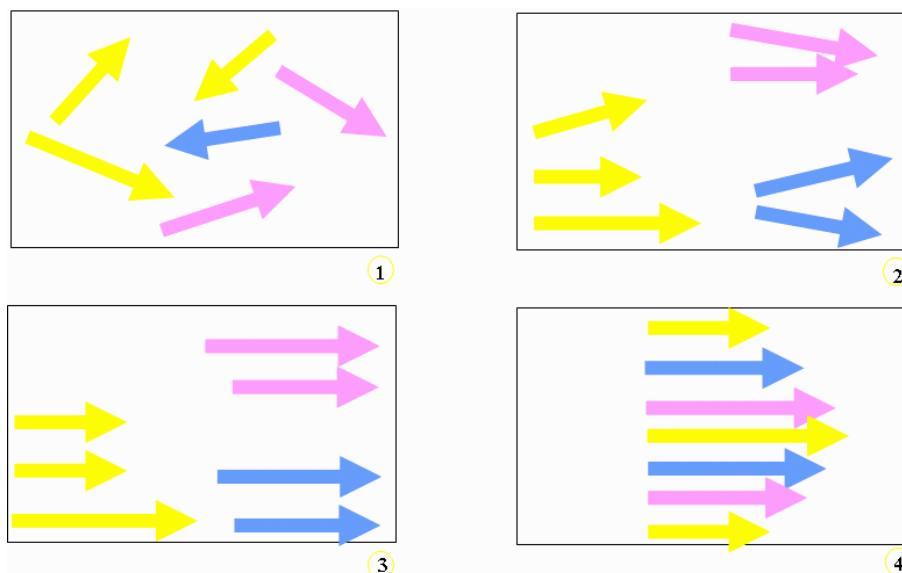
1. To interview the managers about the strategy management policy.
2. To concern with the organization structure.
3. To find out the existing all the systems in supply chain i.e. procurement, order processing, production, warehouse management, transportation, etc.
4. To study the leaderships of ceramics industries managers.
5. To survey all the staff's skill especially in production process.
6. To interview the academic background for all staff.
7. To develop the concept of wisdom in ceramics industries

## 3. RESULTS AND DISCUSSION

In this study, there are 34 industries (10%) as a representative of ceramic industries in Thailand. As a result from questionnaire, the 7 factors are to organize a company in a holistic and effective way. Together these factors determine the way in which a corporation operates as following:

1. **Strategy:** A strategic business unit is a significant organization segment that is analyzed to develop organizational strategy. In ceramic industries (souvenir products) are SME. Then almost companies do not the strategic policy. Due to all owners operate with experiences with no direction as shown in Figure 2.

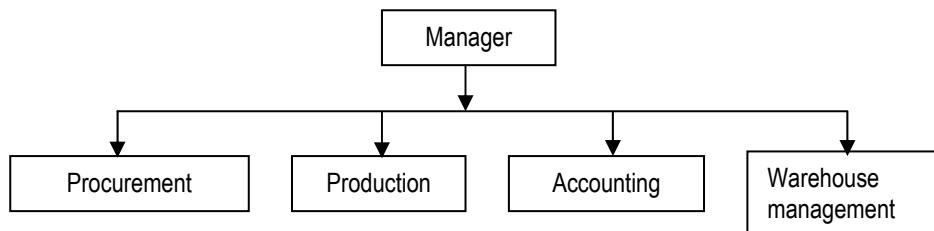
From Fig. 2, almost the ceramic industries in Thailand demonstrated in Fig. 2.1. Thus, to do the strategy implementation each department Fig. 2.2-2.3 till the whole organization that leads to high potential and competitiveness Fig. 2.4.



**Figure 2: Strategic Implementation**

2 **Structure:** Organizational Culture: the dominant values and beliefs, and norms, which develop over time and become relatively enduring features of organizational life. There are 2 types of organization structure as following:

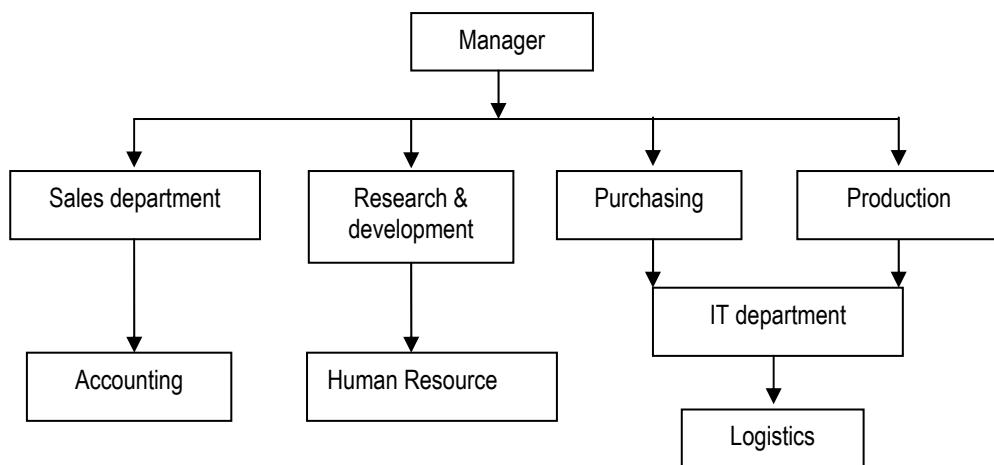
2.1 Flat structure: a flat organisation especially in the ceramic industries in Thailand will have relatively few layers or just one layer of management. This means that the “Chain of Command” from top to bottom is short. Due to the small number of management layers, flat organisations as shown in Fig. 3.



**Figure 3: Flat organization structure**

2.2 Hierarchical structure: are ranked at various levels within the organisation, each level is one above the other. At each stage in the chain, one person has a number of workers directly under them, within their span of control as shown in Fig. 4.

Most ceramic industries in Thailand are flat structured.



**Figure 4: Hierarchical organization structure**

- 3 **Systems:** there are 7 systems development in the ceramic industries as following table:

**Table 1:** 7 systems development in the ceramic industries in Thailand

System	Development Guideline	Benefits
Forecasting system	➤ Customer database development	➤ Decreased stock ➤ Customer satisfaction
Tracking system	➤ Using RFID for tracking the origin of the products.	➤ To find out the problem for better solving
Internal communication	➤ Real time communication ➤ Systematic meeting scheduling	➤ Fast problem solving ➤ Reduced cost
Accounting and Financial	➤ Accounting Information System ➤ Target costing	➤ Reduced cost ➤ Value-added
Operation performance	➤ Develop operation planning	➤ Reduced production process ➤ Reduced loss ➤ Reduced energy
Enterprise Resource Planning (ERP)	➤ Develop each module of ERP	➤ Planning efficiency ➤ Control resources efficiency ➤ Marketing response
CRM	➤ Questionnaire	➤ Customer satisfaction

4. **Style:** Management Style: more a matter of what managers do than what they say; How do a company's managers spend their time? What are they focusing attention on? Symbolism – the creation and maintenance (or sometimes deconstruction) of meaning is a fundamental responsibility of managers. Leadership theory has moved to behavioral approaches, to contingency and situational models. Leadership at the executive level is different from leadership at mid-management, which is different than first line leadership. There are four categories and there are times when each approach is appropriate and times when it would not be as following:

- 4.1. Structural Leaders focus on structure, strategy, environment; focus on implementation, experimentation, adaptation
- 4.2. Human Resource Leaders believe in people and communicate that belief; they are visible and accessible; they empower, increase participation, support, share information, and move decision making down into the organization
- 4.3. Political leaders clarify what they want and what they can get; they assess the distribution of power and interests; they build linkages to other stakeholders; use persuasion first, then negotiation and coercion only if necessary
- 4.4. Symbolic leaders view organizations as a stage or theater to play certain roles and give impressions; these leaders use symbols to capture attention; they try to frame experience by providing plausible interpretations of experiences; finally they discover and communicate a vision

Most of the producers are small- to medium- sized industries (SMIs), the managers are Structural Leaders.

5. **Staff :**The people/human resource management – processes used to develop managers, socialization processes, ways of shaping basic values of management cadre, ways of introducing young recruits to the company, ways of helping to manage the careers of employees as shown in table 2:

**Table 2:** The ways of helping to manage the careers of employees

Ways	Guideline
5.1 Recruitment	➤ Not focus only local staff but also to do the collaboration with academic sector for the students to gain more experience during summer with the real sector in ceramic industry.
5.2 Develop the incentive system and working environment	➤ Awards system ➤ Staff development ➤ Improve working environment ➤ Initiative working happiness
5.3 Establish special technical training center by government	➤ Encourage industries to do staff development
5.4 Develop knowledge management	➤ To develop the knowledge-based system for transfer knowledge and experience from generation to generation
5.5 Create the attitude	➤ Encourage worker to train and develop evaluation system

6. **Skills:** The distinctive competences – what the company does best, ways of expanding or shifting competences. Thai workers are notable in their manual skill, possessing high potential for product and technology development
7. **Share Values:** Guiding concepts, fundamental ideas around which a business is built – must be simple, usually stated at abstract level, have great meaning inside the organization even though outsiders may not see or understand them as shown in Fig. 5.

**Figure 5:** Ceramic industry is the local wisdom

From Fig. 5: one of the ceramic factories announces that all workers are not labor but they are local wisdom from generation to generation.

#### 4. CONCLUSION AND RECOMMENDATION

The 7-S Model is a valuable tool to initiate change processes and to give them direction. A helpful application is to determine the current state of each element and to compare this with the ideal state. Based in this it is possible to develop action plans to achieve the intended state. Effective organizations achieve a fit between these seven elements. This criterion is the origin of the other name of the model: In change processes, many organizations focus their efforts on the hard S's, Strategy, Structure and Systems. They care less for the soft S's, Skills, Staff, Style and Shared Values. The most successful companies work hard at these soft S's. The soft factors can make or break a successful change process, since new structures and strategies are difficult to build upon inappropriate cultures and values. These problems often come up in the dissatisfying results of spectacular mega-mergers. The lack of success and synergies in such mergers is often based in a clash of completely different cultures, values, and styles, which make it difficult to establish effective common systems and structures. Formal and informal procedures support the strategy and structure. (Systems are more powerful than they are given credit). If one element changes then this affects all the others. For example, a change in HR-systems like internal career plans and management training will

have an impact on organizational culture (management style) and thus will affect structures, processes, and finally characteristic competences of the organization.

When they are not, the company is not really organized even if its structure looks right. If a 7-S analysis suggests that strategy implementation will be difficult, managers either can search for other strategic options, or go ahead but concentrate special attention on the problems of execution suggested by the framework.

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## **SECTION 2**

# **SCIENCE & TECHNOLOGY**

# INFRARED PEN DEVELOPMENT FOR VIRTUAL SMART BOARD

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## ABSTRACT

Currently, smart board technology is very famous. This is because this technology is applied not only for better presentations but also for education efficiency. However, smart boards are very expensive which makes the technology less likely to be adopted on a wide scale by the education industry. Thus, the main objective of this study is to develop infrared pens for virtual smart board use for education. The research methodology is to apply "Wii Remote" technology by using embedded high solution infrared camera as a capture image tool. The image is directly sent to a computer via Bluetooth connection. Then to develop C# program using RANSAC algorithm to do the image processing. After testing the infrared pen with a virtual smart board and developing more features for the program. Finally, it can be concluded that the development of infrared pen for virtual smart board is very economical and highly efficient.

**Keywords:** *Infrared Pen, Smart Board Technology, RANSAC Algorithm*

## 1. INTRODUCTION

Currently advanced computer technology is developed for easy-use especially in education. In Thailand, the traditional teaching used dusty chalk and dry-erase boards. Then the technology used whiteboard with pen, overhead projector. In this knowledge age, it is very important that the most up-to-date technology in order to prepare the students in the 21<sup>st</sup> century job market. Information technology has changed the role of teachers in the classroom. Many students with an abundance of knowledge with technology, so it is important that we as teachers both stay current with new technology and are willing to learn from the students and allow them to teach us. The modern educator today employs tools such as smart boards to teach students. Especially interactive white boards are currently used in many classrooms as replacements for standard white boards, blackboards and flip charts. They also have replaced of the DVD and television combinations schools have used for years. Smart board is controlled by computer and internet completely i.e. highlights text, zoom in-out using infrared pen.

The main objective of this study is to develop infrared pen for smart board working efficiency.

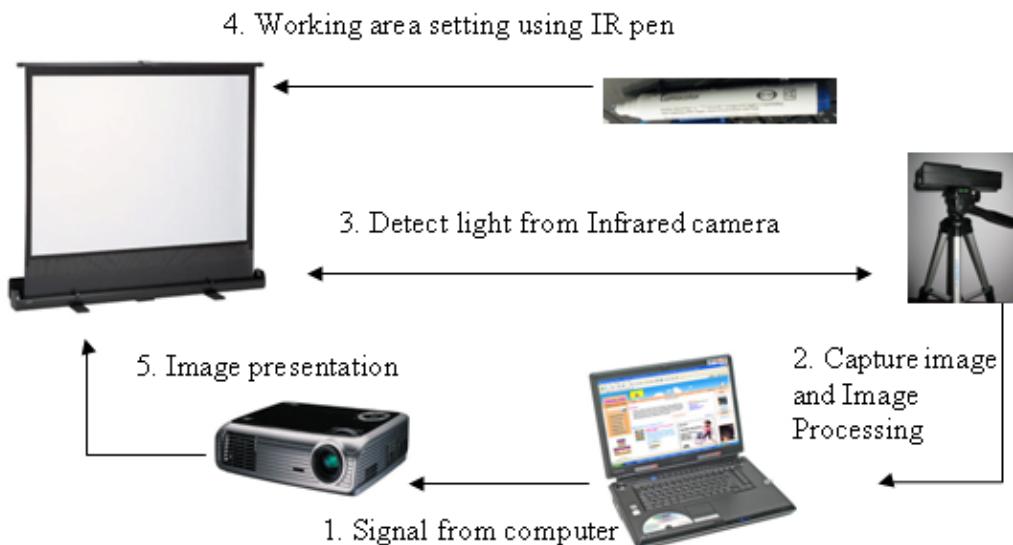
## 2. METHODOLOGY

To develop the infrared pen (IR) development for virtual smart board, the system consists of 5 components as following:

1. Projector is projecting the pictures from computer, CD players, DVD players, etc. for presentation
2. IR Camera is functioning to capture light from IR pen before image processing
3. Computer is supporting at least BluetoothEDR2.0 signal
4. Infrared pen
5. Smart board programming using C language

To connect all the hardware, the computer connect with projector via VGA. Then image signal from computer send to projector.

2. Infrared camera capture image from projector via Bluetooth. 3. Detect the light from infrared camera from screen 4. Set up the working area with 4 points from IR pen using image processing is shown in Figure 1.



**Figure 1:** Infrared pen development for virtual smart board

To develop IR pen, the step of development as following:

## 2.1 IR Pen Material Preparation

Switch on-off, whiteboard pen, dry cell battery, infrared sender and wire are shown in Figure2.



**Figure 2:** IR pen material

## 2.2 IR Pen Development

The components of IR pen are pen tip, body and pen bottom as shown in Figure 3.



**Figure 3:** IR pen components

### 2.2.1 To prepare IR pen

Punch a hole in the body for installing on-off switch as shown in Figure 4.



Figure 4: Punching pen body

### 2.2.2 Set up the circuit for IR pen

As shown in Figure 5.

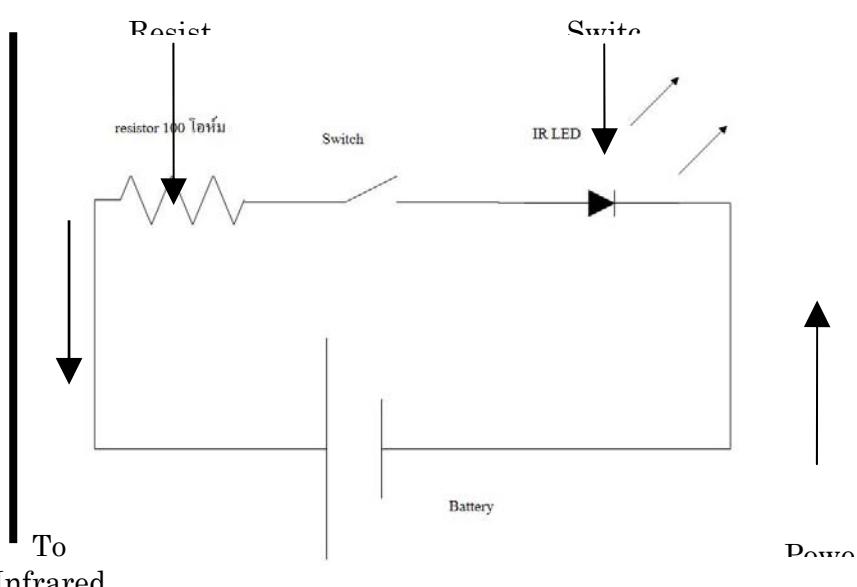


Figure 5: Internal circuit in IR pen

### 2.2.3 Test IR pen

Using digital camera as shown in Figure 6.



Figure 6: IR pen testing

## 2.3 Programming Language

Using C# and RANSAC algorithm. The flowchart is shown in Figure 7.

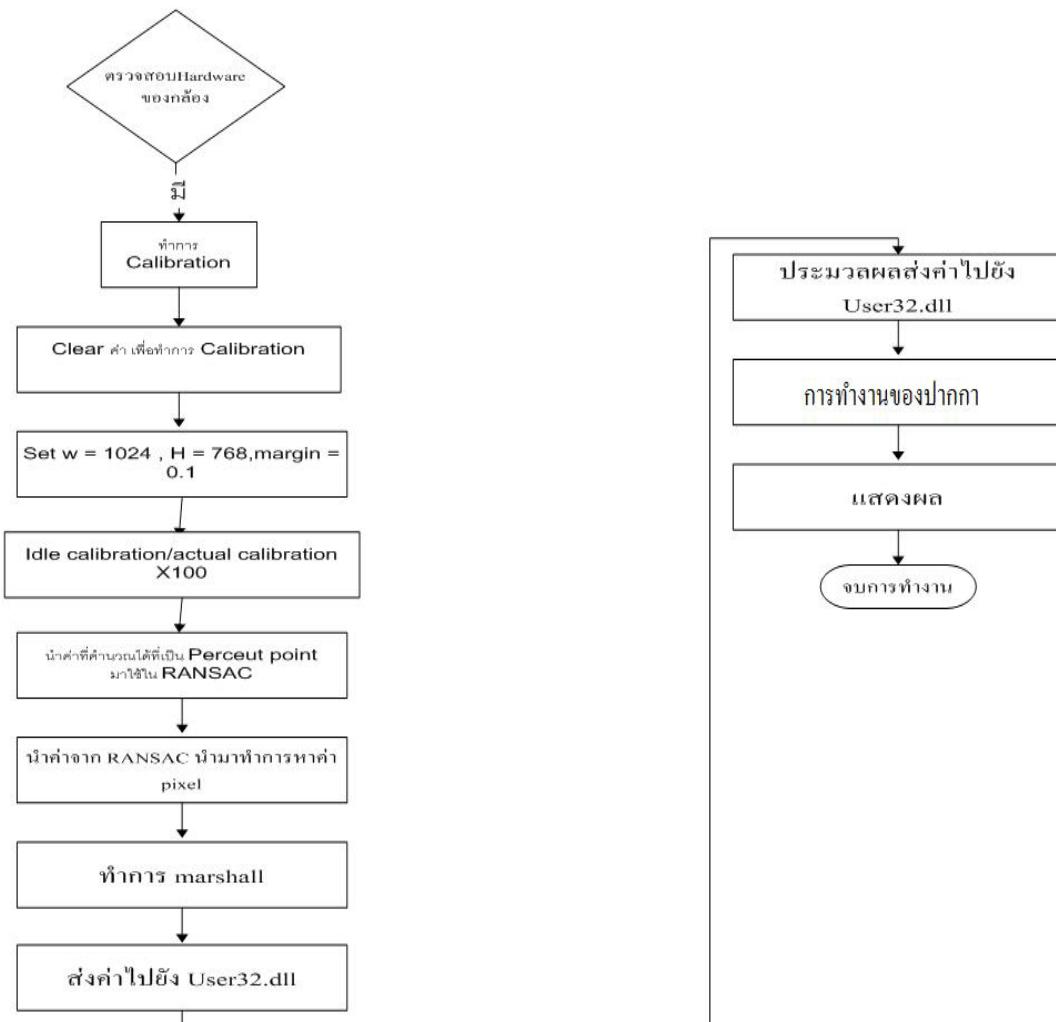


Figure 7: Flowchart of IR pen with smart board

## 3. RESULT

### 3.1 Testing Smart Board

The working area for displaying the optimal image processing is shown in Fig. 8.



Figure 8: Smart board working area

From Fig. 8, the projector is projecting the working area 4 points approximately 120x150 inches using flowchart to control as shown in Figure 8.

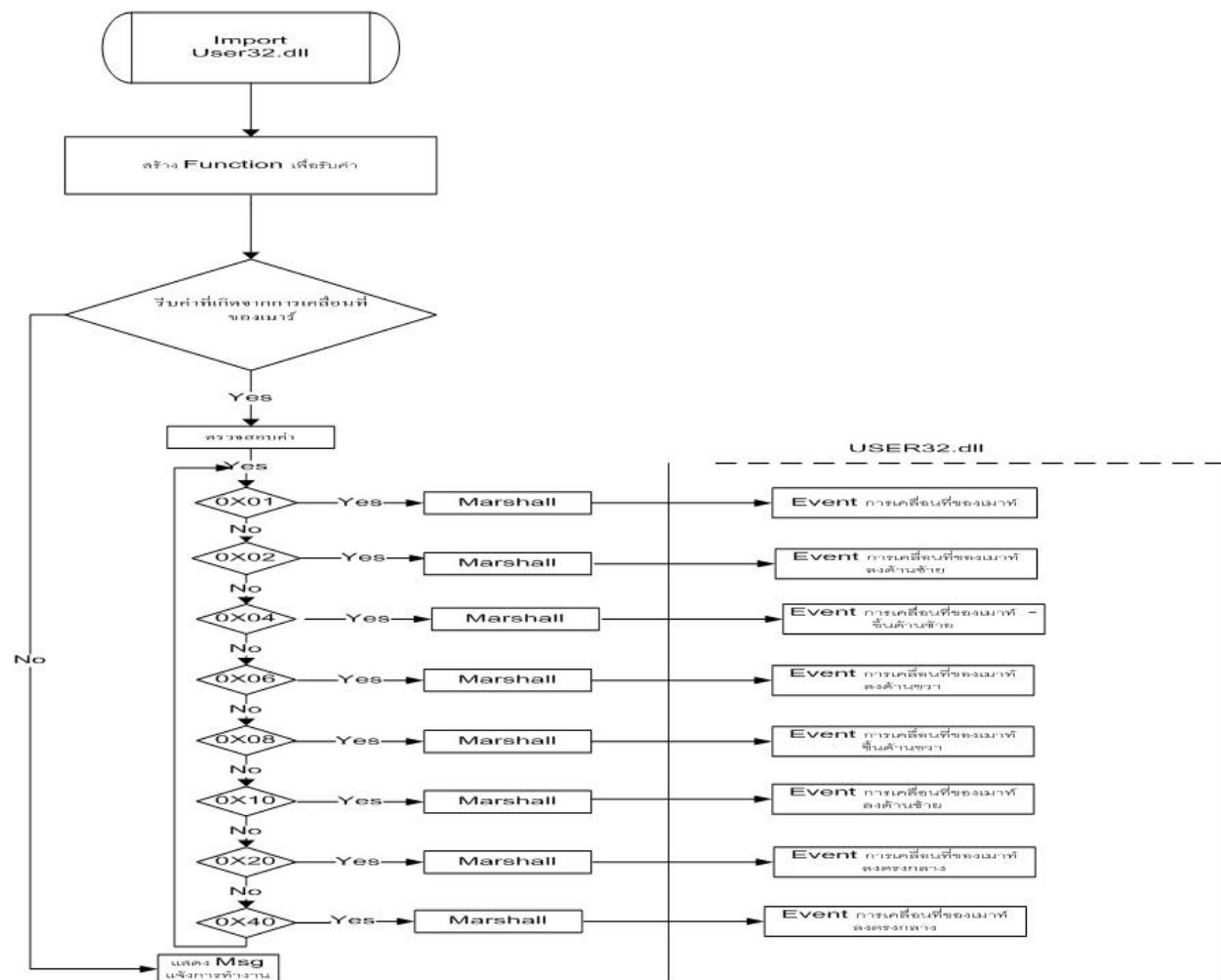


Figure 8: Flowchart for setting working area

### 3.2 Testing IR Camera

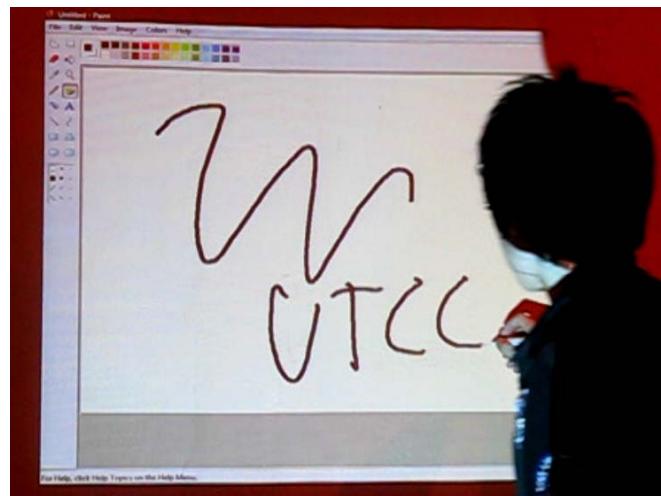
By connecting IR camera with high speed computer support. EDR2.0 via Bluetooth is shown in Figure 9.



Figure 9: Testing IR Camera

### 3.3 Testing IR Pen

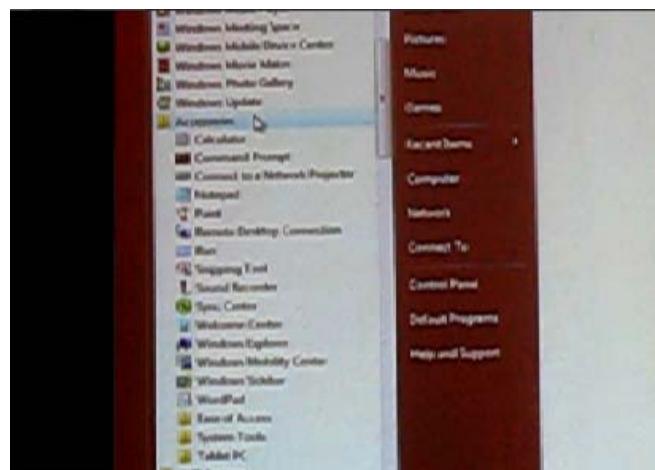
With smart board is shown in Figure 10.



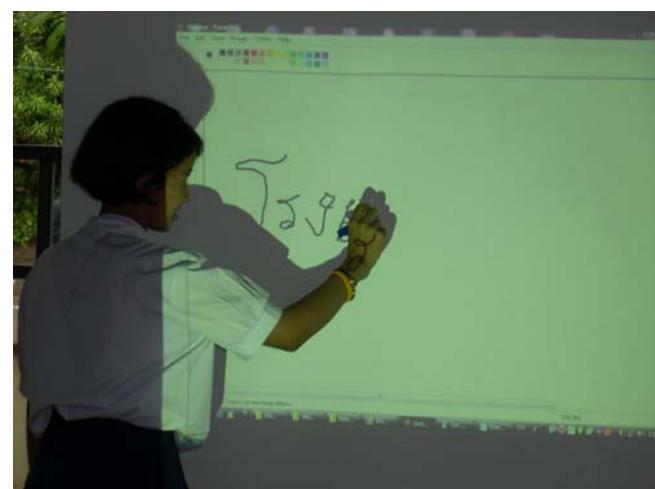
**Figure 10:** Testing IR Camera

### 3.4 Running Application

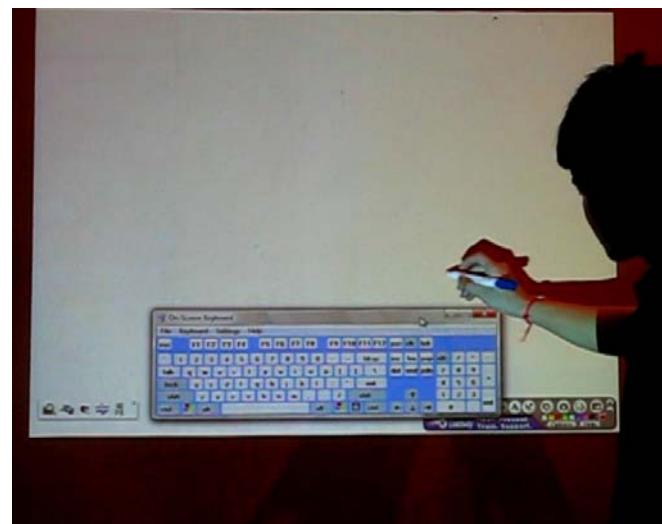
Using integrating the IR pen, smart board and program utility is shown in Figure 11 a-d.



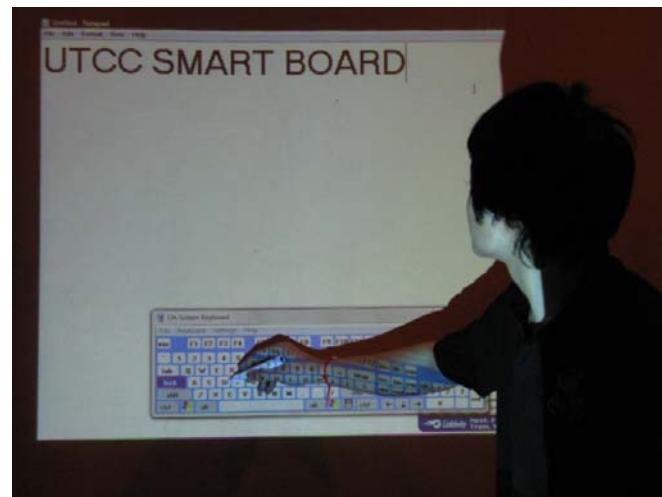
**Figure 11-a:** Running application



**Figure 11-b:** Running application



**Figure 11-c:** Running application



**Figure 10-d:** Running application

It can be concluded that the development of infrared pen for virtual smart board with C# program using RANSAC algorithm is very economical and highly efficient.

#### **4. CONCLUSION**

The limitation of this study is the shadow from light source of projector to the smart board. The working area is limited only 120x150 inches and only 3 meters between IR pen and computer. On-going research is to develop microcontroller instead of Wii remote.

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# AN EXPLORATION OF CYBER TECHNOLOGY AND MBA STUDENTS IN THAILAND

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## ABSTRACT

*The use of cyber technology by faculty in hybrid classrooms of higher education can present pedagogical and technological challenges in fully addressing students' learning styles and enhancing e-learning effectiveness. Faculty members are often challenged to incorporate advanced technology innovatively with the course design that can cultivate a student-centered e-learning environment and address students' unique learning dynamics. The purposes of this descriptive study are to examine the effects of cyber technology on Thai MBA students' learning outcomes in relation to learning styles, personality orientation, and technical competency. A face-to-face classroom attendance and any technological resources, such as the Internet, computer, course management system, constitute a hybrid course. The sample population included students who were enrolled in MBA hybrid courses at public and private universities in Thailand in 2009. A paper-based survey was used to collect primary data including demographic information, learning styles, and personality orientation. Out of 226 Thai MBA students who participated in the study, 187 responses were used in the final data analysis. The findings of the proposed study provides academic stakeholders including policy makers, institutional administrators, faculty members, students, and researchers with insights into how to best incorporate technology innovatively to enhance learning effectiveness in the MBA hybrid classrooms of the twenty-first century.*

**Keywords:** *E-Learning, Cyber Technology, Thai MBA, Innovative, Learning Styles*

## INTRODUCTION

The current knowledge-based, global economy requires new methods of delivering education with cyber technology, partly to enhance traditional methods of knowledge acquisition and distribution in brick-and-mortar higher education institutions (Chen, Gupta & Hoshower, 2006). The cyber technology such as information communication (ICT) and computer mediated communication (CM) enables higher education institutions to enhance education delivery and knowledge acquisition in the global e-learning environment where learners and faculty members can be at a distance from one another but are connected by technological media (Saba, 2005). E-learning can be a strategic alternative to accommodate the needs of adult learners who are often too constrained to attend traditional classrooms due to working schedules (Zhang, 2004). Since the flexibility of e-learning allows adult learners to engage in knowledge acquisition and e-learning at anytime and anywhere, the number of students enrolled in hybrid course has more than doubled in the past five years in the United States (Romano, 2006). Likewise, the demands for e-learning are also growing in the Eastern countries (Chorpothong & Charmonman, 2004). Many traditional brick-and-mortar higher education institutions in Thailand are transitioning to become hybrid institutions that offer ground, hybrid, and online courses to meet the needs of adult learners and sustain long-term competitiveness (Charmonman, 2008).

## BACKGROUND OF THIS STUDY

Given the demand for continuous learning in the information-based postmodern global societies, many global organizations and higher education institutions embrace e-learning as an essential component to sustain long-term competitiveness in the global market (Combe, 2005). The U.S. Department of Labor estimates that "corporate e-learning revenues are expected to increase from \$550 million to \$11.4 billion, a projected 83% compound annual growth rate" (Fry, 2001). Multinational corporations, as shown in Table 1, have incorporated ICT, CMC, and e-learning into their corporate universities that provide cross-continent employees with technology-based trainings.

**Table 1:** e-Learning Corporate Universities

Company	Employees	Locations	Reference
IBM	300,000	Worldwide	Mantyla, 2001
Cisco	10,000 engineers; 40,000 partners	132 countries	Galagan, 2001
GE	300,000	Worldwide	Schank, 2002
Verizon	170,000	Worldwide	Munzer, 2002
Motorola	110,000	Worldwide	Elswick, 2002
Delta	33,000	32 cities	Salopek, 2003
GM	88,000	Worldwide	Pantazis, 2002

Likewise, academia is expected to grow at an “annual growth of 40%” in the next decade (Fry, 2001). As the demand of using technology to deliver educational content electronically continues, faculty members in higher education are expected to transition from teaching in the traditional face-to-face classrooms to teaching in the virtual classrooms (Alshare, Kwun, & Grandon, 2006; Cao, 2005; Zhang, 2004). According to a survey study conducted by the Association to Advance Collegiate Schools of Business, sixty percent of full-time faculties were involved in online course creation, maintenance, and delivery through the Internet and course management systems (Singh & Bernard, 2004; Trees, 2000; Mossavar-Rahmani & Larson-Daugherty, 2007).

## Problem Statement

The problem is that teaching with hybrid or online course with text-based materials do not cultivate a multisensory learning environment and students' learning styles may not be fully addressed. Furthermore, teaching in the global e-learning environment (e-teaching) when the technological infrastructure in countries like Thailand or China could present faculty members with pedagogical and technological challenges (Cao, 2005; Zhang, 2004; Bourne & Moore, 2004).

## Intellectual Merit

While the literature is filled with e-learning comparative studies, examining effects of cyber technology on Thai MBA students' academic performance in relation to students' personality orientation and learning styles remains under explored (Aduwa-Ogiegbaen & Isah, 2005; Alshare, Kwun, & Grandon, 2006; Blass & Davis, 2003; Britt, 2006; Carr-Chellman, 2006; Cheng, 2009; Durrington, Berryhill, & Swafford, 2006; Lessen & Sorensen, 2006; Pagram & Pagram, 2006). In addition, much research argued that people of dissimilar cultures and e-learning infrastructures may consider technological factors differently. Therefore, conducting such a research study to gain insights can benefit academic stakeholders of Thailand including policy makers, institutional administrators, faculty members, students, and researchers.

## Research Objectives

The descriptive study has four objectives. The first objective is to examine Thai MBA students' perception of their academic success regarding technological factors. Participants could report how they perceive each of technological factors. The second objective is to examine and compare the effect of cyber technology on academic performance in relation to Thai MBA students' personality orientation. Participants could self-select their temperament-orientation from two pre-defined temperament-orientations including “introversion” and “extroversion”. The third objective is to investigate and compare the effects of innovative technology on academic performance in relation to Thai MBA students' learning styles. Participants could self-select one preferred learning orientation from three pre-defined choices including “auditory”, “visual”, and “kinesthetic” learning style. The last objective is to examine the effect of innovative technology on academic performance in relation to Thai MBA students' technical competency. Participants who could self-select their technical competency from three pre-defined levels including “beginner”, “intermediate”, and advanced”. Based on these objectives, this study seeks to answer the following research questions:

**RQ1:** What are Thai MBA students' perceived relative strengths of technological factors as measured by Technological Factors Survey (TFS)?

**RQ2:** What are the effects of cyber technology on Thai MBA students' academic performance in relation to students' personality orientation as measured by TFS?

**RQ3:** What are the effects of cyber technology on Thai MBA students' academic performance in relation to students' academic learning styles as measured by TFS?

**RQ4:** What are the effects of cyber technology on Thai MBA students' academic performance in relation to students' technical competency as measured by TFS?

## MEHODOLOGY

The research design of this study is descriptive. The time dimension of the study is cross-sectional. The sampling frame is convenient sampling, which comprised MBA students who enrolled in hybrid courses at public and private universities in Thailand. Data collection process was conducted on a voluntary basis. Appendix shows the researcher-constructed survey to be used for this study.

### Survey Instrument

The reliability of the researchers-constructed survey was established in previous pilot test and previous studies. The Cronbach's alpha index (reliability coefficient) was performed using Statistical Package for the Social Sciences (SPSS) software to examine inter-item correlation and covariance. In addition, factor analysis was also conducted using the SPSS software. The factor analysis procedure included the "extraction method of *principal-component-factor* analysis with *Varimax rotation* that maximized total variation of variables for factor loading and retention" (Kinnear & Gray, 2006, p. 503). The logical sets that were based on theory instead of grounded approach were used for the actual study.

### Data Collection

Data were collected at public and private schools in Bangkok, Thailand. All students are enrolled in international MBA program that are taught in English. Different universities require different minimum Test of English as a Foreign Language (TOEFL) scores, but the lowest required score was 450. This score could be substituted by achieving scores of other tests such as International English Language Testing System (IELTS) that are normally used for higher education institutions in Australia and the United Kingdom. The requirement may be waived if the student passes all English courses designed for graduate students who desire to enroll in international MBA programs. By meeting the language requirements, Thai MBA students demonstrated no language barriers when taking the paper-based survey that was written in English. Out of 226 Thai MBA students who participated in the study and completed a paper-based survey, 39 responses were discarded due to unusable responses. Eighty-two usable responses came from public institutions and 105 responses came from private institutions. After the data collection was ended, data from the paper-based survey were first entered in Excel spreadsheet. To minimize possible discrepancies between actual data and data entered, the data set was entered by two people and both were compared. Some inconsistencies were found and then corrected accordingly. Finally, the verified dataset of 187 responses formed the basis for data analysis.

## FINDINGS OF THE STUDY

### Demographics of Subjects

Subjects were asked to respond to the paper-based survey. The subjects for this study were MBA students who enrolled in Thai three public and two private universities in 2009. Public schools include Chulalongkorn University, National Institute of Development Administration (NIDA), and Kasetsart University. Private universities are Bangkok University and Assumption University of Thailand. All of these institutions are nationally or internationally known and provide quality education in both undergraduate and graduate programs. Student bodies at these universities are typically diverse; therefore, students from different regions of Thailand are commonly found at these institutions. The demographic data analyses are summarized below.

#### Age

For question 19, participants were asked to provide a numeric value for their age. Respondent ages ranged from 22 to 48 years old. Descriptive statistics were performed in Excel. The average age was 27 with a standard deviation of 3.73.

#### Gender

For question 20, participants were asked to identify their gender with two pre-defined categories of "Male" and "Female". Descriptive statistics were conducted in Excel. Of the 187 participants' responses to this question, 77 self-identified as males and 110 as females.

## **MBA involvement**

For question 22, participants were asked to select their level of computer technical skills from three pre-defined choices. Descriptive statistics were conducted in EXCEL. Of the 187 participants' responses to this question, 44 selected "Very Involved," 111 selected "Somewhat Involved," 26 selected "Somewhat Reserved," and six selected "Very Reserved".

## **Data Analyses for Research Questions**

Survey questions 1 through 18 were answered by participants with a five-point Likert-type scale. The Likert-type scale is a widely used attitude scale type in the social sciences (Cooper & Schindler, 2003; Neuman, 2003). The five-point Likert-type scale employed in the study included *Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree* (SA = 5). Findings of the study are presented to answer research questions.

To answer the first research question, *What are Thai MBA students' perceived relative strengths of technological factors as measured by Technological Factors Survey (TFS)?* A parametric-like *index of relative strength of faculty perceptions* for each of the technological question in the survey were calculated with Excel based on the formula below. A rank list, as shown in Table 2, was generated based on the indices of perceived relative strength (RS) of technological factors.

*Index of relative strength of the student perceptions* for question Q#XX =  $\{[(\text{number of Likert-scale 1's}) \times (1.0)] + [(\text{number of Likert-scale 2's}) \times (2.0)] + [(\text{number of Likert-scale 3's}) \times (3.0)] + [(\text{number of Likert-scale 4's}) \times (4.0)] + [(\text{number of Likert-scale 5's}) \times (5.0)]\} / N$

**Table 2:** Summarized Rank List of Technological Factors E-Learning Motivators

Question #	Technological Factors	Relative Strength
10	Maintaining close interactions with peers is important for me to succeed in MBA courses.	4.05
2	Having structured and user-friendly technological resources is important for me to succeed in MBA courses.	4.02
15	The inclusion of group project(s) for MBA courses is important for me to collaborate with diverse team member and develop global competency.	3.97
8	Having course work that engages me in professional growth is important to retain me in the MBA program.	3.94
6	Having global access (24 hours a day) to course content and e-resources is important for me to succeed in MBA courses.	3.93
18	The use of innovative learning modules that cultivate critical thinking and problem solving skills is important to retain me in the MBA program.	3.92
1	Being provided with an orientation to technological resources is important for me to succeed in MBA courses.	3.91
12	Guideline from faculty on how to learn can help me succeed in MBA courses.	3.84
13	Having timely feedback and close interactions from faculty is important for me to succeed in MBA courses.	3.79
9	I am self-motivated to complete course load and succeed in MBA hybrid courses.	3.78
17	The use of innovative multimedia-based learning modules in MBA courses addresses my preferred learning style.	3.75
7	Having an online component is important for me to succeed in the MBA courses.	3.59
16	If applicable, being provided with credits to journal and reflect transformative learning is important for me to succeed in MBA courses.	3.59
3	The lack of technical ability on my part may hinder my ability to succeed in MBA courses.	3.57
14	Being provided with discussions board is important for me to participate in MBA courses.	3.57
5	Being provided with extended faculty member support in the evenings and weekends is important for me to succeed in MBA courses.	3.53
11	Not having interactive and multimedia-based learning modules will deter my ability to succeed in MBA courses.	3.49
4	Having a face-to-face meeting every week is important for me to succeed in MBA courses.	3.33

To answer the second research question, *What are the effects of cyber technology on Thai MBA students' academic performance in relation to students' personality orientation as measured by TFS?*, Excel descriptive statistical tool was used to determine the frequency for each pre-defined GPA categories. Table 3 summarizes the findings in relation to personality orientation.

**Table 3:** Thai MBA Students' Academic Performance in Relation to Personality Orientation

GPA	Personality Orientation		Total
	Introverted	Extroverted	
2.50-3.00	6	6	12
3.01-3.50	30	27	57
3.51 or higher	37	29	66
Don't know	22	30	52
Total	95	92	187

To answer the third research question, *What are the effects of cyber technology on Thai MBA students' academic performance in relation to students' academic learning styles as measured by TFS?*, Excel descriptive statistical tool was used to determine the frequency for each pre-defined GPA categories. Table 3 summarizes the findings in relation to preferred learning styles.

**Table 4:** Thai MBA Students' Academic Performance in Relation to Preferred Learning Styles

GPA	Preferred Learning Style		
	Auditory	Visual	Kinesthetic
2.50-3.00	4	7	1
3.01-3.50	13	29	15
3.51 or higher	25	26	15
Don't know	12	27	13
Total	54	89	44

To answer the last research question, *What are the effects of cyber technology on Thai MBA students' academic performance in relation to students' technical competency as measured by TFS?*, the data were analyzed. The descriptive statistics of technical competency in relation to pre-defined GPA categories are summarized in Table 5.

**Table 5:** Thai MBA Students' Academic Performance in Relation to Technical Competency

GPA	Technical Competency		
	Beginner	Intermediate	Advanced
2.50-3.00	2	10	0
3.01-3.50	6	45	6
3.51 or higher	5	46	15
Don't know	9	29	14
Total	22	130	35

## DISCUSSION

Without realizing factors that are important to the students and not integrating those factors into the class instruction, it is likely that the students will fail to succeed in any class. The findings of Thai MBA students' perceived relative strengths of technological factors summarized in Table 1 could provide valuable insights to academic stakeholders. Even though subjects' responses indicate relative strength indices toward the agreement on Question 1, 2, 3, 5, 6, 10, 11, 13, and 16, only Question 2 and 10 are the most important factors to the students' success. Question 2 rated the highest among cyber technology related questions. This makes sense because structured and user-friendly technological resources would minimize any problem using cyber technology. To support students' success, administrators, decision makers, and related personnel must ensure that the technological resources available for students to use are well structured and user-friendly. However, Question 10 still ranked

the highest of all questions. An explanation to this finding is that Thai students familiar with social learning (Pagram & Pagram, 2006). Close interaction with peers forms the relationship and permits the students to ask for help from their peers when experiencing any technological or non-technological problem. Group activities help promote the relationship among classmates. Therefore, it is crucial for faculty members to encourage group activities in MBA courses.

MBA programs are usually known for intensive class discussion and students' performance in business classes may be impacted by their personality orientation. One can imagine that a shy person would less likely to participate in any discussion. The findings summarized in Table 3 were surprises. With similar numbers of people, academic performances of both introverted and extroverted orientations look very much alike. This could imply that personal orientations may not have any impact on academic performance if the "Don't know" responses are not taken into account. Without considering "Don't know" responses, the reason to this finding could be the performance measure used in MBA classes in Thailand. Participation in discussion is definitely encouraged but may not be required while students with introverted personality can still gain the same knowledge as extrovert students from listening and taking notes. This argument may be attested by looking into grading policies of MBA classes that data collection was conducted. Unfortunately, the authors were not able to get the information.

Similar to a personality orientation, different learning styles should have an impact on students' performance. The findings summarized in Table 4 provide some interesting information regarding preferred learning styles. Not taken "Don't know" responses into account, 9.52% of subjects who preferred auditory (hearing lectures), 11.29% of those who responded visual (watching/reading lectures), and 3.23% of respondents who answered kinesthetic (doing hands-on assignments) performed poorly at a graduate level (GPA 3.00 or below on a scale of 4.00). While the rest of subjects in each preferred learning style have the minimum of 3.01 GPA, roughly one half of these subjects who responded visual and kinesthetic, and 65.79% of these subjects who responded auditory performed well (or have a GPA above 3.50). Almost 50% of the subjects preferred visual learning style and this group has the highest percentage of poor performance among the three groups. However, out of 187 subjects, auditory, visual, and kinesthetic styles represent 28.88%, 47.59%, and 23.53% respectively. This implies that if possible the instructor should design class instruction that promote all of these learning styles, with an emphasis on visual due to the highest percentage of the three style. Doing so would support students' learning and eventually improve their performance.

Since cyber technology has been used more and more in class instruction, it makes logical sense that somehow students' performance may be affected by their ability to use technology. Table 5 shows that 88.24% of participants identified themselves as intermediate and advanced users. Without taken "Don't know" responses into account, 15.3% of beginner and 9.90% of intermediate level participants demonstrate poor performance while none of the advanced level respondents has a GPA of 3.00 or below. For the subjects who have GPA of 3.01 or above, the percentages of who performed well at beginner, intermediate, and advanced levels are 38.46%, 45.54%, and 71.43%, respectively. These numbers suggest that students' performance may be different according to the level of technical competency. The implication is that additional computer trainings may help improve academic performance of those in beginner and intermediate levels. Therefore, advisors can suggest classes that promote students' technical competency level.

## **LIMITATION OF THE STUDY**

This descriptive study has several limitations. First, the study had a small sample. Collecting data from a non-probability sample may result in the possibility of sampling errors. Data were collected at public and private graduate schools in Bangkok, Thailand, only 226 MBA students participated in the study. The small sample size could be contributed due to the lack of incentives since no awards were offered.

Second, the collected data suggested more female students than male students and these female students are considered as 58.82% of the respondents when the surveys were administered. According to the United Nation database (retrieved on 10/28/2009), the statistics indicate that 1,235,685 female students enrolled in tertiary education (equivalent to postsecondary education in the United States) for the year of 2005 in Thailand. This number represents 52.38% of the tertiary education enrollment, and it indicates that the data from the current sample are somewhat in line with the general population. However, the analyzed data from this study should be used with cautions.

Third, this study relied on participants to self-report his or her preferred temperament-oriented (personality orientation of introversion and extroversion) and academic-oriented learning styles (auditory, visual, and kinesthetic). Self-reporting instrumentation can subject to personal biases and veracity of the respondents since survey data fall "mostly in the realm of the honesty and accuracy of the respondents' reporting" (Ulmer & Wilson, 2003, p. 535). Measurement error can result from self-

reporting instrument tools (Neuman, 2003; Berenson, Levine, & Krehbiel, 2006). These limitations hinder the researchers' ability to generalize the findings to a larger population.

## SIGNIFICANCE OF THE STUDY TO LEADERSHIP

Traditional higher education institutions are no longer protected by geographic service areas since advanced technology and e-teaching models allow virtual universities such as the University of Phoenix to recruit working adults without geographic constraints (Drucker, 2001; Folkers, 2005). E-learning can be a critical strategy for traditional higher education institutions to accommodate adult learners' needs (Murphy, Mahoney, Chen, Noemi, & Yang, 2005). The unique findings of this study provided academic stakeholders including students, faculties, administrators, and policy makers of Thailand with several benefits.

First, the findings of the proposed study can help educators understand the effects of using cyber technology, so that quality e-learning modules can be developed to address students' learning styles and enhance e-learning effectiveness. Next, the insight gained from the study can help administrators revise policies to support faculty with resources and trainings to enhance e-teaching in appropriate environments (i.e., different cultures). Furthermore, the insights gained from the study enable traditional brick-and-mortar universities to make the transition to becoming hybrid institutions and sustain long-term competitiveness.

## FUTURE RESEARCH

Several future studies are suggested to further explore technological factors in Thai higher education institutions. First, researchers may want to further explore why Thai MBA students responded to cyber technology differently. At the institutional level, a triangulation study can be conducted that begins with a quantitative survey study and follows up with a qualitative interview to explore each of the technological factors.

Several future studies are suggested to also explore how faculty members respond to cyber technology. At the institutional level, a triangulation study that compares Thai faculty and MBA students' perceptions can provide further insights for Thai higher education institutions. Since technological infrastructure and stakeholders' readiness can affect faculty members' abilities to teach online and students' abilities to learn, Thai higher education must address these factors before transitioning to hybrid institutions and offer online MBA education.

## CONCLUSION

While online education can offer traditional higher education institutions innovative methods to deliver education and an alternative educational strategy to recruit adult learners, the success of e-teaching and e-learning depends on the academic stakeholders' efforts. This study contributes to the literature by providing results of an empirical investigation of Thai MBA students' perceptions towards technological factors, the effects of these technological factors on their learning outcomes in relation to learning styles and personality orientation. The knowledge gained from the study provides faculty members with insights to further explore innovative use of advanced technology to better address students' learning styles and personality orientation. As more traditional brick-and-mortar higher education institutions transition to become hybrid institutions offering online courses, the knowledge of how to use cyber technology innovatively to enhance e-teaching and e-learning effectiveness is becoming more important. Fostering close collaboration and participation from researchers, policy makers, administrators, faculty, and students is critical to cultivate a successful e-learning environment and deliver quality online education in the current knowledge-based, global economy for knowledge acquisition (Chen, Gupta, & Hoshower, 2006; Folkers, 2005; Sandman, 2009; Zapalska & Brozik, 2007).

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## APPENDIX –TECHNOLOGICAL FACTORS SURVEY FOR THAI MBA STUDENTS

Description of MBA Survey Item		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
<b>1 = Strongly Disagree</b>						
<b>2 = Disagree</b>						
<b>3 = Neutral</b>						
<b>4 = Agree</b>						
<b>5 = Strongly Agree</b>						
1. Being provided with an orientation to technological resources is important for me to succeed in MBA courses.						
2. Having structured and user-friendly technological resources is important for me to succeed in MBA courses.						
3. The lack of technical ability on my part may hinder my ability to succeed in MBA courses.						
4. Having a face-to-face meeting every week is important for me to succeed in MBA courses.						
5. Being provided with extended faculty member support in the evenings and weekends is important for me to succeed in MBA courses.						
6. Having global access (24 hours a day) to course content and e-resources is important for me to succeed in MBA courses.						
7. Having an online component is important for me to succeed in the MBA courses.						
8. Having course work that engages me in professional growth is important to retain me in the MBA program.						
9. I am self-motivated to complete course load and succeed in MBA hybrid courses.						
10. Maintaining close interactions with peers is important for me to succeed in MBA courses.						
11. Not having interactive and multimedia-based learning modules will deter my ability to succeed in MBA courses.						
12. Guideline from faculty on how to learn can help me succeed in MBA courses.						
13. Having timely feedback and close interactions from faculty is important for me to succeed in MBA courses.						
14. Being provided with discussions board is important for me to participate in MBA courses.						
15. The inclusion of group project(s) for MBA courses is important for me to collaborate with diverse team member and develop global competency.						
16. If applicable, being provided with credits to journal and reflect transformative learning is important for me to succeed in MBA courses.						
17. The use of innovative multimedia-based learning modules in MBA courses addresses my preferred learning style.						
18. The use of innovative learning modules that cultivate critical thinking and problem solving skills is important to retain me in the MBA program.						

<b>Demographic Information - Please provide one best answer for each question below:</b>	
19. What is your age?	
20. What is your gender?	1 = Male 2 = Female
21. What is your preferred learning style?	1=Auditory (hearing lectures) 2=Visual (watching/reading lectures ) 3=Kinesthetic (doing hands-on assignments)
22. How do you feel about your MBA participation?	1=Very Involved 2=Somewhat Involved 3=Somewhat Reserved 4=Very Reserved
23. What is your personality orientation?	1=Introverted (shy) 2=Extroverted (outgoing)
24. What is your level of computer expertise?	1=Beginner 2=Intermediate 3=Advanced
25. What is undergraduate GPA?	1=Below 2.50 2=between 2.50 to 3.00 3=between 3.01 to 3.50 4=Above 3.50
26. What is your current GPA?	1= No grades Yet 2=Below 2.50 3=2.50-3.00 4=3.01-3.50 5=3.51 or higher 6=Do not know

# MODELING THE DIFFUSION PROCESS WITH INDIRECT NETWORK EXTERNALITIES

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## ABSTRACT

The failure of Betamax technology in the video cassette recorder (VCR) market and the success of Sony and Philips in the CD market reflect the importance of indirect network externalities effect (hereafter INE) in the diffusion process. To successfully launch a new hardware/software system, the interdependence between hardware and its corresponding software should not be ignored. However, limited studies have tried to incorporate INE factor into the analysis of a new product's diffusion process. In this paper, we study a firm's new product compatibility strategy for a hardware/software system. We claim that apart from the innovation effect and imitation effect as defined in the original Bass model, the diffusion process of a durable product also depends on the competition in the hardware market, the availability of corresponding software and compatibility among different hardware/software systems.

We investigate a duopoly situation where there are two firms competing in both hardware market and software market. The manager of each firm has to decide the compatibility degree of his own system to his competitor's. We find that a firm's optimal compatibility strategy depends on the competition effect and the INE effect. We close with a discussion of managerial implications, limitations and future studies.

**Keywords:** New Product Diffusion; Innovation; Network Externalities Effect; Indirect Network Externalities Effect; Game Theory

## 1. INTRODUCTION

The diffusion of new products across the society is of recurring interest to researchers in marketing and innovation (Bass 1969; Mahajan, Muller and Srivastava 1990; Oliver, Marwell and Teixeira 1985; Parker 1992; Rogers 1995). After the seminal paper of Bass (1969), researches have been done to incorporate various factors into the original Bass diffusion model, such as marketing mix strategies (Kalish 1985), competition (Lehmann and Esteban-Bravo 2006; Peterson and Mahajan 1978), different populations (Kalish et al. 1995; Putsis et al. 1007; Tellis et al. 2003) and technology upgrade (Norton and Bass 1987). The Bass model assumes that the diffusion of a durable product depends on two effects, the innovation effect and the imitation effect. Though Bass model proves to be quite robust in many empirical results, there are still some interesting characteristics that the Bass model fails to capture. The success of many durable products, especially in the high technology industry, depends not only on their own installed base (i.e. the number of consumers that have adopted this technology), but also on the installed base of their complementary products as well.

A classical anecdote is the competition between two video cassette recorder (VCR) technologies in early 1980s. There were two types of technology in VCR market at that time, Betamax versus VHS. Although researchers claimed that Betamax technology was on its own as good as its rival, VHS technology, it still tipped the market to VHS in late 1980s (Park 1997). VHS dominated the market since 1988 because of its successful implementation of its complementary software (video cassettes) in the retail market. Another example is the success of the CD player. Philips and Sony realized the importance of the complementary software market. They encouraged the adoption of the hardware, CD player, as well as the software, CD. In order to expand the installed base, they even licensed their technology to more than 30 firms. Recently, several studies in the video game industry also incorporate the impact of software availability to evaluate the performance of the hardware, game consoles (Shankar and Bayus 2003; Stremersch et al. 2007). The interdependence between the hardware and software makes the availability of software a crucial factor for the success of hardware.

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Our research is sparked by the theory of indirect network externalities effect (hereafter INE). INE effect occurs when the value of the focal product (in this case, the hardware system) increases through the availability of its complementary products (the software) (Katz and Shapiro 1985; Tirole 1998). This positive effect from the complementary products makes the focal product more attractive for potential adopters, thus increases the sales of the corresponding hardware. However, the importance of INE effect has not been fully addressed in the diffusion literature.

Decision on compatibility also plays a crucial role in the hardware diffusion process, because it affects the availability of software as well as the competition in the hardware market. We define two hardware systems are compatible if these two systems could use the same software (Farrell and Saloner 1992). If the manager of a new hardware product decides to make it compatible with its competitors, the new product will benefit from the enlarged software installed base. However, the competition in the hardware market may become fierce because of this decision. The manager needs to decide an optimal compatibility level to balance the tradeoff.

We try to fill those research gaps in this paper. Our main contributions of this paper are twofold. First, we propose a modified Bass model by incorporating INE effect, compatibility decision as well as firm competition. Second, we solve for the optimal compatibility decisions under different scenarios. We make managerial suggestions based on our analytical results.

The remainder of the paper is organized as follows. We review the related literature Section 2. We describe our proposed model in Section 3 and provide analytical results in Section 4. We conclude with contributions and limitations in Section 5.

## 2. LITERATURE REVIEW

### 2.1 Network Externalities Effect

Katz and Shapiro (1985, 1986, 1992, and 1994) have systematically defined two types of network externalities effects, direct network externalities effect (DNE) and indirect network externalities effect (INE). The value of some products depends not only on their own attributes, but also on the number of consumers who have adopted the products (DNE) and the availability of their complementary products (INE). A typical example of DNE would be telephone. The ownership of a telephone is valuable if and only if there are certain numbers of users who already join the telephone network. On the other hand, if there exists positive INE, the availability of software (such as video games) makes the hardware (in this case, the game console) more attractive, thus increases the hardware sales.

When several firms compete in the same industry, the managers may face the dilemma of whether to make their product compatible with the rival's. Incompatibility could be the case that a subscriber of one network cannot communicate with those of another network (under the case of DNE), or the components of one system cannot work with the components of another system (under the case of INE). If two technologies/products are incompatible, the market might end with *de facto* standardization, i.e. one of them will defeat the other and dominate the whole market. Katz and Shapiro (1985) believe industrial compatibility is socially beneficial, where both industry output and firms' profits will increase. Farrell and Saloner (1992) study the impact from converters which allow consumers to use different technologies and achieve *ex post* compatibility. They find that imperfect converters, which cannot induce perfect substitution among technologies, will only hurt social welfare.

The existence of network externalities has also been empirically tested and measured in several industries, such as ATM machines (Saloner and Shepard, 1995), spreadsheet market (Gandal, 1995; Brynjolfsson and Kemerer 1996), VCR (Park 2004), and video game industry etc (Shankar and Bayus 2003; Stremersch et al. 2007; Yang and Mai 2009).

There are a few papers incorporating network externalities effect into the new product development and adoption literature. Gupta, Jain and Sawhney (1998) apply indirect network externalities to forecast the sales of HDTV. They show the existence of a potential coordination failure in the HDTV market. If the suppliers of hardware and software are independent, neither firm would like to move first to invest in the new market. Song, Parry and Kawakami (2009) incorporate network effects into the Technology Acceptance Model (Venkatesh et al. 2003). They study Japanese consumers purchase intention towards digital music, and find DNE and INE both positively influence consumers' purchase intention.

### 2.2 Diffusion Model

The focal parameters in the original Bass model are innovation parameter and the imitation parameter (Bass, 1969). They are also referred to as external influence parameters and the internal influence parameters in some literatures respectively (Parker and Gatignon, 1994). The external influence (or innovation parameter) measures the adoption intention that potential adopters will buy the product independently from the influence of others. The external influence may reflect the aggregated impact from

the firm's marketing strategies, such as promotion, pricing, etc. The internal influence (or imitation parameter), on the contrary, measures the influence from those people who have already adopted the product. Since the internal influence captures the impact from existing adopters, it could include word of mouth effect, herding behavior, direct network externalities, etc. Overall, the internal influence parameter represents the impact from the existing installed base of product users on potential adopters.

The original Bass model does not address competition because the model utilizes the aggregated sales information from the whole industry (i.e. the whole product category). Incorporating competition into the diffusion model would offer meaningful strategic implication for the managers. Peterson and Mahajan (1978) are the first to try to model the diffusion process with competition. They further use their model to discuss four types of products: complementary products, contingent products, substitute products and independent products (Peterson and Mahajan, 1978). A contingent product in their definition reflects the interdependence between hardware and software. However, their model does not consider the indirect network externalities effect. Parker and Gatignon (1994) empirically tested different diffusion models based on Peterson and Mahajan (1978)'s model setting.

Developed from the literatures of network externalities and new product diffusion, our model will incorporate indirect network externalities effect, market competition and product compatibility into the diffusion process of hardware. We will also discuss the compatibility strategy for a firm under different scenarios.

### 3. THE MODEL

#### 3.1 The Bass Model

The Bass model studies the data at the industry level, and it is used to forecast the diffusion process of the first-time adopters of a new product. The Bass model doesn't consider 'intra-brand' competition. For example, if we use this model to forecast the diffusion process of desktop computers, we will use the sales data of the whole computer category instead of separating sales volume of PC from MAC.

Bass argues that there are two effects in the new product diffusion process: innovation effect and imitation effect. The Bass model can be represented as following:

$$\begin{aligned} \frac{dF(t)}{dt} &= (a + bF(t))(1 - F(t)) \\ \Rightarrow S(t) &= \frac{dX(t)}{dt} = (a + b \frac{X(t)}{M})(M - X(t)) \end{aligned} \quad (1)$$

Where

a: represents the innovation effect, which measures the tendency of a potential customer to adopt the product with only external communication influence (such as the promotion activities from the firm).

b: represents the imitation effect, which measures how much the potential consumer will be influenced by existing adopters, for example, word-of-mouth effect.

$F(t)$  is the accumulative proportion of adopters of the focal product at time  $t$ .

$M$  is the potential market size for the focal product.

$X(t)$  is the accumulative sales of the focal product at time  $t$ ,  $X(t)=M*F(t)$ .

The Bass model could be solved as:

$$F(t) = \frac{1 - e^{-ft}}{1 + e^{-ft}}, e = \ln \frac{b}{a}, f = a + b$$

#### 3.2 The Bass Model with Competing Formats

In their 1978 paper, Peterson and Mahajan were the first to construct a model to capture the competition among different formats within the same product category. For example, PC and MAC both belong to the same product category, desktop computers. However, they have different formats and compete with each other. Assume a consumer will purchase only one

desk top computer, either PC or MAC. When there are  $n$  different formats competing in the same market, the diffusion process of format  $i$  can be represented as following:

$$\frac{dX_i(t)}{dt} = [a_i + b_i \frac{X_i(t)}{M_i} + c_i (\frac{X(t) - X_i(t)}{M - M_i(t)})] (M_i - X_i(t)) \quad i = 1, 2, \dots, n \quad (2)$$

This model captures competition at the format level. Assume there are  $n$  brands in the market. For simplicity, assume each brand uses different format. Then:

$a_i$  represents the innovation parameter for brand  $i$ .

$b_i$  represents the imitation parameter for brand  $i$ .

$c_i$  measures the competitive influence of other brands on the diffusion process of brand  $i$ . Because different formats compete with each other,  $c_i$  is negative.

$X_i(t)$  is the cumulative sales of brand  $i$  at time  $t$ .

$X(t)$  is the cumulative sales of the whole product category at time  $t$

$M_i$  is the potential market size for brand  $i$ .

$M$  is the potential market size for the whole product category, which is the sum of all  $M_i$ .

This modified Bass model has incorporated the competition effect in the hardware market, but it doesn't consider the indirect network externalities effect.

### 3.3 Proposed Model with Indirect Network Externalities

Besides the competition factor, if a new hardware product is launched with its complementary software, we should also consider indirect network externalities and compatibility. If there exists a positive indirect network externalities effect, the increasing sales of software will add value to the corresponding hardware, thus help the diffusion process of the hardware. For the manager of the hardware product, it is important to decide whether to make his own hardware compatible with his rival's software. If his hardware is completely compatible with the competitor's software, he will benefit from the rival's software sales through indirect network externalities effect. However, this decision may increase the competition in the hardware market.

Our proposed model incorporates competition in the hardware market, indirect network externality as well as a firm's compatibility decision. We focus on the hardware/software system. We assume the firm manufactures both hardware and its corresponding software in an oligopoly market with a few competitors. We use this assumption to avoid the 'principal-agent problem' between hardware manufacturer and software producer, which is not our concern in this paper. In other words, firm  $i$  has the decision power on the hardware of format  $i$  as well as the software of format  $i$ . The firm also needs to decide the degree of compatibility of its own hardware to its competitors' software.

We define hardware  $i$  to be compatible with hardware  $j$  if software  $j$  can be run on hardware  $i$ . Assume there are  $n$  firms in the market and each produces both hardware and its corresponding software. Our proposed model is as follows:

$$\frac{dX_i(t)}{dt} = [a_i + b_i \frac{X_i(t)}{M_i} + c_i (\frac{X(t) - X_i(t)}{M - M_i(t)}) + e_i (\frac{Y_i(t)}{N_i(t)} + \sum_{j=1, j \neq i}^n \lambda_{ij} \frac{Y_j(t)}{N_j(t)})] (M_i - X_i(t)) \quad i = 1, 2, \dots, n \quad (3)$$

We denote  $X_i(t)$  as the cumulative hardware adopters of brand  $i$  at time  $t$ .  $X(t)$  is the cumulative sales of the whole product category (including all different formats) at time  $t$ .  $M_i$  is the potential market size for brand  $i$ 's hardware.  $M$  is the potential market size for all brands in the hardware industry, which can be represented as the sum of all  $M_i$ .

$Y_i(t)$  is the cumulative software adopters of brand  $i$  at time  $t$ .  $Y_j(t)$  is the cumulative sales of software of brand  $j$  at time  $t$ ,  $i \neq j$ .  $N_i$  is the potential market size for brand  $i$ 's software.  $N_j$  is the potential market size for brand  $j$ 's software, and  $i \neq j$ .

**Competition Effect:** We use  $c_i$  to represent the competition impact from other brands on brand  $i$  in hardware market.  $c_i$  should be less or equal to zero.

*Indirect Network Externalities Effect:* We denote  $e_i$  to capture the indirect network externalities effect, i.e. the diffusion process of hardware also depends on its corresponding software. The more people using the software, the more attractive the hardware is. We expect  $e_i \geq 0$ .

*Compatibility Variable:* Firm  $i$  produces hardware  $i$  and its corresponding software  $i$ . It is possible that the software of firm  $j$  can also be run on hardware  $i$ , i.e. they are compatible. We use  $\lambda_{ij}$  to represent the compatibility of software  $j$  on hardware  $i$ , which is in the range of  $[0, 1]$  by assumption. If software  $j$  is completely compatible with hardware  $i$ ,  $\lambda_{ij} = 1$ ; firm  $i$  benefits not only from its own software externalities, but also from those of software  $j$ . But if  $\lambda_{ij} = 0$ , i.e. software  $j$  is completely incompatible with hardware  $i$ , then the sales of software  $j$  contribute nothing to hardware  $i$ 's adoption. If  $0 < \lambda_{ij} < 1$ ; then hardware  $i$  benefits partially from software  $j$ . We assume  $\lambda_{ij}$  is the decision variable of firm  $i$ .

To make our model tractable, we reduce our model to a duopoly situation. Assume there are only two firms in the market. To simplify the notations, we define  $\lambda_{12} = \lambda_1$ , which is the compatibility decision of hardware 1 to be compatible with software 2; and  $\lambda_{21} = \lambda_2$ , which is the compatibility parameter for hardware 2 to be compatible with software 1.

Our model in equation 3 can be simplified as follows:

$$\frac{dX_1(t)}{dt} = [a_1 + b_1 \frac{X_1(t)}{M_1} + c_1 \frac{X_2(t)}{M_2} + e_1 (\frac{Y_1(t)}{N_1} + \lambda_1 \frac{Y_2(t)}{N_2})] (M_1 - X_1(t)) \quad (4)$$

$$\frac{dX_2(t)}{dt} = [a_2 + b_2 \frac{X_2(t)}{M_2} + c_2 \frac{X_1(t)}{M_1} + e_2 (\frac{Y_2(t)}{N_2} + \lambda_2 \frac{Y_1(t)}{N_1})] (M_2 - X_2(t)) \quad (5)$$

Assume software sales can be approximated as a function of hardware sales. We make one more assumption here that there exists a linear relationship between cumulative density function of hardware  $F(t)$  and that of software  $G(t)$ .

$$G_1(t) = \alpha [F_1(t) + \lambda_2 F_2(t)]; G_2(t) = \beta [F_2(t) + \lambda_1 F_1(t)] \quad (6)$$

In which:

$F_1(t)$ : the cumulative proportion of adopters of hardware 1 with respect to the potential market size of hardware 1 at time  $t$ ;

$$F_1(t) = \frac{X_1(t)}{M_1}$$

$F_2(t)$ : the cumulative proportion of adopters of hardware 2 with respect to the potential market size of hardware 2 at time  $t$ ,

$$F_2(t) = \frac{X_2(t)}{M_2}$$

$G_1(t)$ : the cumulative proportion of adopters of software 1 with respect to the potential market size of software 1 at time  $t$ ;

$$G_1(t) = \frac{Y_1(t)}{N_1}$$

$G_2(t)$ : the cumulative proportion of adopters of software 2 with respect to the potential market size of software 2 at time  $t$ ,

$$G_2(t) = \frac{Y_2(t)}{N_2}$$

We assume that the diffusion process of software is a function of total available compatible hardware. Since  $\lambda_2$  measures the compatibility degree of hardware 2 and software 1, the total available compatible hardware for software 1 is  $F_1(t) + \lambda_2 F_2(t)$ . Similarly, the diffusion of software 2 is a function of  $F_2(t) + \lambda_1 F_1(t)$ .

Equations 4 and 5 can be represented as:

$$\frac{dF_1(t)}{dt} = [a_1 + b_1 F_1(t) + c_1 F_2(t) + e_1 (G_1(t) + \lambda_1 G_2(t))] (1 - F_1(t)) \quad (4')$$

$$\frac{dF_2(t)}{dt} = [a_2 + b_2 F_2(t) + c_2 F_1(t) + e_2 (G_2(t) + \lambda_2 G_1(t))] (1 - F_2(t)) \quad (5')$$

If we assume a linear relationship between cumulative density function of hardware,  $F(t)$ , with that of software,  $G(t)$  as in equation 6, we can further simplify our model as following:

$$\frac{dX_1(t)}{dt} = [a_1 + \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) X_1(t) + \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) X_2(t)] (M_1 - X_1(t)) \quad (4'')$$

$$\frac{dX_2(t)}{dt} = [a_2 + \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) X_2(t) + \left(\frac{c_2 + \alpha \lambda_2 e_2 + \lambda_2 \beta e_2}{M_1}\right) X_1(t)] (M_2 - X_2(t)) \quad (5'')$$

## 4. ANALYTICAL RESULTS

Firm  $i$  is an integrated manufacture producing both hardware  $i$  and software  $i$ . We assume firm  $i$  is only interested in its hardware sales volume. Given equation (4) and (5), the diffusion curves also depend on the compatibility parameter  $\lambda_i$ . Our research interest is to find an appropriate  $\lambda_i$  for firm  $i$  to maximize its cumulative hardware sales volume.

We have a system of two diffusion processes. Since the cumulative sales volume cannot exceed its potential market size, we have  $M_1 > X_1(t)$  and  $M_2 > X_2(t)$ . For each given value of  $\lambda_i$ , hardware 1 and hardware 2 will achieve their maximal sales volume if:

$$\frac{dX_1(t)}{dt} = 0 \quad \Leftrightarrow a_1 + \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) X_1(t) + \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) X_2(t) = 0 \quad (7)$$

$$\frac{dX_2(t)}{dt} = 0 \quad \Leftrightarrow a_2 + \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) X_2(t) + \left(\frac{c_2 + \alpha \lambda_2 e_2 + \lambda_2 \beta e_2}{M_1}\right) X_1(t) = 0 \quad (8)$$

Our goal is to find the impact of compatibility decision variable on the maximal cumulative sales volume. In the Appendix, we use comparative static approach to illustrate compatibility strategy under various situations.

We set up our benchmark value first.

$$c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1 = 0 \Rightarrow \hat{\lambda}_1 = \frac{-c_1}{(\alpha + \beta) e_1} \quad (9)$$

$$c_2 + \alpha \lambda_2 e_2 + \lambda_2 \beta e_2 = 0 \Rightarrow \hat{\lambda}_2 = \frac{-c_2}{(\alpha + \beta) e_2} \quad (10)$$

The benefit of being compatible to rival's software comes from the indirect network externalities. However, the competition at hardware market will have a negative effect on firm's hardware sales volume. The value  $\hat{\lambda}_i$  measures the benchmark compatibility value, at which the hurt from competition is offset by the benefit.

We define  $\lambda_1^*$  and  $\lambda_2^*$  as the optimal compatibility value for each firm. Please refer to the Appendix for detailed proof.

**Proposition 1:** Under Case I:  $\lambda_1 > \hat{\lambda}_1; \lambda_2 > \hat{\lambda}_2$ , when both firms set their compatibility degrees too high, both firms will reduce the compatibility level till they reach the benchmark value, i.e.  $\lambda_1^* = \hat{\lambda}_1, \lambda_2^* = \hat{\lambda}_2$ .

Proposition 1 shows that a firm won't benefit from an unnecessarily high compatibility degree.

**Proposition 2:** Under Case II:  $\lambda_1 < \hat{\lambda}_1; \lambda_2 < \hat{\lambda}_2$ , when both firms set their compatibility degree too low, both firms will increase the compatibility till they reach the benchmark value, i.e.  $\lambda_1^* = \hat{\lambda}_1, \lambda_2^* = \hat{\lambda}_2$ .

Proposition 2 shows that low compatibility will lower the firm's overall sales volume, and it is beneficial for both firms to increase their compatibility degree.

**Proposition 3:** Under Case III:  $\lambda_1 > \hat{\lambda}_1; \lambda_2 < \hat{\lambda}_2$ , when firm 1 sets its compatibility degree higher than its benchmark value; but firm 2 sets its compatibility degree lower than its benchmark value, the equilibrium becomes  $\lambda_1^* = \hat{\lambda}_1, \lambda_2^* = 0$ .

Proposition 3 shows that when Firm 1 sets its compatibility level higher than its benchmark, and Firm 2 sets its compatibility lower than its benchmark, firm 1 should reduce the compatibility and meanwhile, it is better for firm 2 to be completely incompatible. The rationale for firm 2 is that the benefit of limited compatibility cannot compensate its cost, and it is better off to be incompatible.

**Proposition 4:** Under Case IV:  $\lambda_1 < \hat{\lambda}_1; \lambda_2 > \hat{\lambda}_2$ , when firm 1 sets its compatibility degree lower than its benchmark value; but firm 2 sets its compatibility degree higher than its benchmark value, the equilibrium becomes  $\lambda_1^* = 0, \lambda_2^* = \hat{\lambda}_2$ .

Similarly, we could use the same argument as in Proposition 3. Under this case, the equilibrium becomes  $\lambda_1^* = 0, \lambda_2^* = \hat{\lambda}_2$ .

## 5. CONTRIBUTIONS AND LIMITATIONS

### 5.1 Theoretical Contributions

We construct a modified Bass diffusion model to incorporate indirect network externalities, compatibility, and competition. We argue that for a hardware/software system, it is important for the managers to take indirect network externalities into consideration. The compatibility decision is also vital in hardware diffusion process. To make a firm's hardware product compatible with its rival's, the firm benefits from indirect network externalities. However, the firm may also face fierce competition in the hardware market because of this compatibility decision. We have analyzed four different scenarios and proposed the managers' compatibility decision under various situations.

### 5.2 Limitations and Future Research

We conclude by addressing the limitations of our current study, and discussing future research topics. There are still some limitations in our approach. First of all, we assume firms are only interested to maximize its hardware sales at each time  $t$ , thus we do not consider the cost of compatibility in our model. The result might differ if the firm tries to maximize its profit instead of overall sales. Compatibility may also incur additional cost. For example, in the video game industry, if a video game publisher wants to make its game compatible with one of the game consoles, it needs to enter a licensing agreement with the console manufacturer and pays a royalty fee per DVD. The new model could set firm's profit as the objective function with dynamic diffusion as the demand constraint. Second, we assume an integrated form for firm  $i$  in our analysis, i.e. firm  $i$  manufactures both hardware  $i$  as well as software  $i$ . It would be an interesting study if the software manufacturer works as an independent firm and makes its compatibility decision on different formats in the market. Thirdly, we don't consider dynamic situation in our analysis. We assume that a firm makes its compatibility decision  $\lambda_i$  at the beginning of the time period. In reality,  $\lambda_i$  could also be a decision variable at each time  $t$ . The firm can redesign the product during the diffusion process to change its compatibility to its rival's. We could model  $\lambda_i$  as  $\lambda_i(t)$ , which could vary to different degrees over the diffusion process. Furthermore, empirical studies will also be useful to compare the proposed model with the original Bass model.

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## APPENDIX:

Since  $M_1 > X_1(t)$  and  $M_2 > X_2(t)$ , and given equation (4'') and (5'')

$$\frac{dX_1(t)}{dt} = [a_1 + \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) X_1(t) + \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) X_2(t)](M_1 - X_1(t)) \quad (4'')$$

$$\frac{dX_2(t)}{dt} = [a_2 + \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) X_2(t) + \left(\frac{c_2 + \alpha \lambda_2 e_2 + \lambda_2 \beta e_2}{M_1}\right) X_1(t)](M_2 - X_2(t)) \quad (5'')$$

We have

$$\begin{aligned} \frac{dX_1(t)}{dt} &= 0 \\ \Rightarrow a_1 + \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) X_1(t) + \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) X_2(t) &= 0 \end{aligned} \quad (\text{A1})$$

$$\begin{aligned} \frac{dX_2(t)}{dt} &= 0 \\ \Rightarrow a_2 + \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) X_2(t) + \left(\frac{c_2 + \alpha \lambda_2 e_2 + \lambda_2 \beta e_2}{M_1}\right) X_1(t) &= 0 \end{aligned} \quad (\text{A2})$$

Completely differentiate (A1) and (A2) with respect to  $\lambda_1$ , firm 1's decision variable, we have:

$$\begin{aligned} \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) \frac{\partial X_1}{\partial \lambda_1} + \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) \frac{\partial X_2}{\partial \lambda_1} &= -\frac{\lambda_2 \beta e_1 X_1}{M_1} - \frac{(\alpha + \beta) e_1 X_2}{M_2} \\ \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) \frac{\partial X_2}{\partial \lambda_1} + \left(\frac{c_2 + \beta \lambda_2 e_2 + \alpha \lambda_2 e_2}{M_1}\right) \frac{\partial X_1}{\partial \lambda_1} &= -\frac{\lambda_2 \alpha e_2 X_2}{M_2} \\ \Rightarrow \begin{bmatrix} \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) & \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) \\ \left(\frac{c_2 + \beta \lambda_2 e_2 + \alpha \lambda_2 e_2}{M_1}\right) & \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) \end{bmatrix} \begin{bmatrix} \frac{\partial X_1}{\partial \lambda_1} \\ \frac{\partial X_2}{\partial \lambda_1} \end{bmatrix} &= \begin{bmatrix} -\frac{\lambda_2 \beta e_1 X_1}{M_1} - \frac{(\alpha + \beta) e_1 X_2}{M_2} \\ -\frac{\lambda_2 \alpha e_2 X_2}{M_2} \end{bmatrix} \end{aligned}$$

Define:

$$\begin{aligned} D &= \begin{vmatrix} \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) & \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) \\ \left(\frac{c_2 + \beta \lambda_2 e_2 + \alpha \lambda_2 e_2}{M_1}\right) & \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) \end{vmatrix} \\ &= \left(\frac{b_1 + \alpha e_1 + \lambda_1 \lambda_2 \beta e_1}{M_1}\right) * \left(\frac{b_2 + \beta e_2 + \lambda_1 \lambda_2 \alpha e_2}{M_2}\right) - \left(\frac{c_1 + \alpha \lambda_1 e_1 + \lambda_1 \beta e_1}{M_2}\right) * \left(\frac{c_2 + \beta \lambda_2 e_2 + \alpha \lambda_2 e_2}{M_1}\right) \end{aligned}$$

Similarly we could fully differentiate (A1) and (A2) with respect to  $\lambda_2$ .

It could be shown the numerator of  $\frac{\partial X_1}{\partial \lambda_1}$  equals to

$$= \lambda_1 \underbrace{\left[ -\frac{\lambda_2 \alpha e_2 * \lambda_2 \beta e_1 X_1}{M_2} \right]}_{<0} + \underbrace{\frac{\lambda_2 \alpha e_2 X_2 * \left( \frac{c_1}{M_2} \right)}{M_2}}_{<0} + \underbrace{\left[ -\left( \frac{\lambda_2 \beta e_1 X_1}{M_1} + \frac{(\alpha + \beta) e_1 X_2}{M_2} \right) \right]}_{<0} \frac{b_2 + \beta e_2}{M_2} < 0$$

Similarly, the numerator of  $\frac{\partial X_2}{\partial \lambda_2}$  is

$$= \lambda_2 \underbrace{\left[ -\frac{\lambda_1 \beta e_1 * \lambda_1 e_2 \alpha X_2}{M_1} \right]}_{<0} + \underbrace{\frac{\lambda_1 \beta e_1 X_1 * \left( \frac{c_2}{M_1} \right)}{M_1}}_{<0} + \underbrace{\left[ -\left( \frac{\lambda_1 \alpha e_2 X_2}{M_2} + \frac{(\alpha + \beta) e_2 X_1}{M_1} \right) \right]}_{<0} \frac{b_1 + \alpha e_1}{M_1} < 0$$

Thus the sign of  $\frac{\partial X_1}{\partial \lambda_1}$  and  $\frac{\partial X_2}{\partial \lambda_2}$  depends only on the denominator D.

Case I: When  $\lambda_1 > \hat{\lambda}_1; \lambda_2 > \hat{\lambda}_2$

We have  $(\beta \lambda_2 e_2 + \alpha \lambda_2 e_2)(\alpha \lambda_1 e_1 + \beta \lambda_1 e_1) > (\alpha e_1 + \lambda_1 \lambda_2 \beta e_1)(\beta e_2 + \lambda_1 \lambda_2 \alpha e_2) \Leftrightarrow (1 - \lambda_1 \lambda_2)^2 > 0 \Leftrightarrow D > 0$

Thus  $\frac{\partial X_1}{\partial \lambda_1} < 0$  and  $\frac{\partial X_2}{\partial \lambda_2} < 0$ , both firms will reduce the compatibility level till  $\lambda_1^* = \hat{\lambda}_1$  and  $\lambda_2^* = \hat{\lambda}_2$ .

Case II: When  $\lambda_1 < \hat{\lambda}_1; \lambda_2 < \hat{\lambda}_2$

We can show  $D < 0$  as long as the negative competition impact is large enough, thus we will have  $\frac{\partial X_1}{\partial \lambda_1} > 0$  and  $\frac{\partial X_2}{\partial \lambda_2} > 0$ .

Both firms have incentive to increase the compatibility level till  $\lambda_1^* = \hat{\lambda}_1$  and  $\lambda_2^* = \hat{\lambda}_2$ .

Case III:  $\lambda_1 > \hat{\lambda}_1; \lambda_2 < \hat{\lambda}_2$  and Case IV:  $\lambda_1 < \hat{\lambda}_1; \lambda_2 > \hat{\lambda}_2$

Under both Case III and Case IV, the asymmetric situation will lead to  $D > 0$ . Thus we have  $\frac{\partial X_1}{\partial \lambda_1} < 0$  and  $\frac{\partial X_2}{\partial \lambda_2} < 0$ . Thus for

Case III, firm 1 will reduce the level to  $\lambda_1^* = \hat{\lambda}_1$ , and firm 2 will reduce the level to  $\lambda_2^* = 0$ . Similarly, under Case IV, firm 1 will set  $\lambda_1^* = 0$  and firm 2 will have  $\lambda_2^* = \hat{\lambda}_2$ .

# INTERACTIVE MULTIMEDIA DVD: MENU BUILDING IN ADOBE ENCORE AND ADOBE AFTEREFFECTS

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## ABSTRACT

*The latest Adobe Creative Suites integrate the ability to create cutting edge, dynamic DVD presentations using Adobe Encore and Aftereffects. Adobe Encore has become an effective DVD authoring tool used in tandem with advanced video and sound editing programs such as Aftereffects and Premiere to create animated presentations for television or computer. This format can be used for student portfolios, museum presentations and exhibits, as well as classroom aids. The possibilities for the tools are limitless. This paper explores the technical aspects of creating menus and content in the DVD format as well as the different scenarios in which these programs can be used, highlighting how to effectively use the tool and how to technically accomplish final projects.*

**Keywords:** *Interactive, Multimedia, Education, Promotion, Design, DVD*

## INTRODUCTION

The realm of DVD as media has long been dominated by movie and television production. While that remains the primary use for the format, this form of communication can revolutionize how we work in the classroom, present projects, prepare portfolios and archive work. The DVD as classroom tool can allow educators to teach from anywhere without Internet connection, Microsoft PowerPoint software or compatibility issues. DVDs are a versatile tool that can be played on any computer or television with a DVD drive and allow for large amounts of information to be stored and presented professionally. The tools available in the Adobe Creative Suite are appropriate for every level of skill from beginner to advanced. Depending on the presentation, the tool can be interactive, animated or simply a presentation of materials similar to Microsoft PowerPoint. In this study I detail the skills and procedures needed to effectively use the main tools for DVD production as well as highlight possible applications for use.

## LEARNING THE SOFTWARE

The first step in planning your DVD project is to list all assets. Assets are videos, music, and pictures: everything to be included. The next step is to create a visual representation of your project on paper that will allow you to define your links and menu structure (Figure 1: Flowchart Template). All assets should be included by the time full flow chart is complete so that project expectations and linking structure are determined before the project begins. With the flowchart complete and assets gathered, the project can be started. As you create a DVD in Adobe Encore a duplicate flowchart will be created in the program and can be used as a way to check your work. See Figure 1 for a sample flowchart.

With the flowchart complete, the user can now move onto the final simple set up states of a DVD project. All DVD project files and assets should be bundled together in one folder. The DVD creates links between each asset and the project file. Creating a folder for the project with another folder inside it called "Assets" is a good way to start a project. The next step is to open Adobe Encore, start a new project and save it to the folder.

## ADOBE ENCORE

Adobe Encore comes bundled with an extensive and powerful library of menus and assets that help the new user understand how the program functions. All DVDs must start with a main menu. Access the program library in the main screen of Encore and double-click on any menu to add it to their project. After double-clicking the menu will show up in the main monitor screen as well as in the list of assets for the project. The main menu is the first thing the user sees when the disk is started. As a result it is important to right click on the main menu in the project panel and select "Set as first play", making this the first thing that plays when the disk is inserted in a DVD drive. This is a small but critical step.

Every menu consists of a background image (static or animated) and a series of buttons overlaid on top. These buttons will allow the user to dig deeper into your content: into sub-menus, timelines, slideshows, etc. New users can use and edit pre-made menus and buttons using the text tool in Encore. However, the real power of Encore comes with its integration with other programs. One such integration is with Adobe Photoshop. Users can make use of all the powerful design tools in Photoshop to create fully functional menus and buttons. Using a few simple layer-name prefixes, Adobe Encore will automatically recognize button sets, highlighting, and video thumbnails. Once imported into a project, the menu can be modified in Adobe Encore or edited in Photoshop without closing the project. The key here is to bring in the Photoshop menu “as a menu” during the import process.

## MAKING THE MENU IN PHOTOSHOP

To create a menu from scratch in Photoshop, begin by creating a new Photoshop document, making sure to select the preset image size, now designated as “Film and Video” in the latest version of Photoshop (but more commonly known as NTSC). This sets the document with the correct ratio for DVD menu building. It will also include guides for text safe zones.

In Photoshop, add all the elements that make up the background. Anything that will not be part of a button is considered background. The background can exist in Photoshop inside or outside a layer set. Backgrounds usually consist of still images, shapes, and title text.

The next step is to create the button elements in the menu. Buttons are the links between your menu and any other content. Begin by creating a layer set. All the power of the integration between these two programs starts here. Name the layer set using the code (+), for example name the layer: (+) Button 1. Adobe Encore uses this code to identify whatever is inside this set as a button. Everything to be included with the button will go inside this folder. Buttons consist of several elements, most commonly text and a highlight/rollover element that lets users know when a button is active and can be clicked. Begin by creating the text of the button. To create a simple button highlight or subpicture highlight simply create a shape or underline layer that signifies an active button and name that layer with the code (=1), for example name this layer: (=1) Highlight. This creates a one-color subpicture highlight. More advanced users can create highlights that can have three colors each on their own layer. One solid color per layer. Add one of the following codes to the name each highlight layer: (=1), (=2), and (=3).

In order to create a video thumbnail, create a new button layer set with the (+) prefix. Insert a layer into the new button layer set and add the prefix (%) to its name, for example name this layer: (%) Thumbnail. This prefix signals to Encore that this layer will be used for a video thumbnail. On this layer, draw a rectangle that will serve as a placeholder for the video. Encore sizes the video to fit the rectangle. Text and highlights can be added to these layers as well.

Create any number of buttons using this same process. Once saved and completed, import the menu into Encore. In Encore simply import the asset as a menu using File > Import as Menu. The new asset will recognize the Photoshop coding and function properly. Buttons can now be linked to other content as it is added. By clicking on a button in the main screen the menu palette will open up in encore and the linked item will be active. Buttons can now be linked using the link box in the menu palette to other DVD content. Video thumbnail layers will appear gray and highlight layers are not visible. Until you link the video thumbnail button to video content on a timeline layer the box remains gray (video content must be imported “as a timeline). To view the button highlights, click the “Show Selected Subpicture Highlight” button at the bottom of the Menu Editor window in the center of Encore. This button previews the highlight images.

To modify the menu, simply highlight it in the project panel and choose Menu > Edit in Photoshop or select the Photoshop icon at the top of Encore. This establishes a dynamic link between the programs, showing edits in real-time.

## ADOBE AFTEREFFECTS

Once the menu building and Photoshop integration aspect of Encore is mastered the more advanced user can add in aftereffects animation techniques. This requires a working knowledge of the software but those with experience in aftereffects can create dynamic animated menus and DVD content.

### The Process of Going from Aftereffects to Encore Successfully

- Animate and create all background and animating elements in Aftereffects. Pay attention to the time of the movie, as it will effect looping later when the menu is imported.
- Save original aftereffects file, render the AVI.

- Import into Encore and open up a Blank Menu from the library.
- Import the AVI as an asset.
- Select the menu and click the motion tab in the properties panel and link “Video” to the AVI background.
- With the menu selected hit the Photoshop button.
- In Photoshop build buttons as usual with the proper coding, this will build them on top of the animated background.
- Save the menu and return to Encore.
- Preview the menu. In the preview panel make sure to hit the render button to preview the animated portion. You should now see the motion background with buttons layered over it.
- In the menu properties panel users can choose to loop the background, not loop at all, or loop only a specific number of times.

Aftereffects can be used in DVD projects in several places: Animated menu backgrounds, animated button transitions as well as content timelines.

## AFTEREFFECTS AND BUTTONS

In order to create buttons that do not show up before my animated menu background the user will have to return to aftereffects for a few more final design elements.

- Animate and create all background and animating elements in Aftereffects.
- Create animated text layers for your buttons.
- Save original file, render the AVI.
- Go into Encore and open up a Blank Menu from the library.
- Import the AVI as an asset.
- Select the menu and click on the motion tab in the properties panel and link “Video” to the AVI background.
- With the menu selected hit the Photoshop button.
- In Photoshop build buttons as usual with the proper coding on top of what is there but be sure to not add a highlight layer.
- Save the menu and return to Encore.
- In the layers pallet in Encore hide the content of each Photoshop button layer effectively layering invisible working buttons over the ones that are animated in the background in aftereffects.
- Preview the menu. In the preview panel make sure to hit the render button to preview the animated portion. You should now see your motion background (including animated button text) with invisible buttons layered over it.
- In order to keep the buttons from continuously playing behind the menu the Encore loop point should be set slightly after the buttons finish. Take note of where in the timeline this occurs in aftereffects so the loop point can be set in the menu palette in Encore. The buttons should only animate once when the loop point is set right after they finish the animation.
- Users can choose to add the highlight layer into Photoshop when creating invisible buttons. Keep that visible but hide the text only in each button. The downside of this is that highlights may show up a few seconds before buttons.

## Using Aftereffects for button transitions

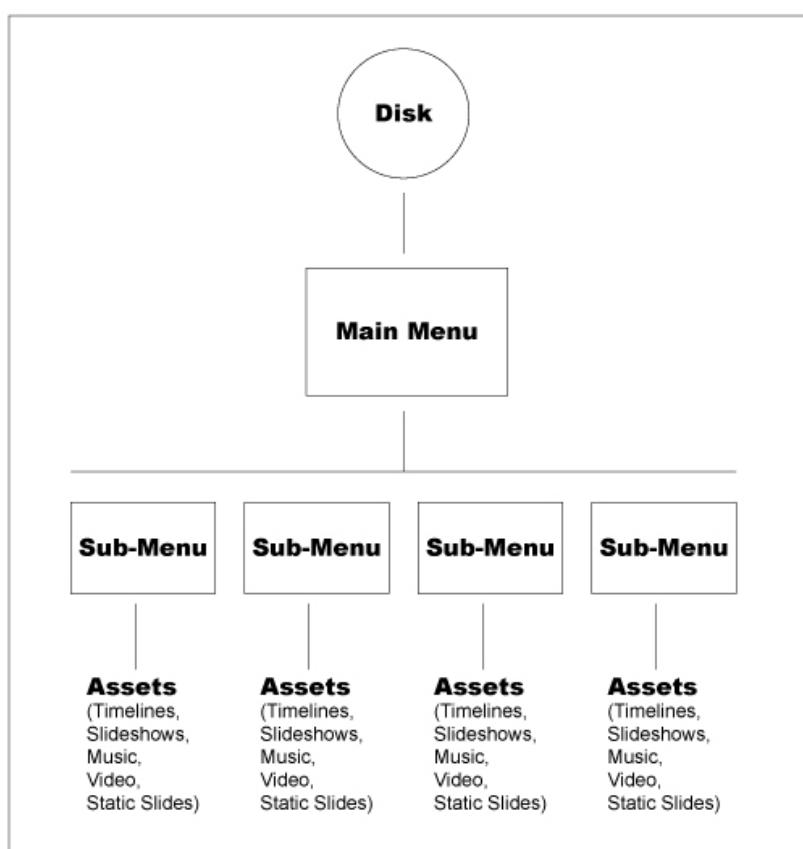
Aftereffects movies can be used as transitions between menus and content creating a more dynamic and interesting composition.

- Create a subtle and short transition animation in aftereffects. This should be something that dissolves in from black, shows a small message or animation and then dissolves back to black.
- Render the AVI.
- Import the movie into Encore as an asset.
- Select the menu and then select a button. In the properties panel there is a tab for transition. Click that tab to bring it forward.
- Link the transition movie you created to the button you've selected. You are not linking the button to this content. The button still goes to where it is linked. Linking the transition option to your animation simply tells this movie to play this animation before it proceeds to your content.

## CONCLUSIONS

Using the tools available and dependent on the level of skill, the Adobe Creative Suite is a strong and effective tool for any presentation. The format solves storage space, archiving and compatibility issues by allowing for easy to copy, present and create DVD presentations. Practical uses for this format are numerous: student and professional portfolios, museum presentations, professional presentations, archiving, as well as classroom aids. The only limitation to the tool is the technical knowledge needed to complete the presentation. By following the simple steps detailed in the menu building section of this paper beginners can easily create simple projects from start to finish. With more advanced aftereffects knowledge advanced users can create dynamic, exciting presentations, crossing platforms and eliminating compatibility issues.

**Figure 1:** Flowchart Template



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# NOVEL ASSAY FOR CITRULLINE MEASUREMENTS IN SERUM

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## ABSTRACT

*Citrulline is a basic, nonessential amino acid that serves as an active metabolic intermediate in the urea cycle, and as a principal L-arginine metabolite during nitric oxide synthesis. A novel assay has been developed for the colorimetric quantification of blood serum-citrulline concentrations on the basis of selective reagent-citrulline binding and standardized spectrophotometric measurement. Citrulline-blood serum concentration detection may indicate the progress or status of specific metabolic activities and physiological processes. A series of assays were conducted to indicate the effectiveness of prepared experimental reagents in correspondence with the devised and tested protocol. Initial blood serum-excluded assay data suggested proportional citrulline-reagent binding with incrementally increased standard citrulline concentrations. (normal range in serum 0.1 mM to 5.0 mM). The co-efficient of variation of this assay is below 5%. A subsequent blood-included pilot assay generated similar results, which demonstrated reagent-citrulline specificity and selective capacity. Randomized blood testing confirmed the potential for universal application. The specificity of assay was further confirmed by using bovine serum albumin to the assay further resulted in no interactions between the added BSA to the assay results.*

**Keywords:** Citrulline, Phosphoferric Antipyrin and Diacetylmonoxime

## ACKNOWLEDGEMENT

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## INTRODUCTION

The nonessential amino acid citrulline is a critical constituent of the urea cycle and nitric oxide synthesis. Urea cycle-based ammonia detoxification, as well as nitric oxide- maintained cardiovascular and endothelial homeostasis, relies on balanced citrulline concentrations for normal physiological function. It is the focus of this experiment to identify a means of determining citrulline blood serum concentrations to allow for citrulline detection and general analytic measurement. Previous work has been demonstrated an indirect method by using enzymatically, which is so cumbersome (Bagrel 1975). Based on those experiments, a simple and novel microassay has been developed. Quantitative assessment of blood serum citrulline concentrations on the basis of relative reagent binding has been experimentally demonstrated through a series of devised assays that indicate selective and proportional reagent-citrulline binding. Primarily, citrulline standards and an experimental master reagent composed of phosphoferric antipyrin and diacetylmonoxime were prepared and reacted to identify reagent-citrulline interaction and concentration indicated by colorimetric analysis. A successive blood serum-included pilot assay was performed to determine reagent-citrulline selectivity relative to blood proteins and potential nonobjective molecules. Ten random blood samples were collected and tested to identify both this assay's universal capacity, and typical blood-citrulline concentrations within a healthy human population. To further verify reagent specificity, the master reagent was reacted BSA, resulting in minimal reagent-BSA interaction and low associated absorbance values.

## Citrulline Biosynthesis

*Urea Cycle.* Ammonia, a dynamic nitrogenous compound, is produced during numerous metabolic processes, and acts as a major constituent of amino acid synthesis and degradation. Abnormal ammonia and excess nitrogen accumulation as a result of irregular metabolic activity may adversely affect normal physiological progression. To avoid such accumulation-based toxicity, ammonia is sequentially converted into a less toxic, water-soluble, and thus readily-excreted, waste product called

urea. Urea exists as the principal amino acid-derived nitrogenous disposal form for most terrestrial vertebrates. Urea is synthesized in the liver during the urea cycle, secreted into the bloodstream, and sequestered by the kidneys prior to urinary excretion. During the urea cycle, citrulline acts as a metabolic intermediate that is initially formed within hepatocyte mitochondria, followed by cellular cytosol-bound mitochondrial exportation, and further chemical conversion. The urea cycle initiates with ATP-inorganic phosphate (Pi)-donated bicarbonate ( $\text{HCO}_3^-$ ) phosphorylation to yield carbonyl phosphate and ADP. Nucleophilic ammonia attacks the carbonyl phosphate  $\alpha$ -carbon, thereby displacing the phosphate to produce carbamate and an inorganic phosphate (Pi). Subsequent ATP-induced carbamate phosphorylation yields carbamoyl phosphate and ADP. Carbamoyl phosphate contains the first of two nitrogen atoms that are required for urea biosynthesis. The carbamoyl phosphate-contained carbamoyl group is then enzymatically dissociated and transferred to ornithine to yield citrulline by the catalytic activity of ornithine transcarbamoylase (Bagrel 1975).. The second nitrogen atom required for urea production is contributed by the argininosuccinate synthetase-catalyzed condensation of citrulline's ureido functional group with an aspartate amino group. ATP-catalyzed ureido oxygen atom dissociation through citrullyl-AMP intermediate formation allows for aspartate amino group AMP displacement. A resultant covalent linkage between citrullyl and aspartate produces argininosuccinate, which is then converted to arginine by argininosuccinase-catalyzed fumarate elimination. Argininosuccinase reaction-generated fumarate can be reconverted to aspartate by fumarase and malate dehydrogenase reactions to yield oxaloacetate with subsequent aspartate formulation by transamination. Arginase-catalyzed hydrolytic cleavage of arginine yields one molecule of urea coupled with ornithine regeneration. Ornithine is then transported back into the mitochondrion, where the molecule systematically reacts with carbamoyl phosphate to again produce citrulline (Greenberg 1951).

## MATERIALS AND METHODS

### Chemical Reagents

Reagents R1 and R2 were prepared and mixed in a R1:R2 4:1 ratio. Reagent 1, phosphoferric antipyrin reagent, was formulated with the dry weight addition of 0.122 g of 65 mM antipyrin, and 0.202 g of 12.5 mM ferric chloride ( $\text{FeCl}_3$ ) to 6.25 mL of 100 mM phosphoric acid ( $\text{H}_3\text{PO}_4$ ), and 3.75 mL of distilled water ( $\text{dH}_2\text{O}$ ). Reagent 2 consisted solely of 1 mL of 2,3-butanedione monoxime, also known as diacetylmonoxime. The experimental master reagent was prepared with the combination and thorough mixing of 4 ml of reagent 1, phosphoferric-antipyrin, and 1 mL of reagent 2, 2, 3-butanedione monoxime.

### Citrulline Standard Preparation

Citrulline standards were prepared by 1.0 mM dilution to regular intervals of 0.01 mM, 0.05 mM, 0.1 mM, 0.2 mM, and 0.5 mM. 100  $\mu\text{l}$  of each citrulline standard was then transferred into a 96 well plate. For the primary assay, the 0.01 mM citrulline standards were placed vertically into wells 1A-4D, the 0.05 mM standards into wells 2A-4D, the 0.1 mM standards into wells 3A-4D, the 0.2 mM standards into wells 4A-4D, and the 0.5 mM standards into wells 5A-5D.

### Method I: Primary Assay

In a primary 96-well plate, 100  $\mu\text{l}$  of the each prepared citrulline standard was formatted in the mentioned arrangement, followed by the introduction of 100  $\mu\text{l}$  of 10% T.C.A into each well. 50  $\mu\text{l}$  of the citrulline-T.C.A. mixture was removed from each well, placed into complementary wells of a secondary 96 well-plate, and the first 96-well plate was disregarded. 250  $\mu\text{l}$  of the master reagent was then added to each 50  $\mu\text{l}$  citrulline-T.C.A. mixture-containing well, bringing the final well-contained volume to 300  $\mu\text{l}$ . The 96-well plate was then tightly sealed with parafilm, and was carefully placed on the water surface of a pre-heated 100°C water bath for 20 minute using an indigenously made floating device. The plate was then cooled in the dark for 10 minutes with subsequent spectrophotometric readings at 450 nm with a reference wavelength of 492 nm.

### Method II: Pilot Assay

In this assay, four wells of the 96-well plate were utilized such that controls, which contained 100  $\mu\text{l}$  of blood serum, 100  $\mu\text{l}$  of 10% T.C.A, and 50  $\mu\text{l}$  of  $\text{dH}_2\text{O}$ , were placed in wells 1A and 1B. Citrulline-spiked blood serum spikes of known concentrated consistency, which contained 100  $\mu\text{l}$  of blood serum, 100  $\mu\text{l}$  of 10% T.C.A., and 50  $\mu\text{l}$  of 0.05 mM citrulline, were placed in wells 3A and 3B.

First, four 1.5 mL microfuge tubes were obtained. 100  $\mu\text{l}$  of O- blood was combined with 100  $\mu\text{l}$  of 10% T.C.A in each of the four microfuge tubes, finalizing the volume of each microfuge tube to 200  $\mu\text{l}$ . Two of the four microfuge tubes were then designated as controls, and the remaining microfuge tubes as spikes. 50  $\mu\text{l}$  of  $\text{dH}_2\text{O}$  was added to the two assigned controls, and 50  $\mu\text{l}$  of 0.05 mM citrulline was added to the two assigned spikes. The four microfuge tubes were centrifuged at 5000 rpm

for 10 minutes to allow for blood serum isolation. 50  $\mu$ l of blood serum-T.C.A-containing supernatant was then transferred from each tube into a pre-prepared 96-well plate in wells. The supernatant of the two controls were transferred 1A and 1B, while the supernatant of the two spikes were transferred to wells 3A and 3B. The blood precipitate was disregarded. 250  $\mu$ l of the master reagent was then placed into each of the four 50  $\mu$ l blood serum-T.C.A mixture-containing wells, bringing the final well-contained volume to 300  $\mu$ l. The 96-well plate was then tightly sealed within parafilm, and was carefully placed on the water surface of a pre-heated 100°C water bath for 20 minutes. The plate was then cooled in the dark for 10 minutes with subsequent spectrophotometric readings at 450 nm with a reference wavelength of 492 nm.

### **Method III: Normal Blood Analysis**

*Randomized Testing.* Ten random blood samples were obtained. Approximately 100  $\mu$ l whole blood was primarily extracted from each of the ten blood donors. Subsequent whole blood microfugation yielded approximately 50  $\mu$ l of objective blood plasma per 100  $\mu$ l blood sample, and was then frozen at 4°C. A single 96-well plate was obtained, and a blank consisting of 75  $\mu$ l of diH<sub>2</sub>O and 50  $\mu$ l of 10% T.C.A was prepared and transferred to well 1A. Five citrulline standards of concentrations 0.01 mM, 0.05 mM, 0.1 mM, 0.2 mM, and 0.5 mM were prepared and transferred in a horizontal arrangement into wells 1A-5A respectively. Each standard consisted of 50  $\mu$ l of differently concentrated citrulline, 25  $\mu$ l of diH<sub>2</sub>O, and 50  $\mu$ l of 10% T.C.A. 100  $\mu$ l of each concentrated standard solution was added into the 96-well plate wells. The plate was arranged so that citrulline standard concentrations increase in a single horizontal row, and allows for the production of a standard curve to which to compare blood serum-citrulline concentrations. Next, ten microfuge tubes were obtained for each of the ten blood samples. The blood samples were prepared with the addition of 50  $\mu$ l of blood plasma, 25  $\mu$ l of diH<sub>2</sub>O, and 50  $\mu$ l of 10% T.C.A to each of the ten microfuge tubes. A single blood-citrulline spike was formulated with the addition of 50  $\mu$ l of blood plasma, 25  $\mu$ l of 0.05 mM citrulline substrate, and 50  $\mu$ l of 10% T.C.A. These samples were centrifuged at 5000 rpm for 10 minutes. 50  $\mu$ l of supernatant was transferred from each microfuge tube, and added in assigned, horizontally-oriented, blood testing wells 1C-10C, with spike placement in well 1E. 250  $\mu$ l of master reagent was added to each well, the 96-well plate was covered with parafilm, and was carefully placed on the water surface of a pre-heated 100°C water bath for 20 minutes. The plate was then cooled in the dark for 10 minutes with subsequent spectrophotometric readings at 450 nm with a reference wavelength of 492 nm.

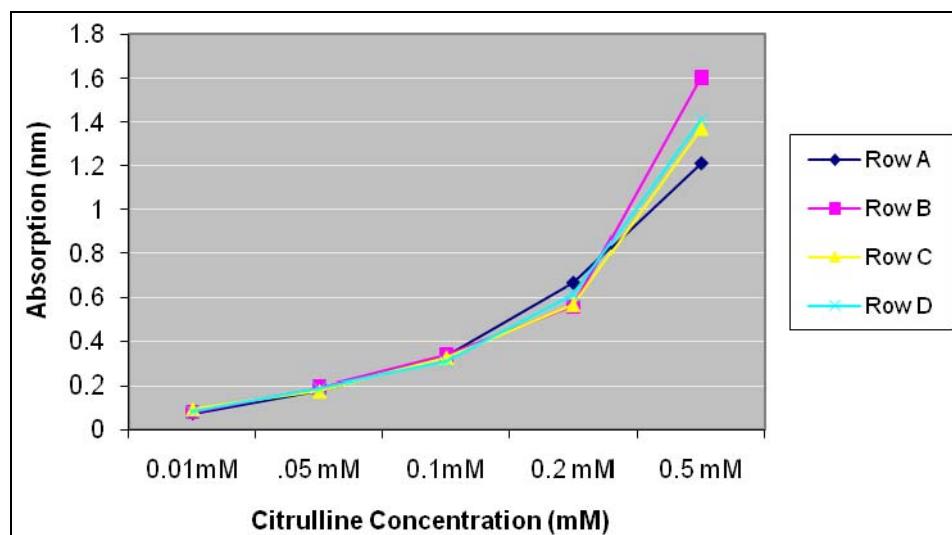
### **Method IV: Citrulline Assay Validation**

Four 50  $\mu$ l B.S.A. standards were prepared within 4 microfuge tubes at concentration of 0 mg/mL, 1 mg/mL, 10 mg/mL, and 100 mg/mL. 50  $\mu$ l of T.C.A. was added to each microfuge tube, and the contents of each were transferred and placed in a horizontal arrangement in a 96-well plate. B.S.A 0 mg/mL standard was placed into well 1A, 1 mg/mL into well 2A, 10 mg/mL into well 3A, and, 100 mg/mL into well 4A. 250  $\mu$ l of master reagent was added to each well, the 96-well plate was covered with parafilm, and was carefully placed on the water surface of a pre-heated 100°C water bath for 20 minutes. The plate was then cooled in the dark for 10 minutes with subsequent spectrophotometric readings at 450 nm with a reference wavelength of 492 nm.

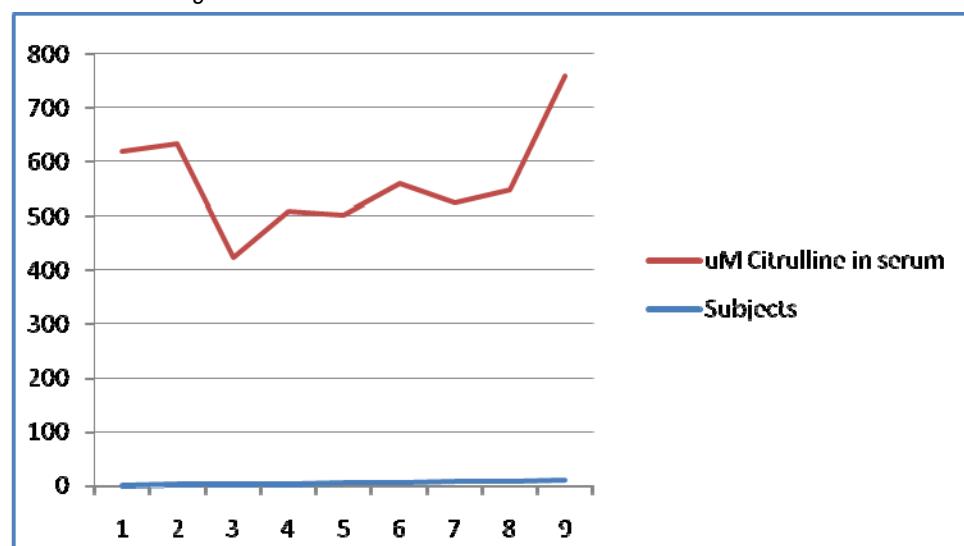
## **RESULTS**

In the primary blood-excluded assay, Figure 1 data indicates a positive and increasing spectrophotometric absorbance ratio in correlation with incrementally increased citrulline concentrations. Standard absorbance (O.D units) averaged 0.125 at 0.01 mM, 0.18 at 0.5 mM, 0.25 at 0.1 mM, 0.35 at 0.2 mM, and 0.75 at 0.5 mM. This suggests an approximate 0.07 absorbance increase per 0.05 mM. The blood serum-included pilot assay revealed evidence of selective binding interaction between the master reagent and objective citrulline, as absorbance values remained within the experimentally-determined range. Absorbance values for the random blood serum-included assay blood-citrulline concentration averaged 1.56 O.D units with low to high absorbance ranging from 1.18 O.D units to 2.1 O.D units. The concentration of normal healthy human subjects citrulline is 0.5 mM. Finally, reagent selectivity was further established on the basis of low and insignificant BSA assay-included absorbance values, which indicated a low tendency of reagent-nonobjective protein interaction.

**Figure 1:** Assay of standard citrulline with different concentrations.  
Rows indicate the trial numbers.



**Figure 2:** Human serum citrulline concentrations. There are 9 subjects have donated their blood for this assay, Average 0.558 mM SE 9.5.



## DISCUSSION

An apparent trend of amplified absorbance relative to increased citrulline concentration suggests citrulline-reagent complex formations in ratios proportional to concentration. Furthermore, the detection of extremely low citrulline concentrations (value in 10 uM from Figure 1) indicates exceptional assay sensitivity, and may allow for citrulline detection and quantification at very low concentrations. The blood-included pilot assay data initially implied selective reagent-citrulline binding, as parallel absorbance values remained within a range comparable to known primary assay-derived standard values. Randomized blood serum testing further established assay reagent selectivity, as absorbance values ranged within ideal absorbance and concentration ratios. Standard curve comparison verified values within the experimentally-devised citrulline concentration ranges, thereby implying a standard blood-citrulline concentration range of approximately 0.01 mM to 0.5 mM. Substantially decreased or elevated citrulline blood-concentration values when compared to population-confirmed typical blood-citrulline concentration range of approximately 0.01 mM to 0.5 mM may suggest irregular physiological activity if deviation is detected.

Advantages of this novel citrulline assay.

1. Low quantity of Blood or fluid required. <50ul, No need to insert or draw blood or vein puncture. We can use of a drop of blood from the lancet.
2. Highly specific for Citrulline.

3. Measuring citrulline directly with a specific assay reagent.
4. The interference of blood albumin is negligible.
5. Measurements for high throughput analysis is possible.
6. The time taken for one assay is so minimum it takes 30-35 minutes.

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# ENERGY CONSIDERATIONS FOR LIFTING ICE-MELT FROM THE EARTH'S GRAVITATIONAL WELL

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## ABSTRACT

Climatologists have calculated that a complete melting of the Greenland ice sheet would cause global sea levels to rise by at least 7 meters (22 feet). The majority of this melting is expected to occur over the next 1500 years. This article investigates the possibility of physically removing this excess water from the surface of the Earth by lifting the water into space, beyond the Earth's gravitational reach. The minimum amount of work required for this task is calculated. Surprisingly, the result is equal to the total amount of solar energy intercepted by the Earth itself in 28 years. Spreading the effort over the full 1500 year period would make this task achievable.

## RATIONALE

A complete melting of the Greenland ice sheet would cause global sea levels to rise 7.2 meters (23.6 feet). This melting is expected to occur over the next 1500 years. (refs). As some 30% of the world's current human population lives within 50 km (30 miles) of the coast (ref), the rising sea is likely to displace many millions of people all over the world (ref). This estimate could weigh on the conservative side.

Seventy percent of the Earth's surface is covered by the oceans (ref). The volume of water represented by the 7.2 meter depth is immense: some 2.5 million cubic kilometers (609,000 cubic miles). Even if the salt in the excess sea water could be extracted in an economical way, the continents lack the storage capacity to accommodate such a titanic volume. This is enough to cover all the land masses on Earth to a depth of 16 meters (54 feet). By comparison, the storage capacity of North America's Ogallala Aquifer, one of the largest underground reservoirs of fresh water in the world, is estimated to be (as of 2005) 3608 cubic kilometers (ref), just 0.144% of the volume considered here.

This article investigates the possibility of physically removing this excess water from the surface of the Earth, by calculating how much work would be required to lift this mass beyond Earth's gravitational influence. This value is then compared to the total amount of solar energy that is intercepted by the Earth in one year. The stunning result is that the amount of time required to collect the energy needed to lift the ice-melt is comparable to the amount of time over which the melting itself is expected to occur.

## ENERGY CALCULATIONS

The gravitational potential energy between the (nearly spherical) Earth and a test mass located at the Earth's surface is given by

$$U = -GM_E M_t / R_E \quad (\text{Eq. 1}) \quad (\text{ref}),$$

where  $M_E$  is the mass of Earth ( $5.98 \times 10^{24}$  kg),  $M_t$  is the mass of a test weight,  $R_E$  is the average radius of the Earth ( $6.38 \times 10^6$  meters), and  $G$  is the Universal Constant of Gravitation ( $6.6732 \times 10^{-11}$  Nm $^2$  / kg $^2$ ). Evaluating this expression for a test mass of 1 metric-ton yields a value of  $62.5 \times 10^9$  Joules (J). This means that some 62.5 billion Joules of work would need to be performed in order to separate the 1-ton of mass from the Earth by an infinite extent, that is, completely beyond the gravitational influence of the Earth. The total mass of the ice-melt can be found by multiplying the volume of ice melt ( $2.50 \times 10^{15}$  m $^3$ ) by the density of water (1 ton / m $^3$ ), or  $2.50 \times 10^{15}$  tons. (If the water contains dissolved salt, this result must be multiplied by a factor of 1.03.) The total amount of energy required to lift the (pure water) ice-melt is then  $62.5 \times 10^9$  J / ton  $\times$   $2.50 \times 10^{15}$  tons, or  $1.56 \times 10^{26}$  J. This amount of energy is some 420,000 times greater than the total amount of energy currently produced by all of human civilization from all sources in one year (ref).

The only source of energy available to human beings that could possibly begin to supply an amount of this magnitude is the solar energy intercepted by the Earth itself. Every square meter, positioned outside the Earth's atmosphere and at normal incidence to the Sun, intercepts some 1366 J/sec (Watts) of power (ref). When taken over the entire projected area of the Earth ( $\pi R_E^2$ ), some 128 million square km, the total intercepted power is  $175 \times 10^{15}$  Watts. Multiplying by the number of seconds in one year (31.56 million) yields the total amount of solar energy intercepted by the Earth in one year, some  $5.52 \times 10^{24}$ J.

This result is just 3.54% of the work required to lift all the ice-melt. Therefore, the entire mass of water could be lifted in some 28.2 years, if *all* the intercepted solar energy were to be applied to this task (and the mechanical process is perfectly efficient). This result is remarkable. It implies that if human civilization could begin to capture and direct the energy available at the Earth on a planetary scale, this task is theoretically possible.

## PRACTICAL CONSIDERATIONS

Attempting a massive engineering project to capture a large portion of the solar energy incident upon the surface of the Earth would dramatically interfere with the Earth's energy budget. For this reason, the collector would need to be placed in space. If the lifting process were performed over the full 1500-year interval, itself some 50 times longer than the 28 year result, then at any given time only 1/50 of the Earth's total intercepted solar power would be needed, assuming a 100% operating efficiency. As a practical matter, we must consider the effect of system efficiency on the process. If the conversion efficiency of the collector were at least 50%, and the mechanical efficiency of the lifting mechanism were at least 80% (yielding a total system efficiency of 40%), then some 6.4 million square kilometers of solar collector area would be needed.

## IMPLEMENTATION

Almost certainly, a practical implementation of this idea would require the use of a global arrangement of space elevators (ref). The necessary elevator design would likely need to be that of a continuous loop, which revolves over a wheel located at the far end (ref). This loop could support thousands of water-filled containers, which would open and release their contents at the far end. The machines would need to operate continuously for the duration of the melting.

## CONCLUSION

From the Sun, the Earth intercepts a fantastic quantity of energy – all that is needed to lift from the Earth's gravitational well the excess water expected from the melting of the Greenland ice sheet, and do so within a time frame that is comparable to that of the melting itself. Thus, human civilization has a means to avoid the global flooding that will result from the massive rise in sea level caused by the melting. Implementation of this concept will require the construction of space-elevator lifts, and the collection and management of solar energy on a planetary scale. Perhaps this is an achievable goal in the centuries to come.

# PHOSPHORYLATIONS OF NFkB SERINES AND BREAST CANCER CELL GROWTH INHIBITION BY *INDIGOFERA TINCTORIA*

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## ABSTRACT

Ethanopharmacological relevance: *Indigofera tinctoria L.* (Leguminosae), has been a part of the traditional Indian and Chinese folk medical system for various illnesses.

Aim of the study: To investigate the cell growth inhibition, total and differential NFkB serine residue phosphorylations on estrogen insensitive MDA-MB 231 breast cancer cells by ethanolic extract of *Indigofera tinctoria* leaf and camptothecin.

Materials and Methods: Cell growth assay was carried out using WST-1 method, after 24 hr incubation with various concentrations of the plant extract and camptothecin as a standard chemotherapy drug along with DMSO control. NFkB phosphorylations were assayed using NFkB Elisa kit. The specific serine residue phosphorylation was studied using respective anti-phospho serine antibodies.

Results: WST-1 cell growth assay showed that plant extract at all tested concentrations showed a significant decrease in MDA-MB 231 cell growth that is comparable to camptothecin (26% growth inhibition). NFkB Elisa assay of camptothecin and plant extract treated hormone insensitive cells exhibited 70% increase in the phosphorylations of both ser 536 and ser 468 residues than DMSO treated cells and inhibiting the cell growth.

Conclusion: These results may suggest that MDA-MB231 cell growth is inhibited by camptothecin and *I. tinctoria* leaf extract due to phosphorylations of serine residues of NFkB.

**Keywords:** *Indigofera Tinctoria, Nuclear Factor Kappa B (NFkB), MDA-MB 231 cells*

## ACKNOWLEDGEMENT

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## 1.0 INTRODUCTION

A study from our laboratory has shown that the biopsies of breast cancer tissue express higher concentrations of MAPK activities by immunohistochemistry (Ramasamy et al 2005). Therefore much emphasis has been placed on molecular signaling pathways that regulate MAPK expression as a way to explore the therapeutical activities of dietary phytochemicals derived from fruits and vegetables. One of the genes activated by NFkB is MAPK promoter (Orlowski 2002 and Small 2005). Nuclear factor kappa B (NFkB) is a dimeric transcription factor from 'Rel' protein family (Verma. et al 1995) NFkB subunits are in cytosol of cells as an inactive form associated with I kB inhibitory proteins not allowing them into nucleus by masking their nuclear localization sequence during unstimulated conditions. The basal levels of NFkB phosphorylations are necessary to activate certain genes that are involved in regulating cell proliferation (Monks and Parde 2006). However, the overall number of phosphorylation sites, the signaling pathways and protein kinases that target p65 NFkB and the functional role of these phosphorylations are still being uncovered. Serine residues, ser468 and ser536 are involved in transactivation.

These serine residues are phosphorylated by specific protein kinases. Ser536-phosphorylated p65 is found predominantly in the cytosol. In contrast, the Ser468 phosphorylated form of this transcription factor occurs mainly in the nucleus, suggesting a function for transactivation. The present attempt showed a need of phosphorylations of both of these serine residues to exhibit chemotherapeutic activities.

*Indigofera tinctoria L.* (Leguminosae), has been a part of the traditional Indian and Chinese system since time immemorial (Chopra et al., 1956; Liang and Jin, 1977). It has been used in the treatment of several nervous and hepatic disorders, cancer

and inflammatory diseases. The plant contained high level of blue dye indigotin (indigo) (Chen and Xie, 1984; Zhang, 1983), but the anti-inflammatory (Kunikata et al., 2000) and antileukemic activities are attributed to the red color isomer of indigo, 3,2'-bisindole indirubin (Li, 1987; Wu et al., 1980; Zheng et al., 1979a; Zheng et al., 1979b; Zhang, 1983). Indirubin is an inhibitor of cyclin dependent kinases, glycogen synthase kinase (Hoessol et al., 1999; Damiens et al., 2001; Leclerc et al., 2001) and c-Jun NH<sub>2</sub>-terminal kinases (Xie et al., 2004). It inhibits DNA synthesis in several cell lines (Zhang ZN et al., 1985) in a cell free assay and in vivo in rats with Walker-256 sarcoma (Chang and But, 1996; Du and Ceng, 1981).

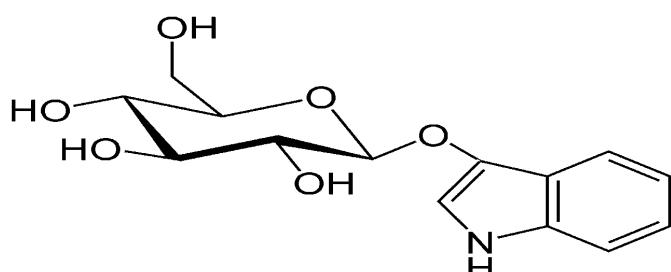
## 1.1 Hypothesis

Phosphorylations of serine residues of constitutive NF<sub>κ</sub>B are directly involved in modulating cell survival/growth. Ethanolic extract of *Indigofera tinctoria* leaves / camptothecin or both together activate the serine residues of constitutive NF<sub>κ</sub>B phosphorylations and modulate the cancer cell growth.

The objective of the present study is to investigate the effect of ethanolic extract of *Indigofera tinctoria* leaves with standard chemotherapeutic agent camptothecin on NF<sub>κ</sub>B p65 phosphorylation and correlate with the inhibition of *in vitro* human breast cancer cell growth studied by WST-1 assay.

## 2.0 MATERIALS AND METHODS

Chemicals were purchased from Sigma, (St Louis, MO). Fresh leaves of *Indigofera tinctoria* were collected during the month of June, 2006 from arid regions around Karur, Tamil Nadu, India. Coarse powder from the shadow dried leaves of *I. tinctoria* (500g) was extracted to exhaustion with ethanol using a soxhlet apparatus. The extract thus obtained was dried using a rotary evaporator under reduced pressure at 40°C and the approximate yield was 10% w/w. In our study, the ethanolic extract of *Indigofera tinctoria* had showed the same finger print of glucoside indican in Mass spectra. 1 mg of ethanol extract contained 250 micrograms of glucoside indican, which was found to exhibit anti-cancer properties. The chemical structure of the compound glucoside indican is given in Figure 1. Stock solutions of the extract was prepared in DMSO and stored in -20° C. This was added to the concentrations indicated, with a final vehicle concentration of ≤0.5% (v/v).



**Figure 1:** Chemical structure of Indican Glucoside.

### 2.1 Cell lines and Cell culture

Breast cancer cell line MDA-MB 231 was purchased from ATCC and was routinely cultured in RPMI 1640 medium (Gibco) supplemented with 5% fetal bovine serum, penicillin G sodium at 100 units/ml, and streptomycin sulfate at 100 µg/ml (Life technologies, Inc., Grand Island, NY)

### 2.2 WST-1 Proliferation Assay

The proliferative activity of MDA-MB 231 cells was assessed using a WST-1 assay according to the manufacturer's instructions (Roche, Indianapolis USA). The WST-1 assay is a formazan-based colorimetric assay, which has been frequently used for the determination of *in vitro* cell proliferative activity. A total of 10<sup>5</sup> cells per well were used in a 96-well plate. After 24-hour preincubation with the standard RPMI medium, the medium was exchanged for that containing appropriate concentrations of the plant extract and camptothecin, and incubation continued for a further 24 hours. The WST1 reagent (10µl/100µl medium) was added and incubated for 2 hours before reading the plate. Each assay was conducted in 3-6 sets. The optical densities were monitored using 'Anthos' multi plate reader at 405nm with the reference of 492nm wavelength. The percentage of the cell death was calculated from the difference in the OD of solvent control treated wells and drug treated wells. The average of 8 wells reading was computed along with standard error mean.

### 2.3 NFkB Assays

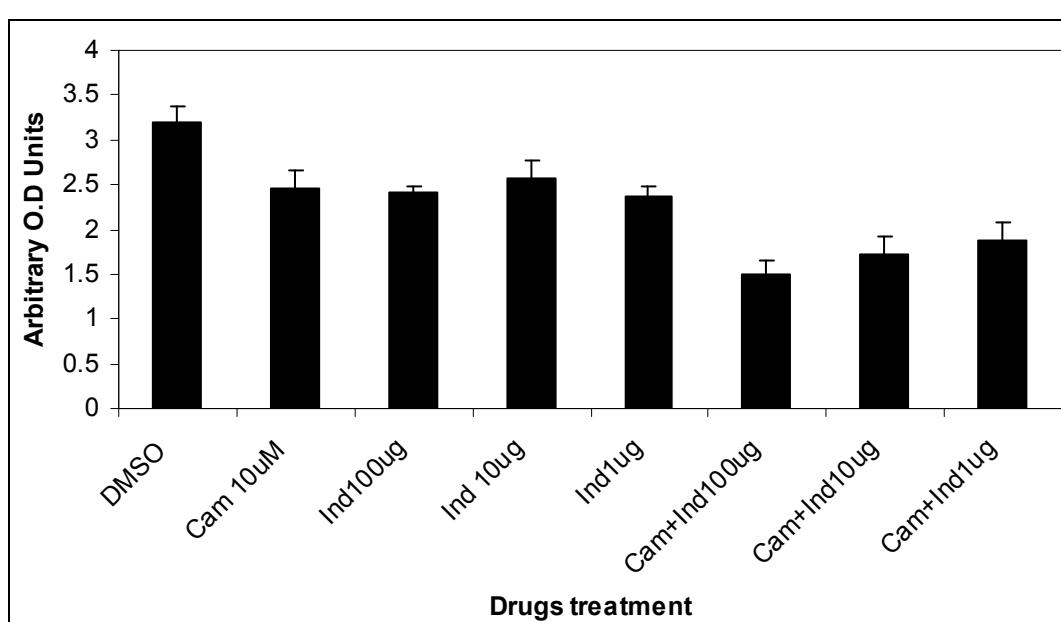
NFkB phosphorylation activity, as judged by the presence of phosphorylated NFkB protein, was determined with the Fast Activated cell-based ELISA (FACE™) kit, which was used according to the manufacturer's specifications (Active Motif, Carlsbad, CA). Briefly, the cells were cultured in 96 –well plates by incubating with plant extract and / or chemotherapeutic camptothecin. Following this drug dosing, the cells were rapidly fixed to preserve activation-specific protein modifications. Each well was then incubated with primary antibody that recognizes phosphorylated NFkB p65 at Serine 536, Serine 468 or total NFkB p65. Subsequent incubation with secondary HRP-conjugated antibody and developing solution provided an easily quantified colorimetric readout.

### 2.4 Statistical analysis

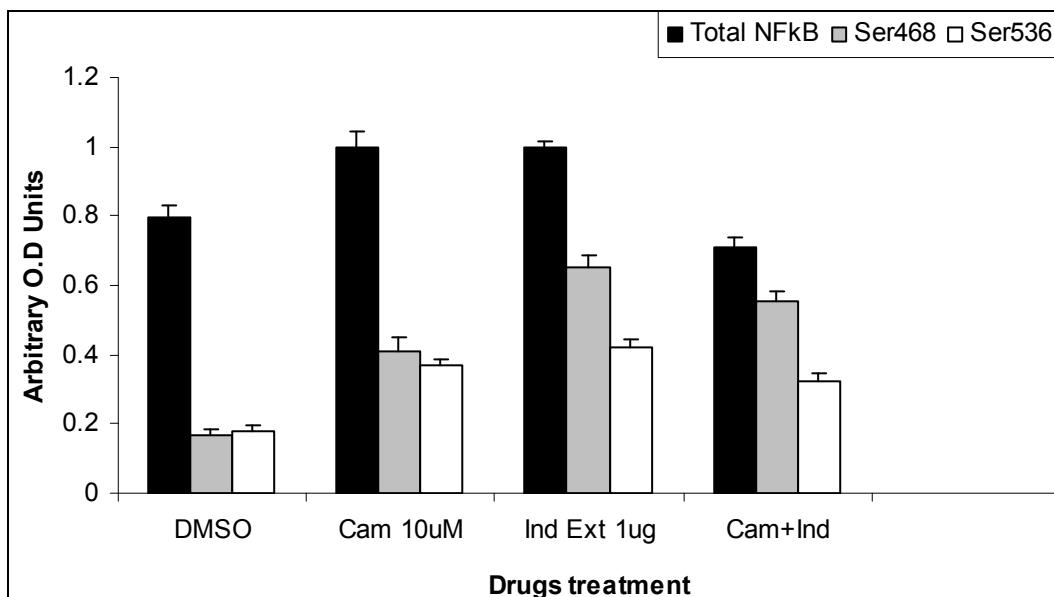
All values are reported as mean  $\pm$  SEM. Statistical significance was calculated using ANOVA two tailed t-test and set as P<0.05.

## 3.0 RESULTS AND DISCUSSION

WST-1 cell growth assay showed that *I. tinctoria* leaf extract inhibited 23-26% at all the tested concentrations (Figure 2) equally comparable to camptothecin (26% growth inhibition). Figure 3 showed the NFkB p65 profiler Elisa assay with 10 $\mu$ M of camptothecin and 1 $\mu$ g plant (250 ng of indican glucoside) extract. Treated cells with either camptothecin or plant extract exhibited 26% induction of total NFkB activation. However, the combination of both camptothecin and plant extract treated cells exerted a 10% decrease in total NFkB phosphorylation activity. On the other hand, the individual Serine468 residues of NFkB exhibited an increase of 2.4 fold for camptothecin and 3.8 fold for plant extract and 3.24 fold for combination of camptothecin and plant extract treated cells when compared to the DMSO treated control cells. Similarly, Serine536 residues of NFkB exhibited an increase of 2.1 fold for camptothecin, 2.3 fold for plant extract and 1.79 fold for combination of camptothecin and plant extract treated cells when compared to the DMSO treated control cells. Cells treated with drugs alone and their combinations exhibited the phosphorylations of both ser 536 and ser 468 residues and inhibitions of the cell growth. This indicates that the standard chemotherapy camptothecin and plant extract can activate constitutive phosphorylations of both cytosolic (specific for Ser536) and nuclear (specific for Ser468) protein kinases and thereby inducing apoptotic signaling genes to inhibit the cell growth. Also, in our earlier report (Somasundaram 2007) it was suggested that phosphorylation of Ser468 alone by limonin and its glucosides did not induce cell growth inhibition in MDA MB 231 cells. Further the combinations of standard chemotherapy camptothecin with plant extract might potentiate the chemotherapeutic activities of camptothecin. There is a report (Das et al 1995) that warns that the elevation of NFkB activities might lead to chemoresistance in certain cell lines. The present results may suggest that the total NFkB activity is decreased during the combined action of drugs indicating that the ethanolic extract of *Indigofera tinctoria* leaves might play a significant role in preventing the cancer cells from developing chemoresistance.



**Figure 2:** Effect of ethanolic extract of *Indigofera tinctoria* and camptothecin on the growth of MDA-MB231 human breast cancer cells.



**Figure 3:** Effect of ethanolic extract of *Indigofera tinctoria* and camptothecin on constitutive NF $\kappa$ B activity in MDA-MB231 human breast cancer cell line.

## 4.0 CONCLUSIONS

These results may suggest that hormone insensitive MDA-MB 231 cell growth is inhibited by the ethanolic extract of *Indigofera tinctoria* leaf and camptothecin through differential phosphorylations of serine residues of NF $\kappa$ B. *Indigofera tinctoria* in particular potentiate the chemotherapy of camptothecin.

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## **SECTION 3**

# **EDUCATION, SOCIAL & ADMINISTRATION**

# PRIMARY TEACHER EDUCATION IN JEOPARDY: PRE-SERVICE TEACHERS' UNDER ACHIEVEMENT IN ATTAINMENT OF DESIRED ENGLISH COMPETENCY LEVELS

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## ABSTRACT

*The key to educational quality is the quality of the teaching force. It is a well known fact that no educational system can be stronger than its teachers. Bearing this in mind, it is the duty of every government to ensure that its teaching force is well trained and educated. Experience has shown that both academic and professional qualifications are important in teaching. A teacher has to have a certain level of these two qualifications, among others, to be able to handle students at a certain level. A study was conducted in Kenya to find out the competency levels of pre-service teachers who aspire to be teachers of English, which is the medium of instruction. Three criterion-referenced tests (CRTs) were administered to 120 pre-service first year students, in three Teacher Training Colleges. Paper 1 tested acquisition of listening and writing skills, Paper 2 tested listening, speaking, reading and grammar skills, and Paper 3 tested the ability to read with understanding, write coherently and legibly, and compose creatively. Acquisition of sub-skills embedded in these basic skills were also tested. Performances in form of percentage scores were placed into three competency levels: Below Minimum Competency Level (BMCL), Minimum Competency Level (MCL) and Desired Competency Level (DCL). The results show training of primary school teachers in Kenya leaves a lot to be desired. This paper discusses the performance of the pre-service teachers in three test papers. Conclusions are drawn and recommendations made.*

## Key Terms

**Medium of Instruction:** This is the language of instruction used across the curriculum. It is also the language used for textbooks, classroom teaching and learning materials, as well as for examinations.

**Multilingualism:** While bilingualism refers to proficiency in two languages, this refers to proficiency in more than two languages.

**Norms:** These are performance standards/benchmarks that specify levels of achievement, by defining the levels learners will progress and by which grade. They also describe how well learners should be able to demonstrate knowledge and skills acquired.

**Second Language:** This describes a language that an individual adds to a mother tongue. There is exposure through various media.

**Trilingual:** This refers to the ability to communicate in three languages as is the case with most educated people, for example, in Kenya and Tanzania. They can speak mother tongue, Kiswahili, and English proficiently.

## INTRODUCTION

In order to attain the universal access to quality basic education, a systematically-devised language-in-education policy is central to overcoming marginalization and exclusion. Education can contribute to involvement of the people in social, political, cultural, and economic development. One of the important indices of development in any country is the measure of the literacy levels of the citizenry. It is also the extent to which the education is enjoyed by the members of the given society, that can see the need for: top quality managers, top quality researchers, top cadre of experts, and development of human resource, among others. There is no doubt that the quality of education in primary schools is critical as this forms the basis for further learning.

Attainment of literacy skills empower people to have self-esteem, understand their rights and also fight for them. They are able to participate in cultural, political, social and economic activities for their self actualization. Literate people are able to engage in critical thinking, make informed decisions, make a living and stay healthy (Dutcher, 1995; Lopez, 200; Rubagumya, 2000). Apart from literacy being a human right, it is also a foundation for all further learning, reduction of poverty, and it carries profound individual and social benefits. It is important to note that, where poverty rates are higher, literacy rates tend to be lower. Therefore, lowering the illiteracy rate should go hand in hand with reduction in poverty.

Since the inception of Free Primary Education (FPE) in Kenya in 2003, there has been a major expansion of primary education, with about 1.7 million children and youth joining primary schools at various grade levels. However, an enormous expansion of the formal education system alone cannot address existing, let alone future, basic learning needs. In light of this, there is need to evolve policies that place high priority on advancing quality education, through acquisition of literacy. Development of literacy will contribute to the achievement of the UNESCO - Dakar Development Goal 3 (Meeting the learning needs of all young people and adults), as well as Goal 5 (Achieving gender equality in education).

Among the factors that could undermine quality education is poor knowledge of the language of instruction, because the transfer of knowledge and skills is mediated through the spoken or written word (Bangbose, 1996). It is argued that education might have its relevance enhanced, only if it is supported by an appropriate medium of instruction. There is also a general agreement that cognitive development is a function of the language in which the learner has proficiency.

Kenya's Sessional Paper No. 1 of 2005 outlines issues that need to be addressed in the attainment of Education For All (EFA) goals by the year 2015. The key concerns are: access to education by all, retention of learners who have joined schools, equity in provision of education to all, and provision of quality and relevant education. Among the strategies recommended for improving teaching and learning in schools are: regular in-service training of teachers on the best methods of teaching English language literacy, providing guidance and counseling regarding children's growing up and sexual maturation process, revision of teacher education curriculum, and capacity building for school-based assessment. The policy document also recommends adoption of collaborative demand-driven research, that emphasizes value added research findings. The issues raised in the Sessional Paper are corroborated by findings of past Quality Education for Social Transformation (QUEST) studies on quality education, which advocated mastery of English by the end of the primary education cycle (after 8 years of basic education). Studies done in 1989 and 2003 had indicated that over 70% of the Kenyan grade 6 pupils had not attained the desired competence levels in the reading skill (SACMEQ 2000; ELN Project, 2007). Teacher quality and curriculum relevance were also in question. This propelled the researchers into seeking ways of supporting the teacher and learner through various interventions.

## THE NATURE OF THE INTERVENTION

Performance in English has been going down and provision of quality education is in question, bearing in mind the congestions in rural primary school classrooms. In order to address the issue of providing quality education, English literacy norms (ELN) were developed for primary schools. These were aimed at being used to gauge teaching, learning as well as assessment (Kenya University, 2004). To develop the intervention, eight critical variables were also manipulated within an integrated framework. Those that were brought to bear within the intervention were:

- [a] **Teacher Quality:** Teachers must have the desirable competencies in order for them to be able to pass them on to their pupils effectively. Teachers in the intervention received training on how to use norms-based teaching approach and resources to improve literacy in English from grade 1 – 6, using the ELN and the Teachers' Resource Books (TRBs), which were developed for grades 1 – 6. In order to encourage Teacher Training Colleges (TTCs) to pay attention to the competencies of their trainees in language teaching, this project introduced use of Norms-based approach in teaching and learning, as well as promoted the use of Criterion-referenced Tests (CRTs) to assess English language competencies among Pre-Service teachers.
- [b] **Curriculum Relevance:** Teachers' capacities for teaching the Kenyan English language curriculum has been improved substantially through a project known as School-based Teacher Development (SbTD). Through this project, the government in-service trained most teachers in several phases. The content of the training is already available in four modules in various disciplines. The Teaching and Learning English in the Primary Classroom module contains nine units covering all areas of language learning. Much of the content of each module is a theoretical description of what is good practice, what research has found out, and what conditions determine successful teaching and successful learning. While these modules are valuable in getting the teacher to appreciate why it is important to teach well, they offer little to a teacher who wishes to teach well but does not have the content to do so. Therefore, two norms-based TRBs for classes 3 and 6 were developed from the syllabus and other sources, and these act as the perfect complement to the SbTD modules. As already explained, the content in the TRBs enables the teacher to select what to teach, explains how to teach it, suggesting the skills and competencies to aim at developing among the learners, and how to assess students' competencies. The interventions enabled the classroom teacher to interpret and deliver the curriculum better.
- [c] **Instructional Materials:** The Kenyan education scene shows inadequate provision of non-textbook reading materials, especially in the English language, particularly to the lower grades. This deficiency was addressed by enabling children

- access relevant reading materials to promote learning outcomes, and by ensuring that schools and classrooms use optimally all available materials. Teachers and learners were also trained how to make school-made reading materials
- [d] **Forms of Assessment:** At both classroom and National testing of language skills, listening and speaking skills are not tested leading to a negative backwash effect, where classroom teaching does not strive to develop these skills sufficiently among pupils. The developed interventions demonstrated how the periodic use of simple CRTs based on the norms can encourage teachers to focus on these skills and lead to better achievement by learners and thus promote overall education quality.
  - [e] **Parental/Community Involvement:** With the introduction of FPE, many parents assumed that the government would shoulder all the educational obligations, thereby abdicating their responsibility. This project joined the FPE effort by helping to promote parental and community participation, especially in the area of literacy development. Parental/Community involvement was also important in implementing educational initiatives in order to ensure sustainability of the project beyond the donor-funding period.
  - [f] **Policy Translation and Implementation:** There appeared to be a general ignorance among teachers and teacher trainers of or non-adherence to educational policies that pertain to language teaching and use in the education system, perhaps due to the fact that policies are not well communicated to the users. However, the government made efforts towards communication of policy through the National Conference on Education and training, which was convened by Ministry of Education Science and Technology in November 2003, with the objective of redefining the country's education strategies. This project addressed the deficiency by organising an international conference on language policies in 2007 and also produced and disseminated user friendly policy supportive documentations.
  - [g] **Learning Environment:** In many schools in Kenya, the environment is not quite conducive to learning due to many factors. The major one is congestion in many classrooms as a result of a declaration of free primary education in 2003, which saw more than 1.7 learners join primary schools countrywide. As part of the involvement of parents and communities in school initiatives, the interventions promoted the idea of a student friendly school environment, and also enabled learners in the sample schools to have access to teaching and learning materials, as well as class readers and other learning resources.
  - [h] **Quality Assurance:** It was observed that the quality of education in public schools, especially in areas where parents' incomes were low, was compromised by several factors, among them: teacher shortage and high teacher attrition rates arising from various causes. The quality of education and of the teaching force in the Arid and Semi-arid Lands (ASALs) was also very low. The teacher-pupil ratio had also been found to be unfavourable especially with the introduction of FPE, resulting in unfavourable and threatening classroom environments. The situation was aggravated by the inadequacy of teaching and learning materials (Republic of Kenya, 2004). In addition, quality assurance was negatively affected due to lack of resources for supervision. As part of its overall engagement with policymakers at all levels, the interventions encouraged better teacher preparation in the teaching of language by promoting the use of CRTs for assessment of pre-service teachers. Data were gathered using the developed monitoring and evaluation tools and the results disseminated to sample schools and to stakeholders who had been involved in the project from the initial stages. There was need to explore how the monitoring work could become a model at school level for strengthening and promoting quality assurance.

In developing an integrated intervention that orchestrates the 8 critical variables, it was assumed that concentrating on improving the teaching, learning and practice of literacy in schools using a norms-based approach could be a fulcrum that turned all eight critical variables described above. Once these variables are engaged, literacy teaching, learning and practice can catalyze improvement in all areas of the curriculum for all learners in the schools and the wider system. As pointed out above, the norms-based approach in the proposed intervention: *[a]* engaged both in-service and pre-service teacher education; *[b]* involved classroom-based teaching, testing and remedying of mastery of language and literacy skills; and *[c]* involved teachers and others such as writers and publishers, in development of relevant instructional materials and children's literature. All these assist teachers to learn how to interpret the syllabus. In addition, a set of norms-based CRTs were developed to test the competencies of pupils and pre-service teachers. This paper presents the performance of pre-service teachers in these tests.

## DEVELOPMENT OF PRE-SERVICE TEACHERS' DIAGNOSTIC TESTS

The English literacy norms for class six that were hypothesized in a previous study (Comprehensive English Literacy Norms, 2004) were used to develop criterion-referenced diagnostic tests for pre-service teachers. Class six CRTs that were used in the

previous study were also used as a basis for developing the tests. However, the test items in the diagnostic tests were more and a bit longer, since the level of the pre-service teachers was also higher than that of class six pupils. The testees were also required to write a longer composition in a shorter time. In addition, items with information pertaining to the process of growing up and sexual maturation were also included as teachers are expected to teach this in primary schools, as their pupils reach puberty at this level. Research has shown this is an area that many teachers shy away from, yet lack of such knowledge causes many girls to drop out of school. Content validity was ensured by making sure test items were based on the developed English literacy norms and the English language syllabus for that level. The main objective of assessing the English competence levels of pre-service teachers was because such competences would enable them to assist pupils in primary schools, in the development of literacy in English, which is the language of instruction. The purpose was also to find out whether they were able to help primary school pupils to attain the desired literacy norms, as teachers' competences in the same norms were crucial.

## **SAMPLING**

Three teacher training colleges (TTCs), each with 14 streams and forty first year pre-service teachers in each stream were sampled, producing a total population of 1,680 for the study. A random sample was obtained using class registers to ensure the participants were drawn from all the fourteen classes in each college, and that there was equal representation in terms of gender. Further sampling was done from the total population to reduce the sample for the main study to 120 pre-service teachers (40 in each college) and three tutors in-charge of curriculum studies (one from each college). The sample that sat for different test papers and descriptions of the skills tested are indicated below.

## **TEST PAPERS**

Two alternative pilot tests (A and B) were developed with each having at least a third of the same test items and the rest of the items being similar in focus and level of difficulty but different. The tests were piloted in one teacher training college (not one of the three sampled for the main study) to ascertain the suitability of the test items and the practicality of the physical conditions for the administration of the tests. This enabled the researchers to establish the usefulness and suitability of the tests, and where necessary to make revisions. After piloting the two papers, suitable test items from both papers were selected to come up with three tests to be administered in the main study, together with composition writing. The whole evaluation comprised three test papers: Paper 1, Paper 2 and Paper 3 which was in two parts. The three papers assessed acquisition of different language skills and sub-skills, as they are stated in the developed norms.

Paper 1 was aimed at testing listening and writing skills and was administered to the whole sample of 40. The sub-skills tested in this paper were the ability to: demonstrate good listening habits, elicit information from a non-narrative passage presented orally, discriminate between minimal sets and pairs, relate meanings to words, understand use of stress and distinguish meanings brought about by varying the position of stress in words and sentences, distinguish the functional meaning of sentences determined by different intonation patterns, listen to and take down dictation correctly, read aloud with expression paying attention to punctuation marks and correct pronunciation, intonation in words and sentences, listen with understanding to a short narrative and be able to answer comprehension questions, retell the narrative, listen to an explanation and respond to directed questions.

Paper 2 was given to a quarter of the sample (10) because the mode of testing, one-to-one, consumes a lot of time to administer. The Paper tested speaking, listening, reading, grammar and vocabulary. Sub-skills that were tested were the ability to: listen and respond appropriately to questions, commands, instructions and requests, identify objects, colors, sizes and shapes and give their own examples, articulate specific sounds correctly and pronounce problematic words, read aloud using acceptable reading habits, use correct stress and intonation, discriminate homonyms from a context, present information about self, friends and family in a grammatically correct and coherent manner, explain a process by giving reasons why certain steps have to be followed systematically, describe a given picture of an environment correctly, interpret a map, interpret a menu, state distances between different towns from a given table, study a picture and pose five questions, read a series of numbers and calculations aloud, express verbally their likes and dislikes and, describe how to get to point B from point A, stating all the landmarks found on the way and using directional words.

Paper 3 was taken by the whole sample of 40 pre-service teachers and it was in two parts (A and B). The main skills tested in section A were reading and writing skills. Sub-skills tested in this section were the ability to: skim through a short passage (timed) and give the main points, scan through a non-narrative passage (timed) for specific information, relate new information to what is already known, read and obtain information from a map, read and interpret signs and symbols, read and interpret information presented in graphs, matrices and charts, read numbers presented in both numerals and words, interpret

mathematical calculations presented in prose form, interpret mathematical symbols, infer the meanings of words from a given context, use different parts of speech to write own sentences and fill a short form by providing needed information.

Part B involved essay writing and was administered to the whole class of 40. They were required to write a limited piece in prose form. The testees were required to express themselves logically and coherently. Spelling, punctuation, capitalization, paragraphing, sentence structure, creativity and flow of ideas were assessed, among other skills.

## DATA ANALYSIS AND INTERPRETATION

Tests' data were analyzed using frequency counts, percentages and range. Results were placed in intervals according to the expected levels of performance, based on the developed English literacy norms. The levels were as indicated below.

PERCENTAGE SCORE	LEVEL OF COMPETENCE
50% and below	Below Minimum Competence Level (BMCL)
51% - 69%	Minimum Competence Level (MCL)
70% and above	Desired Competence Level (DCL)

The results in paper one showed that 64.3% of the student-teachers had the desired competence level (DCL) while 35.7 % had the minimum competence level (MCL) in listening and writing. This latter group can barely handle the work that requires the listening and writing skills in primary school. Findings of paper two showed that 50% of the sampled trainees attained the MCL which meant that their proficiency in listening, speaking, reading, grammar and vocabulary was below the expectation which meant that their proficiency in these areas was inadequate. In paper three, 90.5% of the students were found to possess the DCL in reading and writing, which meant that they were competent to handle the tested skills in primary schools. When data for composition writing were analyzed, the results showed that the majority of the trainees (92.86%) failed to attain the DCL. This was a situation that caused much concern, bearing in mind that the same trainees would graduate after two years and be posted to teach in primary schools.

Overall findings from the tests also revealed that, over 40% of the teacher trainees did not attain the DCLs in the criterion-referenced diagnostic tests. Bearing in mind that the level of English proficiency in primary schools in Kenya is low especially in rural schools (English is a second language in Kenya, as well as the national language and the medium of instruction from class four upwards), the situation could be worsened if incompetent teachers are posted to schools to teach such pupils. This suggests that primary teacher-trainees should be sufficiently prepared in teaching the four basic language skills of listening, speaking, reading and writing, as well as in grammar and vocabulary, because they would ultimately end up teaching these skills in primary school classrooms, where performance in English was found to be poor.

## INTERVENTIONS

To arrest the situation, researchers in this project conducted in-service training of tutors in the sampled primary teacher training colleges. They were trained how to teach using the norms-based approach that was found to improve English language proficiency among primary school learners. Training was also conducted on how to use the developed Teachers' Resource Books (TRBs) that were based on the developed norms. By using the TRBs, teachers would be able to interpret, teach, practice, consolidate and assess the mastery of basic language skills at various grade levels. Tutors were also trained how to produce criterion-referenced test items that would be used to test specific language skills. To improve the reading skills, the tutors were trained how to produce school-made books and other reading resources using locally available materials. This was aimed at training tutors who then would train the teacher trainees, how to develop these materials, especially where parents could not afford to buy new books. This would assist learners to develop the reading culture and improve on their reading competence, without incurring much cost. Tutors were also shown how to use books boxes as mini-libraries. These boxes were locally made using easily available materials, they could form three shelves when fully open and they could be moved from class to class easily. They were filled with over 2000 class readers, magazines and other materials bought using project funds. The tutors involved in the project were expected to use the skills learnt to train their students before they graduated and were posted to teach.

The following are the innovative interventions that were developed and used in the sample TTCs:

1. English Literacy Norms for classes 3 and 6
2. Two volumes of Teachers' Resource Books.

3. Criterion-referenced tests for primary schools to assess English language skills.
4. Criterion-referenced diagnostic tests for pre-service teachers
5. A text: 'Benchmarks for English Language Education'.

What is now required is to design an integrated intervention that uses the developed tools and information to strengthen teachers' curriculum, capacities, resources for teaching literacy and which promotes participation by schools and communities. It is also important to ensure that works on ensuring that the innovative practices and resources are institutionalized within key institutions in the education system, so as to ensure their support and sustenance.

In the school context, testing and teaching are so interrelated that it is virtually impossible to work in either field without being concerned with the other. The teacher's evaluation of learners is used to provide feedback on the learners' achievement and teachers' performance. The feedback is useful in making informed decisions about:

- instructional techniques
- instructional resources
- the content
- test setting and administration
- planning for teaching

Periodic assessment of the learners is necessary to ensure the learnt knowledge and skills have the desired impact. A diagnostic test should be given to new teacher trainees to establish the weaknesses prior to commencing the actual training so that tutors can conduct remedial activities where necessary.

## **CONCLUSION**

A test is used to assess how much has been learnt in a course or part of it (Oller, 1979). It is an essential tool in any learning program. A test gives useful information regarding the progress or the level of language achievement of the learners. However, language ability commonly reflects linguistic knowledge as well as strategic competence and metacognitive strategies. In the school context, testing and teaching are so interrelated that it is virtually impossible to work in either field without being concerned with the other. The teachers expect learners to have learnt certain new information or skills at the end of a given period. Tests or examinations are used to provide feedback on the learners' achievement. The feedback is used in making informed decisions about language instruction and learning, test setting and administration, and the appropriate research methodology.

Communication in academic settings is often broadly defined as listening, speaking, reading and writing. In Kenya, abilities in reading and writing are often tested in norm-referenced examinations. Abilities in listening and speaking are not tested because of the logistics of conducting such an assessment. The current teaching situation in Kenya is examination oriented. Annual public examinations are taken as the ultimate authority over what should be taught to learners at primary, secondary and teacher training institutions, forgetting largely that there is a normative syllabus. Consequently, this has a negative backwash effect as teachers often ignore skills whose abilities are not assessed or they are given little attention. The natural process of language development starts with the development of the listening and speaking skills and therefore, these skills are vital in any language learning situation.

No study had been done earlier to investigate English language proficiency levels of pre-service teachers in primary teacher training colleges, using norms-based criterion-referenced tests. The assumption has always been that teachers graduating from these colleges have the expected English language competency levels required in a language teacher, who is expected to teach in English as the medium of instruction. After graduation, novice teachers are not inducted into the field and there is no follow-up support. In the few instances when in-service training has been conducted, the training has not been based on any empirical data or theory of language teaching. This study provided a picture of the pre-service teachers' proficiency levels in terms of their ability to teach the basic language skills of listening, speaking, reading and writing as well as grammar and vocabulary. Although not all the abilities in the norms were tested, those chosen provided a scope that was wide enough for testing to enable us make conclusions about the general standards of the trainees. The tests helped to expose student-teachers' strengths and weaknesses in specific areas of English language learning. The tests also provided a good enough starting point for a battery of other tests which could be used in conjunction with the norms to improve the levels of literacy among English language primary school pre-service teachers.

## Policy Options and Recommendations

Awareness of the significance of literacy to human and social development, (and indeed economic and technical development) needs to inform education policy. In terms of policy, the main challenge is to overcome the excessive examination orientation of teachers, pupils, parents, schools, textbook writers and the general public. The following are the proposed government policy options that would improve development of English literacy in primary schools in Kenya. These have been arrived at, from the research findings and after trying out the innovative materials in schools and colleges.

- Criteria for selection of pre-service teachers for training should make it mandatory to obtain a pass in English at the KCSE level, for those who wish to join the teaching profession. Currently, an aspiring teacher is required to obtain an aggregate 'C' grade in the Kenya National Examinations Council examinations that are conducted after four years of schooling in a high school. It does not matter if one has failed in English which is the medium of instruction, provided the overall grade is 'C' and this could be one of the reasons why primary pre-service teachers in this study performed so poorly in English.
- Policy on school/class libraries should be revisited to ensure that children are exposed to enough reading resources. Wide reading exposes learners to various aspects of language learning such as proper spelling, a variety of grammatically correct sentence structures, proper punctuation, self expression, paragraphing, as well as developing creative use of language.
- Capacity improvement mechanisms should be put in place during the development of the curriculum, acquisition and development of resource materials, as well as supervision of curriculum implementation. During this exercise, Quality Assurance and Standards Officers (QASOs), head teachers, classroom teachers and parents should be involved.
- Kenya National Examinations Council (KNEC) develops norm-referenced examinations that are done nationally at various stages in the education ladder. It is proposed that KNEC should look into the possibility of developing an alternative way of testing by giving criterion-referenced tests (CRTs). Since the norms are based on individual skills in various areas of language learning, they could be used to develop CRTs in English. This is important since any examination should not merely reflect the learner's knowledge of relevant examination techniques but their mastery of language used in real life situations.
- Ways should be found to incorporate testing of listening and speaking in national examinations to encourage teachers to give them attention by allocating same teaching time as for other language skills.
- Future development of reading materials based on the English Literacy Norms should consider materials for special needs education. Materials from whatever source should be varied, learner-friendly and a good source of learning various aspects of language.
- In situations where availability of reading materials is lacking, teachers and learners should be trained how to make their own school-made reading and learning resources, using locally available materials that are not expensive. This would ensure learners are constantly being exposed to resources that they are familiar with and which are easy to understand as they can relate to the issued presented. Discussions of such issues would also assist in the development of listening, speaking and writing skills, among others.
- Writers' clubs should be started in schools where none exists, especially for upper classes, to write literary or factual materials such as a description of an event, poems, short stories for lower classes, and issues that affect them in their daily life, at school or at home, as they mature.

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# ACADEMIC PROGRAM ELIMINATION: AN AUTOPSY OF DISCONTINUED E-BUSINESS MASTER'S DEGREES

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## ABSTRACT

Many universities are currently in the process of restructuring and eliminating academic degree programs. E-business degrees are an educational innovation that proliferated rapidly during the past decade as the Internet increasingly influenced business practice. But recently, a noticeable number of these programs have been discontinued. The present study used the Mellahi and Wilkinson (2004) model of organizational failure as a framework for identifying factors that may influence the elimination of e-business master's programs. Previous research was used to identify universities and colleges worldwide that had eliminated e-business programs. Questionnaire data were collected from individuals at the schools regarding the e-business program discontinuation process. Results suggested that low student enrollment and admissions applications had the strongest influences on the decision to eliminate the programs. Other apparently influential factors included the programs' inability to meet business needs, faculty attitudes, insufficient administrative support, and mergers of e-business degree programs with other majors. Recommendations for sustaining innovative educational programs are discussed.

**Keywords:** *E-Business; E-Commerce; Master's Degree; Business Curriculum*

## INTRODUCTION

Advantages offered by e-business are constrained only by organizations' capabilities to recognize and apply innovations as they emerge. Wu and Hisa (2008) pointed out that new, different business models and enhanced dynamic capabilities are needed to take advantage of the impending radical and disruptive innovations in Internet commerce. The impact of e-business is revolutionary and requires new management approaches and organizational structures (Tassabehji, Wallace & Cornelius, 2007). Given such developments, it is not surprising that universities rushed to introduce innovative, new e-business education programs at the turn of the century. But now almost as abruptly, they appear to be discontinuing the programs at a noticeable rate: Fusilier and Durlabhji (2008) reported that 67 e-business master's programs were discontinued from 2003 to 2007 in North America. Tatnall, Singh, Burgess, and Davey (2008) and Rob (2003) documented case studies of e-business education program discontinuations. This trend is reflected in the larger academic community by the growing movement of institutions to cut costs by eliminating classes and entire programs (Eckel, 2000, 2002; Michael, 1998; Yan, 2009).

Rapid launch and discontinuation of e-business degree programs is contrary to evidence that (a) e-business has continued to grow steadily (U.S. Census Bureau News, 2009) and (b) demand for e-business, IS, and IT related skills has increased despite the dot-com bust and widespread reports of off-shoring of jobs (Granger, Dick, Jacobson, & Van Slyke, 2007; Huang, Greene, & Day, 2008; OECD, 2008; Panko, 2008). This inconsistency raises questions about university decision processes to eliminate e-business and possibly other degree programs. Universities may not be setting an effective example for students who upon graduation will participate in organizations and potentially exert influence on increasingly important decisions as their careers progress. Ineffective decisions have been blamed, in part, for the recent crises in industries such as mortgage lending, automotive, and banking.

The decision to eliminate innovative degree programs can have important implications. Start-up costs to establish a new degree are considerable. Faculty and administrative energy must go into course and curriculum development, new personnel might be hired, university catalogs revised, the program advertised, etc. If these costs can be depreciated over the long life of a thriving program, they constitute an effective investment. A short-lived program, however, may result in a net loss for the university offering it.

University stakeholder confidence may be shaken by short cycle launch and discontinuation of degree programs. Graduates of discontinued degrees may feel confusion about the program's cancellation if they had a good educational experience. Or, they may feel conned that they were lured into a "fad" degree program with the promise of financial success that did not become a

reality. Employers and potential employers may be suspicious of the quality of an innovative degree program that has been eliminated. University alumni may question the quality of university decisions and financial management if degree programs are discontinued a relatively short time after being introduced.

Given these implications, educational program discontinuation appears to merit investigation. Exploration of the topic seems urgent because economic initiatives in higher education may threaten innovative programs in spite of a need for them (Harris, 2006; Reisman, 1998). The present paper proceeds with a review of literature on the phenomenon of organizational failure as it might apply to the discontinuation of an educational innovation, e-business degree programs.

## **LITERATURE REVIEW**

Mellahi and Wilkinson (2004) proposed a model of organizational failure that specified (a) deterministic views, which focus on environmental constraints as causes of failure and (b) views that emphasize the role of voluntary forces internal to the organization. Dodor (2008; Dodor & Rana, 2009) applied both perspectives to business schools' intentions to initiate e-business education programs. Dodor (2008) investigated the deterministic approaches of organizational ecology (Hannan & Freeman, 1977) and resource dependence (Pfeffer & Salancik, 1978) while Dodor and Rana (2009) tested individual-level attitudes and perceptions. These perspectives may also be relevant for understanding e-business program discontinuation.

### **External Influences on Organizational Failure: Organizational Ecology**

The organizational ecology view suggests that organizational failure occurs when an organization dissolves; meaning that it no longer carries out its routine activities or sustains its structure (Freeman, Carroll, & Hannan, 1983, p. 694). This view argues that failure is caused by factors external to the organization over which managers have little control (Mellahi & Wilkinson, 2004). Such factors include population density, which is the notion that as more organizations enter a field, the crowding increases competition as well as the likelihood of failure (Hannan & Freeman, 1989). The dramatic expansion of e-business education courses and programs at universities worldwide has been well documented (Durlabhji & Fusilier, 2005; Ethridge, Hsu, & Wilson, 2001; Hameda, Foroughi, & Derr, 2002; Mechitov, Moshkovich, & Olson, 2002). According to the population density logic, discontinuations could be expected in the context of such intensifying competition.

Industry life cycle is another factor identified by organizational ecology perspective as having an impact on organizational failure (Klepper, 1997). Industry life cycle theory suggests that organizational failure can result from demand saturation (Mellahi & Wilkinson, 2004). The proliferation of e-business education offerings may have met or exceeded the demand for such programs. Literature on information technology (IT) education documented decreasing enrollments (George, Valacich, & Valor, 2005; Huang et al., 2008; Tan & Venables, 2008). Tatnall et al. (2008) specifically identified difficulties in attracting students as a reason for an e-business program's discontinuation.

### **External Influences on Organizational Failure: Resource Dependence Theory**

Consideration of demand saturation also fits with resource dependence theory (Pfeffer & Salancik, 1978) which suggests that organizations' power and vitality are based on their ability to acquire resources, in this case enrollment and tuition funds (Dodor, 2008). Rob (2003) attributed an e-business program's failure to its lack of a core faculty, another critical resource. The resource dependence perspective assumes that organizations can exhibit active choice behaviors as they cope with constraints imposed by the external environment (Oliver, 1991). In the e-business context, this means that discontinuation is not necessarily automatic for programs lacking resources. E-business subject matter can be retained in other, surviving degree programs even when an e-business major is discontinued. Strategies could include infusing e-business subjects throughout the business school curriculum (Krovi & Vijayaraman, 2000; Moshkovich, Mechitov, & Olson, 2006) and taking a multidisciplinary approach to teaching e-commerce (Gunasekaran, McGaughey, & McNeil, 2004; Ngai, Gunasekaran, & Harris, 2005).

### **Internal Influences on Organizational Failure**

The organizational ecology and resource dependence perspectives have been criticized for ignoring factors internal to the organization that may influence failure (Flamholtz & Aksihirli, 2000; Mellahi & Wilkinson, 2004). Internal factors are specified in the Mellahi and Wilkinson (2004) model of organizational failure determinants. Such factors may help to address the question of why some e-business programs are discontinued while others continue to operate under the same or similar environmental conditions. The present paper reviews literature on academic program discontinuation to identify potential internal influences on failure. Research in this area appears to be generally in the exploratory stage and not theory-based. Michael (1998) argued that while "much thought is given to academic program development, often little attention is paid to program

discontinuation" (p. 379). According to Michael (1998), factors that can influence program discontinuation include need for the program, institutional capacity to offer it, post graduation employment rates for students, funding, and politics internal or external to the institution.

Eckel (2000; 2002) found that the actual reasons for program discontinuation were sometimes not consistent with the stated goals of program elimination. Programs that were cut did not always have the lowest enrollment or produce the greatest cost savings by their cancellation, rather they were the easiest to cut – their elimination generated the least resistance from faculty, administrators, and other stakeholders. Weiss (1998) detailed the causes of failure for a program intended to promote interdisciplinary communication at eight institutions. Problems included funding, faculty attitudes, administrative changes, lack of program focus and structure, and insufficient institutionalization. To elaborate on the last point, if a program was seen as an "add-on," it was more likely to be lopped-off (Weiss, 1998, p. 9). Tatnall et al. (2008) applied a curriculum development model to e-business education which suggested that a new educational topic's legitimacy grew with its institutionalization in the academic community.

The present study's purpose is to apply findings from the external and internal perspectives on organizational failure to explore reasons why e-business master's programs have been discontinued. The model of organizational failure proposed by Mellahi and Wilkinson (2004) guided the research. Results may help to identify the factors that lead to discontinuation of innovative educational programs and suggest mechanisms for coping with them.

## METHOD

### Identification of Discontinued e-business Master's Degree Programs

A list of worldwide e-business master's degree programs was obtained from previous research conducted from November, 2002 to February, 2003 (Durlabhji & Fusilier, 2005; Fusilier & Durlabhji, 2005). From April to July of 2007, the web site of each of the programs was checked to determine whether it was still in operation. If there was uncertainty, the school was e-mailed or called for confirmation about the program's status. One university had ceased operation and therefore was excluded from the sample. Ninety-eight discontinued programs were identified at 85 institutions. Thirteen institutions had discontinued two separate e-business programs, for example, a master of science in e-commerce and an MBA with a concentration in e-commerce.

The original list of programs from 2002-2003 was compiled through exhaustive web searches to find web page descriptions of e-business master's-level degree programs by institutions of higher education around the world. A variety of search and meta-search engines were employed in the web searches: Google, Lycos, MSN, AskJeeves, Yahoo, Dogpile, Netscape Search, About.com, and Snap.com. Prior evidence suggests that web sites are a valid data source on e-commerce education programs: Burkey (2007) compared 33 e-commerce program curricula displayed on web sites to hardcopy catalogs published by the colleges and universities and found the information to be 100% consistent.

Programs were considered e-business if their titles and/or the degree awarded contained the words e- (or electronic, Internet, or network) commerce or business, or any e-functional business area, such as e-marketing. Some programs that did not have any of these terms in their titles were included in the study if the curricula suggested that they were in fact e-business programs. Some established e-business programs did not have a clear web presence or one that the researchers were able to locate. In such cases, the schools were contacted by e-mail or phone in an effort to obtain information on their curriculum. Programs were included in the study only when a detailed curriculum description was available. Only English search terms were used. This yielded some web sites in languages other than English. These sites were either translated by the authors or by an Internet translation site.

### Identification of Members of the Sample

The web site of each institution was searched for a member of the faculty or an administrator who would be likely to know about the reasons for the program's discontinuation. Criteria used for sample selection focused on evidence that the individual had:

- 1) Been a member of the institution since at least 2002 so that he/she would likely have first-hand awareness of the program discontinuation process.
- 2) Been at the assistant professor level or higher since 2002. Those at higher rank might have more involvement in a program discontinuation decision than an instructor or adjunct faculty member.
- 3) Published or taught in the area of e-business or related fields.

One individual was designated as a respondent for each of the 85 institutions that had discontinued e-business master's degree programs.

## Questionnaire

A questionnaire was constructed in English to solicit reasons for e-business master's program discontinuation. It appears in the Appendix to this paper. Its content was based on the literature reviewed in this paper's introduction concerning organizational failure and academic program discontinuation. Responses to the items could be made on five-position categorical boxes that included No Influence, Slight Influence, Moderate Influence, Strong Influence, and Very Strong Influence. A Not Applicable box was also included as well as space for open-ended comments. The questionnaire contained three sections pertaining to (a) student issues [five items and open-ended comment space], (b) faculty and curriculum [15 items and open-ended space], and (c) administrative factors [11 items and open-ended space]. In an effort to establish content validity, the items were evaluated by three faculty members to evaluate their pertinence to each issue under consideration as well as their understandability. Necessary wording changes were made as a result.

After receiving Institutional Review Board - Research Protections approval, a link to the electronic questionnaire was e-mailed to each member of the sample. A cover e-mail explained the study purpose. The questionnaire was anonymous and participation voluntary.

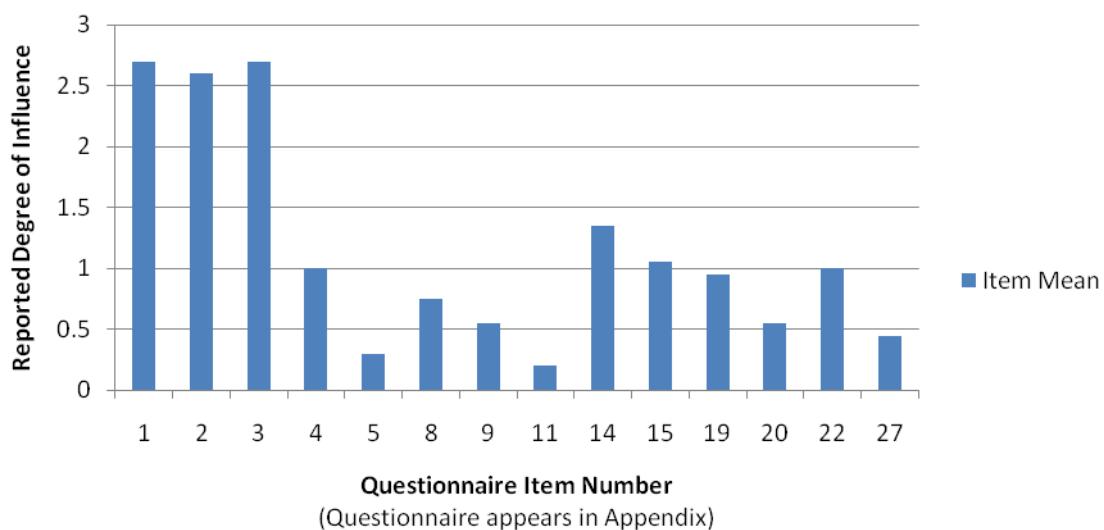
## RESULTS

Twenty completed questionnaires were obtained for a 24 percent response rate. Responses came from institutions in the following countries (numbers of responses appear in parentheses): Australia (5), China (1), England (2), Scotland (1), and USA (11). A second request was e-mailed to the non-respondents two weeks after the first request but it did not yield additional responses. One sample t-tests were conducted to compare the mean response on each item to zero. Test results that reach statistical significance suggest that an item mean is greater than zero. In the present case, this means that the factor in question appears to influence the discontinuation decision. Results appear in Table 1 and are graphically displayed in Figure 1.

**Table 1: Statistically Significant Results of One-Sample t-tests for Item Means**

Questionnaire Item (Questionnaire appears in Appendix)	Mean	SD	t(19)	Significance
(1) Low enrollment	2.70	1.46	8.30	.0001
(2) Few applicants	2.60	1.57	7.41	.0001
(3) Decreasing numbers of applicants	2.70	1.53	7.92	.0001
(4) Concerns about job placements for graduates	1.00	1.21	3.68	.0020
(5) Lack of a sense of community among students	0.30	0.57	2.35	.0300
(8) Faculty attitudes	0.75	1.25	2.68	.0150
(9) Lack of faculty interest	0.55	0.95	2.60	.0170
(11) Not enough technical courses	0.20	0.41	2.18	.0420
(14) e-business content integrated in other courses	1.35	1.53	3.94	.0010
(15) Merger with another program	1.05	1.64	2.87	.0100
(19) Program did not meet business needs	0.95	1.36	3.13	.0050
(20) Lack of business involvement	0.55	1.00	2.46	.0240
(22) Lack of administrative support	1.00	1.62	2.76	.0130
(27) Department was re-organized	0.45	0.89	2.27	.0350

**Figure 1: Graphical Representation of Questionnaire Item Means that differ from Zero at the  $p < .05$  level**



Comparisons among item means suggested that means for the items concerning low enrollment (Item 1), few applicants (Item 2), and decreasing numbers of applicants (Item 3), did not differ from one another but were greater than all other item means. For example, the mean for few applicants (Item 3) was statistically different from (greater than) that for concerns about job placements (Item 4) ( $t(19) = 4.77$ ,  $p < .0001$ ) and that for low enrollment (Item 1) appeared greater than the mean for the department being re-organized (item 27) ( $t(19) = 5.77$ ;  $p < .0001$ ). Descriptive statistics appear in Table 1.

## DISCUSSION

### External Influences on e-business Master's Program Discontinuation

While respondents identified a number of reasons for e-business master's program discontinuation, low enrollment and applications were reported to be the most influential factors in the decision. This lends support to the resource dependence perspective and the influence of demand saturation as derived from industry life cycle theory. There was apparently not enough student demand to support the available e-business programs on the education market. The presence of similar programs at other universities (questionnaire item 29) was identified by only one respondent as having a slight influence on the decision to discontinue the program. The population density logic was therefore not supported: the introduction of new e-business programs at other universities, in itself, did not appear to impact the discontinuation decisions. However, crowding in the e-business education field may have contributed to the low enrollments. Responses to the open-ended questionnaire items further elaborated on the impact of low enrollment. Examples include the following:

- *Enrollment disappeared, so we dropped the program.*
- *The program was closed following the Dot Com crash – student interest waned after this event. We dropped the Masters in Electronic commerce in 2006 because of falling student numbers.*
- *Applications were in line with expectation until .com crash, then collapsed.*

Confronted with the environmental threat of decreased enrollment and the opportunities posed by the demand for e-business skills, some of the institutions actively responded by integrating e-business subject matter into other courses or merging the e-business program with another degree. Such active responses to the environment are also consistent with the resource dependence perspective (Oliver, 1991). Open ended questionnaire responses bearing on this issue include:

- *As e-commerce has grown, it has become an integral part of any marketing program. It almost became redundant with much of what was already covered. It is no longer a “separate” area of business but an element in all business programs.*
- *There wasn't a lot of interest in something called “e-commerce,” mostly because all commerce was essentially either now or in process of becoming e-commerce, so that we couldn't really think of a lot useful to put into courses under that designation that couldn't be folded into the rest of our curriculum.*

- Basically, eCommerce was seen as an outdated tag to use. We are also about to remove the eCommerce technology stream of the MIS for the same reason.

Other resource and stakeholder interface problems appeared to include a lack of business involvement and the program's inability to meet business needs. Although the present study's questionnaire items concerning program cost, funding, and efficiency did not appear statistically different from zero, open-ended questionnaire responses alluded to these issues in conjunction with the business relationship concerns:

- *Expensive to maintain and revise the curriculum. Our curriculum was based on dot-com business models that lacked attractiveness, coherence, and validity after the dot-com bubble burst.*
- *We had faculty, but ... this proved too expensive to maintain relative to a low demand by students. We had also built the curriculum around a set of business models that proved faulty.*

## Internal Influences on e-business Master's Program Discontinuation

Consistent with the Mellahi and Wilkinson (2004) model of organizational failure determinants, factors internal to the institutions also apparently influenced the discontinuation decisions. Lack of administrative support was expressed as a resource concern in the questionnaire items and the following comments:

- *Course leader moved to a new position and did not want the effort of keeping the programme running.*
- *Dean and associate Dean are not the right persons to support this program.*

Faculty attitudes and interest also seemed to influence the discontinuation decisions. Dodor and Rana (2009) reported that attitude contributed to institutional readiness to offer e-business education. The present data support this conclusion. Appropriate faculty attitudes and interests appear necessary to launch and sustain e-business programs. Such individual influences may account for why some e-business master's programs have persisted in their operation in the face of environmental threats such as the dot-com bust, while others were discontinued. Lack of a sense of community among students also appeared to have an influence on the discontinuation decision.

The X factor was defined as an unethical approach to program decisions which can occur when discontinuation decisions are influenced by "sentiment, fear of the consequences of the decisions, and/or intervention by powerful individuals" (p. 395). Such influences can produce decisions that are irrational and unpredictable (Michael, 1998). A cryptic comment that was submitted might reflect Michael's (1998) "X factor" in program discontinuation:

- *I don't want to downplay this issue, but there were other factors that were also involved in our decision.*

## CONCLUSIONS

The Mellahi and Wilkinson (2004) model of the determinants of organizational failure appeared to apply to e-business program discontinuations. The model was generally supported by the present study's results. External and internal influences on the e-business program discontinuation decision were identified.

Results suggested that low student enrollments and applications exerted the greatest influence on the discontinuation decisions. While some institutions appeared to actively cope with the enrollment deficit by offering e-business subject matter through changes such as program mergers, others seemed to respond more passively by simply discontinuing the programs. This suggests that they also eliminated e-business subject matter to the extent that it actually existed in the program. These findings exemplify the continuum of passive to active organizational responses to environmental demands (Oliver, 1991).

E-business skills and innovation capabilities are as critical today for commercial success and adaptation as they have ever been (Wu & Hisa, 2008). Topics such as IT-business process integration and e-business strategy are not traditional business subjects yet they have repeatedly emerged as drivers of e-business success (Eikebrokk & Olsen, 2007; Kumar, Maheshwari, & Kumar, 2004; Weltevreden & Boschma, 2008). If such topics are not adequately being incorporated into the business curriculum, students are left at a disadvantage. Market driven education directed at increasing enrollments has the potential to sacrifice the satisfaction of student needs to student "wants" (Reisman, 1998). Gupta, Saunders, and Smith (2007) reported a disconnection between business schools' MBA curricula and employer needs. Decreased enrollment in e-business programs does not necessarily mean that there is decreased need and demand for such skills from society. Loss of the independent stance that higher education institutions have traditionally taken on curriculum decisions may risk the value of business

degrees. Innovation in education is critical to inspire and equip individuals to build and support the dynamic capabilities required of organizations to thrive in the increasingly complex business environment.

## Recommendations, Study Limitations, and Future Research Directions

What might be done if e-business skills are valuable but students choose not to enroll in e-business programs? In addition to the present study's findings concerning integration of e-business topics into other courses and merging the program with another degree, strategies for meeting this challenge might be drawn from the broader field of IS education. McGann, Frost, Matta, and Huang (2007) successfully improved enrollment by redesigning and integrating an IS curriculum. E-business was taught throughout their curriculum. Granger et al. (2007) advocated improved marketing and increased visibility for the major as ways to attract students. George et al. (2005) suggested that relationships be cultivated with potential employers to obtain input on the curriculum and improve placements for program graduates.

The present study's findings also emphasize the role of factors internal to the institution for the program discontinuation decision. Fostering positive faculty attitudes, interest, and a sense of student community may help to sustain a program. Many universities are experimenting with freshman interest groups (FIGS) to encourage involvement with the study of specialized academic subjects. Attention to factors both internal and external to an institution appear necessary to sustain innovative educational programs such as e-business.

The present study's small sample size constrains generalization of the results. Future research might investigate discontinuation decisions with larger samples and also apply alternative research methods. The present exploratory results suggest hypotheses that can be tested with more rigorous research designs. Eckel (2000; 2002) used a case study approach that included interviews and archival data to investigate the decision processes associated with academic program discontinuation. Such in-depth data from a larger sample could be especially informative.

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## APPENDIX

### Factors Affecting e-business Program Discontinuation questionnaire

Response scale:

No influence (coded 0)	Slight Influence (coded 1)	Moderate Influence (coded 2)	Strong Influence (coded 3)	Very Strong Influence (coded 4)	Not Applicable (coded 0)
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**Student Issues:** Indicate the role of each of the issues below in the discontinuation decision. Please use the scale associated with each item. If you have additional comments regarding any issue, please enter them in the textbox provided.

1. Low enrollment
2. Few applicants to the program
3. Decreasing number of applicants to the program
4. Concerns about job placements for the program's graduates
5. Lack of a sense of community among the students in the program

**Faculty/curriculum issues:** Indicate the role of each of the issues below in the e-business master's program discontinuation decision. Please use the scale associated with each item. If you have additional comments regarding any issue, please enter them in the textbox provided.

6. Insufficient number of faculty
7. Inadequate faculty qualifications
8. Faculty attitudes and concerns
9. Lack of faculty interest
10. Inadequate quality of courses
11. Not enough technical courses in the program
12. Not enough non-technical business courses in the program
13. Not enough e-business courses in the program
14. E-business content was integrated into other courses in other master's or MBA program(s)
15. Merger with another program
16. Program was redesigned and given a different title
17. Courses were not coordinated within the program or with core master's/MBA courses
18. The program lacked focus or structure
19. The program did not meet business needs
20. Lack of business involvement in the program

**Administrative issues:** Indicate the role of each of the issues below in the e-business master's program discontinuation decision. Please use the scale associated with each item. If you have additional comments regarding any issue, please enter them in the textbox provided.

21. Administrative changes
22. Lack of administrative support
23. Program cost
24. Funding cuts
25. Program inefficiency
26. The program did not conform to the college mission
27. The department that housed the program was re-organized
28. The program was redundant with another program in the university
29. Other universities have similar programs
30. Accreditation concerns (AACSB or other accrediting body)
31. Politics external to the university

# LANGUAGE-IN-EDUCATION POLICIES IN AFRICA: PERSPECTIVES, PRACTICES, AND IMPLICATIONS

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## ABSTRACT

Drawing on examples across the world (with specific reference to African educational systems) this position paper attempts to provide highlights of the salient aspects of a number of Language-in-Education policies (LIEPs). Given that a comprehensive and coherent language policy that can enable decision makers to decide on choices about language issues in a rational and balanced way is indispensable to the development of a nation, the exposition provides an overview of historical, recent, and current developments. It is argued that LIEPs should be a critical concern that deserves urgent attention in view of the Dakar World Education Conference (UNESCO: 26-28 April, 2000; EFA, 1990), and the attainment of universal access to quality basic education that can produce citizens who are humane, committed, participative, and productive with a profound sense of patriotism and nationalism: citizens with the right educational and life skills, attitudes, and values. It is contended that a systematically-devised LIEP is central to overcoming marginalization and exclusion. Education might have its relevance enhanced, only if it is lopsided towards appropriate media of instruction. Basing on approaches to language planning and policy making, issues discussed arise from questions common in bilingual and/or multilingual contexts: (a) Does the general agreement, that cognitive development is a function of the language in which the learner has proficiency hold? (b) How can different ethnic groupings be fairly represented in LIEP? (c) What is the potential impact of the early use of second language (L2) as the language of instruction (LOI)? (e) Why are language-in-education policies (LIEP) sometimes not followed in actual practice? (f) How important can the ethnic languages be in LIEP? (g) Which factors influence the choice of one LIEP over another? (h) Does language play a role in educational underdevelopment? (i) Is there empirical evidence to suggest that use of a certain language policy does not adequately facilitate the teaching-learning process because learners are incapacitated? (j) Why should the LIEP be firmly integrated and in synchrony with the national educational goals? (k) Which is the most suitable LIEP for the eradication of illiteracy? (l) What are the basic elements in the process of language planning and policy-making? This paper attempts to answer these questions in relation to LIEPs in Africa.

### **Key Terms:**

**Informative Function:** This is the function of language by which a language plays the role of giving and/or receiving information.

**Multilingualism:** While bilingualism refers to proficiency in two languages, this refers to proficiency in more than two languages.

**National Language Policy:** The set of nationally agreed principles which enables decision makers to make choices about language issues in a rational, comprehensive and balanced way, to suit everybody's interests in the nation.

**Symbolic Function:** This is the function of language that refers to its role in identifying people to belong to some political identity.

**Trilingual:** This refers to the ability to communicate in three languages as is the case with most educated people in Kenya and Tanzania. They can speak mother tongue, Kiswahili, and English, proficiently.

## 1.0 INTRODUCTION

Provision of formal education to everybody has in the recent past gained currency and has consequently been placed high on the priority lists of most countries, particularly the developing ones. In Africa where education is mandated to respond to a number of issues within the global society, it is generally agreed that education can go along way in the involvement of the people in the process of social, political, cultural, as well as economic development. It is believed that education can be one of the keys to the future renaissance of Africa through comprehensive political, social, economic and technical advancement. It is also central to the struggle for African sovereignty, as well as reduction in poverty levels. Many educationists have noted that this continent will not reduce its deficit in economic and technical advancement until the required knowledge and skills of its citizens have been developed through effective formal education (Mulira, 2005).

Nevertheless, it is also becoming increasingly clear that by merely intensifying the access to formal education, without examining the quality of education offered, might not help much (cf. Kirumira, 2003; Brock-Utne, 2000). If the people are to become compliant in the 21<sup>st</sup> century, there is need to evolve policies that place high priority on advancing quality education. These observations are supported by facts during the eighties when Africa had the highest growth figures in educational enrolment at all levels, as well as in expenditure on education (as a percentage of GNP); although in the nineties, these figures stagnated or even declined, leaving Africa with more than 200 million illiterate adults (44% of the adult population) and a high number of unemployed youth.

Schooling is not synonymous with education. The above example serves to show that an enormous expansion of the formal education system alone cannot address existing, let alone future, basic learning needs, as it comes with new problems and challenges. Examples of these are: large classes, need for more teaching-learning space and relevant textbooks/resources, training and re-training of teachers and rewriting or adaptation of curricula. These are inevitable pre-requisites, given the Education for All (EFA) contention that quality basic education for all should not only entail increasing the number of schools, but also the number of children. Gathumbi, 2005; EFA, 1990; Kajubi 2002).

A precise description of most education systems in developing countries is that they are examination-oriented. The consequence is the pre-occupation with examinations, grades, and certificates which, unfortunately, negatively impact on the main purpose of teaching: the promotion of how to solve problems, learning how to do and to feel, and learning how to learn so that in the end we can boast of having contributed to the promotion of attitudes, imagination, spiritual and aesthetic values, community and national spirit. Among the major factors that could undermine the provision of quality education is the language of instruction.

Given the multi-functional nature of language (instrumental, informative, binding, participatory, and symbolic), there is no doubt that it is the most important factor in the learning process because the transfer of knowledge and skills is mediated through the spoken or written word (Bangbose, 1996; 1992). Thus the question that calls for urgent attention concerns the medium of instruction – especially as most countries in Africa are either bilingual or multilingual: which should be the appropriate LIEP? Corson (1990) argues that in bilingual and/or multilingual. There is need for language policies that take cognizance of ethnic and linguistic diversity. Behind every LIEP in developing countries, there is an influencing factor. At this juncture let us briefly consider these factors.

## **2.0 LINGUISTIC BACKGROUND**

The majority of LIEPs in developing countries, particularly those in Africa, are closely related to the historic European scramble for Africa, and the resultant partitioning of the continent among imperial powers, for various interests like markets for manufactured goods, being strategic points for safeguarding commercial and political motives, sources of raw materials most of which were realized through such agents as missionaries, settlers, soldiers as well as trading and mining companies. Consequently, foreign language-speaking superstructures were imposed on Africa, alongside the administrative, legal, and educational substructures, to facilitate imperial subjugation (Schmied, 1991). Up to now, the ex-colonial languages serve as the official languages of learning. The table below shows the media of instruction in some African countries.

**Media of Instruction in Some African Countries**

Country	European Imperial Power	Medium of Instruction
Algeria	France	French & Arabic
Angola	Portugal	Portuguese
Benin	France	French
Botswana	Great Britain	English & Tswana
Burkina Faso	France	French
Burundi	France	French & Rundi
Cameroon	Great Britain & France	English & French
Central African Republic	France	French
Chad	France	French
Congo	France	French
Cote Divore	France	French
Democratic Rep. of Congo	France	French
Djibouti	France	French & Arabic
Egypt	Great Britain	Arabic
Ethiopia	Independent	Amharic
Guinea	France	French
Guinea-Bissau	Portugal	Portuguese
Kenya	Great Britain	English & Swahili
Lesotho	Great Britain	English
Liberia	America	English & Arabic
Libya	Italy	Arabic
Malawi	Great Britain	English & Nyanja
Mali	France	French
Mauritania	France	French & Arabic
Mauritius	Great Britain	English
Morocco	Great Britain	Arabic
Mozambique	Portugal	Portuguese
Niger	France	French
Nigeria	Great Britain	English
Rwanda	France	French & Kinya-rwanda
Senegal	France	French
Sierra Leone	Great Britain	English
Somalia	Italy	Somali & Arabic
South Africa	Great Britain	English & Afrikaans
Sudan	Great Britain	Arabic
Swaziland	Great Britain	English & Swazi
Tanzania	Great Britain	English & Kiswahili
Togo	France	French
Tunisia	Great Britain	Arabic
Uganda	Great Britain	English & Luganda
Zambia	Great Britain	English
Zimbabwe	Great Britain	English

A number of reasons have been advanced for the 'continued use of colonial languages in education, some of them justifiable, others not. Among the reasons advanced according to Schmidt, (1991) are: first, the 'high cost' argument - that most developing nations are under strain with respect to human and financial resources, and any major changes in the education system such as changing to another medium of instruction, would necessitate enormous amounts of money to take care of changes in the curriculum, teacher-training programmes, production of textbooks and teaching aids etc.

Second, there is the 'anti-ethnic' argument which is based on the multiplicity of languages that characterize most of these countries. Given this multiplicity, the ex-colonial languages are the most ethnically neutral for the purpose of nation-building, unity and cohesion. In this respect, any other indigenous language has the potential of threatening and weakening the much sought after unity of the nation-states, since there are very few instances where mother tongues are shared.

Third, with the advent of technological advancement and innovations, it is argued that most African languages lack the modern scientific and technical terminology. It will be, therefore, difficult to develop them even in the near future, due to the enormous efforts and costs required to do so.

Fourth, English is the language used most widely in the world and its benefits beyond the classroom and school are evident. A practical knowledge of English is vital and this, to a large extent dictates the formulation of the language policy. The need for international communication is an argument which is premised on the concept of a global village in which there is need for a common language for wider communication. It is believed that the ex-colonial languages already have the ingredients necessary for serving the purposes of international communication and technological advancement.

On the other hand, the following are the arguments that have been advanced, castigating the continued use of the foreign languages for LIE purposes. Firstly, research literature that reflects psychological theories of language acquisition and development, and precepts of social-cultural evolution, takes the view that in education, the learners' mother tongue/first language (L1) ought to be developed as the LOI, so as to foster the evolution of a truly indigenous way of life in formerly colonized societies. A language is only able to survive if its mother tongue speakers communicate in mother tongue well.

Secondly, many sound psycholinguistic studies have indicated that the child's cognitive development is better facilitated through the first language (most UNESCO recommendations since 1953; De Cecco, 1979). In particular Webb, et al. (1999) lists such cognitive skills as the ability to understand the central purpose of a text or to summarize its main line of argument, the ability to select information and to organize it into a new coherent whole, the ability to discover and formulate generalizations, the ability to understand abstract concepts and to manipulate them in arguments, and the ability to recognize relationships between (and among) events for cause and effect, as some of the central cognitive skills that cannot easily be developed when children learn in a foreign language .

Thirdly, there is the 'elitist argument' that use of a second or foreign language in education (particularly primary education) is not fair to the majority of the children. This is because normally the foreign languages such as French and English are spoken by very few in their homes, only those whose parents are educated, but not in all cases. There are also many educated parents who prefer to use the mother tongue at home. Although it might be true that the use of the 'straight-for-French/ English/ Portuguese/ German' approach is beneficial because it gives children from the French/ English/ German/ Portuguese-speaking homes an initial advantage, children from such homes are an insignificant percentage.

Fourthly, the 'linguistic imperialism' argument observes that Africans should fight for complete independence, and one of the ways to do this is by ridding themselves of all forms of remnants of colonialism. Language is one of those remnants. Continued use of ex-colonial languages is seen as a perpetuation of colonialism or neocolonialism.

Fifthly, there is the 'cultural alienation' perspective. It is argued that the foreign languages are from different social and cultural contexts, therefore they cannot by any means be said to carry the associations and connotations of African identity. As Sanou (1990) points out, while it is in the nature of the colonizer to change the language of the colonized, inseparably, the thinking also changes. Definitions and the value judgements of the colonized are also affected as they become excluded from all social institutions, cut off from their own history, deprived of their own language and of all possibilities of untrammelled self-expression (pp 65). Accordingly, the foreign languages would most likely derail and alienate the African child from his own ancestral backgrounds, and this eventually would most likely have a telling effect on her self-image, self-esteem, and sense of identity.

The 'education and underdevelopment' argument is that disclaiming native languages as mere 'vernaculars' is fraught with many costs (Karl, 1968). Using a foreign language in education causes children to face language barrier as they try to access education. This leads to educational retardation. Additionally, making linguistic and verbal aptitude in a foreign language, a

crucial test in the selection of for example, Scientists and Engineers, compromises and also sacrifices a substantial part of the nation's potential technical and scientific talent. This is further compounded when part of the personnel is forced to work in a language which is not native to them, as their levels of production are likely to be hampered, in their quest for further education. In short, there seems to be a correlation between underdevelopment and the use of a foreign language (cf. Fafunua, 1990).

### 3.0 PERSPECTIVES AND PRACTICES

#### 3.1 Uganda

As was observed above, the LIEP in the schools of Uganda is not an entirely new policy. Like in other former colonies, it is just a definitive statement of practices that have been in place for a long time since the arrival of the first missionaries in 1877 (Ladefoged et al, 1971). Both missionary and British colonial language policy was generally to provide primary education in the mother tongue and to teach English as a subject. At post- primary level, learning was in English as the language of instruction (LOI) (see for example, The Phelps-Stokes Report, 1924; The 1925 Advisory Committee Memorandum on Education Policy in Tropical Africa; The 1927 Memorandum on Language in Africa; A Report of the Commission on Higher Education in East Africa, 1937; The 1943 Memorandum on Language in African School Education; The Makerere Conference on Language, 1944; The Colonial Office Memorandum African 1170, 1947; 1948 Education Report; 1952 Education Report; the De Bunsen Report, 1952; the Education Report of 1953; the Commonwealth Conference, 1961; the Castle Report, 1963; the 1965 Language Policy, and the 1989 Education Review Commission Report). The current language policy stipulates that in rural areas from class 1 to 4, LOI should be the local languages, with English being taught as a subject. From class 4 upwards, it is the LOI. In urban schools, English is a compulsory subject and is the LOI throughout the primary school cycle. It is also the LOI in secondary and post-secondary institutions.

Unfortunately, actual classroom practice does not fully pay heed to the above recommendations. In rural areas, the practice of using English as a medium right from day one of primary education is in about 75% of the schools, contrary to the language policy. This situation is more prominent in urban areas where it is used as the LOI in almost all primary schools – and in many instances even in pre-primary schools (kindergarten and nursery schools). Among the bottlenecks is the competitive education system which is entirely examination-oriented. For a child to go through the primary school leaving examinations successfully and qualify for government selection for secondary school education, it is imperative that s/he prepares for the examinations well ahead in time. Proficiency in English language is critical since all examinations are conducted in English.

In addition, similar arguments that have already been advanced about why countries (at the peril of national development, as well as crippling the child's cognitive development) in practice go against long-standing research findings and educational theory, apply here. For instance, the multiplicity of languages (between 30-50) implies multiplicity of ethnic groups and difficulty to produce teaching-learning materials to take care of children from different linguistic backgrounds; the socio-economic benefits attached to the acquisition of English; most of the indigenous languages not being fully developed to serve as medium of instruction, let alone the exchange of scientific, educational and technical knowledge; and the neutrality of the English language (Josef, 1991), all influence the preference for English. English is regarded as the gateway to higher education, better job opportunities, and higher socio-economic status.

#### 3.2 Kenya

Kenya is a multilingual country where the majority of her people can speak two languages: mother tongue and Kiswahili. The educated people can speak three languages: mother tongue, Kiswahili and English. As in most sub-Saharan African countries shown in Table 1, Kenya follows the policy of using her former colonizer's language (Great Britain) for teaching and learning purposes. Like in her East African neighbors (Uganda and Tanzania), there is lack of a homogeneous culture. Hence, there is a multicultural complexity, characterized by significant differences in linguistic structures and systems – to be precise, the main ethnic languages are 42, some of them with various dialects. These ethnic groupings present divergent communal aspirations, problems, needs, and socio-cultural values, which ideally necessitate specific attention in the process of policy planning and development. The current language policy stipulates that the language of the catchment area (the language of wider communication in an area) should be used as the LOI for the first three years of primary education, while Kiswahili and English are taught as subjects. Thereafter, English is used as LOI from class four upwards. This means the use of mother tongues as media of learning in Kenyan schools should end in primary class three.

However, research has shown that the language policy is not strictly adhered to (Gathumbi, 1985; Muthwii; 2001). The reality on the ground is that in practice, most teachers use English and Kiswahili in teaching, even at the elementary stage. In most cases, the teacher uses code-switching and code-mixing between mother tongue, Kiswahili and English. This is as a result of

using English language in national examinations. A good command of English means better performance. Thus again as in many sub-Saharan African nations - notwithstanding the educational, psychological, and socio-cultural considerations (UNESCO, 1953:11). Research has shown most teachers in Kenya do not strictly adhere to the universal requirement that the best medium for teaching a child is the language that s/he understands well and in this case, the mother tongue for the majority of Kenyan children. The explanation for the above practice can be found in the ethnic diversity described above which consists of four main families: Bantu (e.g. Kikuyu), Nilotic (e.g. Dholuo), Nilo-Hamitic (e.g. Nandi), and Cushitic (e.g. Galla). In this regard and because of the country's ethno-linguistic complexity and diversity, it is argued that English, and Kiswahili, are the most neutral languages in teaching as they do not belong to any ethnic group. It is important to take into account the relationship between primary and post-primary education, as well as political, socio-cultural, and economic considerations, that are vital in unifying the nation.

It is important to note, however, that much as there is strong policy support for English, the proficiency levels of many children are not commensurate; and one would hesitate to commend its continued use as the language of instruction – at least not in the primary schools. In general, as is the case in most Anglophone African countries, the standard of English (especially communication in speech and writing) has been going downhill (Gathumbi in Groenewegen (ed.) 2008; Schmidt, 1991:108). Complaints about the poor standards are said to come from various stakeholders in the society: the general public, employers, examining bodies, peer pressure, teacher-trainers, and even teachers themselves (Cleghorn, et al. 1989).

### **3.3 Tanzania**

The national and official language of Tanzania since attaining political independence in 1961 is Kiswahili. The Education and Training Policy (MOEC, 1995) also stipulates that the medium of instruction in pre-primary and primary schools should be Kiswahili, while English should be a compulsory subject (pp 35-9). It further stipulates that English should be the medium of instruction in secondary school, while Kiswahili is a compulsory subject up to 'O' Level (fourth year of secondary schooling). However, the Ministry of Education and Culture reviewed this policy in 1997 in a Cultural Policy Document titled, 'Sera ya Utamaduni' (with the overall objective of clarifying the position of Kiswahili vis-à-vis other languages (about 120 ethnic groups speaking about 110 different indigenous languages in Tanzania).

Nonetheless, the teaching of English was not demeaned in the review: it was categorically stated that the English language would be strengthened albeit as a subject (MEC, 1997:18). The 'Sera ya Utamaduni' Cultural Policy Document had indicated that Kiswahili would be introduced as the medium of instruction at all levels of the education system. This position was affirmed by the Consultancy Report of 1998. Unfortunately the implementation was slow because much as the majority of Tanzanian children are more proficient in Kiswahili, there are sections of Tanzanians that prefer use of English as the medium of instruction. (MEC, 1998).

The prevalent situation in Tanzania continues unabated despite research reports such as the *Medium of Teaching and Learning Project Report* (UDMS, 1999) which points out that most students have problems with the medium of instruction which is English, (pp71-73). Similarly, Birgit et al. (1997) comment on the Consultancy Report (MEC, 1998) that at secondary school level, the data reveals that teachers and students fail to use English effectively as the LOI. Kiswahili is used in the classroom by teachers to express themselves effectively and for students to understand their teachers and the content. Kiswahili is the de facto medium of instruction in many classrooms, as during the project study, teachers who were seen or heard using English only to teach were often thought to be misleading their students. They further caution that, code-switching which is prevalent in schools is not the solution for providing a bilingual education system.

The situation described above is not peculiar to Tanzania only. It cuts across most countries in sub-Saharan Africa that have stuck to the use of their former colonial languages as media of instruction. The low proficiency in the language of instruction has become a vicious circle: the teacher-trainers' language proficiency is usually unsatisfactory, while that of teacher-trainees is undoubtedly poor. The situation is the same among in-service trained teachers. Consequently, language proficiency of learners cannot be any better. In this perspective, Birgit et al. (1997) refers to the striking response of some panelists with regard to the lecturers'/teachers' language proficiency, "...in a similar vein, in the next five to ten years, the university of Dar-es-Salaam should be able to judge and, if appropriate, to query: If the teacher's English is poor, how about the students?" (p73).

### **3.4 South Africa**

It should be recalled that during the Apartheid era, the official languages were English and Afrikaans. The argument that was advanced by the South African authorities was that in order to avoid the problems that arise from ethno-linguistic complexity outlined above in sections 3.2 and 3.3, including the domination of one language group by another, it was felt that two

languages served the purpose sufficiently well. However, the 1994 elections ushered in a democratically elected government that recognized and raised the status of nine (9) indigenous languages. Thus section 6 (1) of the South African Constitution (RSA, 1996: Education Act) notes: "The official languages of the Republic are Sepedi, Sesotho, Sebswana, siSwati, Tshivenda, Xitsonga, Afrikaans, English, isiXhosa, and isiZulu". The constitution further states, "Recognising the historically diminished use and status of the indigenous languages of our people, the state must take practical and positive measures to elevate the status and advance the use of these languages" (RSA, 1996:2). Thus according to government policy these 11 languages can serve as medium of instruction in the respective communities where they are the mother tongues.

Nevertheless, in practice English is the medium of instruction from Grade 4 onwards. Thus the seemingly good language-in-education policy is NOT being implemented. Like other sub-Saharan countries described above, South Africa does not follow the medium of instruction as laid down by government. In South Africa it is also assumed that by exposing children to the English language as early as possible, they get a head start in the language that will be used in later stages of education, commerce, industry, and public management. It is also assumed that by using English in all content subjects students will in turn become more proficient in English. However, this is not the reality since teachers generally code-switch or code-mix during most lessons – just like is the case in Tanzania, Uganda, Kenya, Nigeria, Ghana, and Cameroon to name just a few. Overall, the current practice of preferring the English language to the official indigenous languages can be partly related to the negative indoctrination of the Africans by the apartheid regime to hate their ethnic languages (Koloti, 2000; Desai, 2000; Alexander, 1999, 2000; Desai, 2000).

Of course the use of the English language instead of the mother tongues has not been without costs. For example, the children's cognitive development as well as their level of participation is affected negatively as well as the overall academic performance. Evidence in this respect is provided by Heugh (1999) who notes that during the time that use of mother tongues was introduced and maintained for 8 years as the primary languages of learning in South Africa, the matriculation results of black students steadily improved, reaching their zenith in 1976, which was at 83.7% pass rate. However, due to the inflexible implementation of Afrikaans as a LOI for 50% of the subjects in secondary schools, it led to the students' uprising in Soweto in 1975, which forced the government to back down, pass the Education and Training Act, and reduce the use of the mother tongue to the basic 4 years of primary schooling, followed by a choice of the LOI between Afrikaans and English. Not surprisingly, the reduction of the use of the mother tongue, coincided with decreasing pass rates, which dropped to as low as 48.3% by 1982, and 44% by 1992 (p304).

## 4.0 IMPLICATIONS

From the perspectives and practices described above, there are several implications that could inform decisions on language planning and policy making. We have noticed that contrary to education theory and research findings, many parents in former colonial countries prefer the foreign languages as the languages of learning and teaching their children, in some cases from day one of primary education. While this preference is based on apparently sound reasons (Webb, et al. 1999), use of a language that both teachers and learners are not proficient in can be one of the factors contributing to the perennial poverty in most sub-Saharan Africa; for why is it that non-English-speaking nations such as China and Japan are successful without using foreign languages? In this regard Mazrui (1996) also asks, "Can any country approximate first-rank economic development if it relies overwhelmingly on foreign languages for its discourse on development and transformation? Will Africa ever effectively 'take off' when it is so tightly held hostage to the languages of former colonizers? (pp3). It is to these questions that Kwaa, (2000) seems to provide answers, "No society in the world has developed in a sustained and democratic fashion on the basis of a borrowed language. It is argued that underdeveloped countries in Africa, Asia and South America remain underdeveloped, partly on account of the cultural alienation which is structured in the context of the use of colonial languages (pp71).

Secondly, given the high prestige that the former colonial languages have in society, there is need to invest and strengthen the teaching of second languages so that people acquire the functional proficiency to enable them use the language with facility. The coping strategies used by many teachers such as translation, code-mixing, and code-switching are unacceptable, especially at higher levels, if learners have to compete for jobs in the global market. Mwansheikhe (2002:67) notes one teacher's response, "If I insist to use English throughout, it is like teaching dead stones and not students" (Saville-Troike, 1982; Myers-Scotton, 1993; Brock-Utne and Holmarsdottir, 2000). That is why the teacher uses code-switching and code-mixing. High quality teaching of the second languages should be done alongside the development of the indigenous languages so that children can learn through languages that they understand better. If the policy is well designed, there should not be any conflict of interest between the needs of mother tongue speakers and those of second language learners. As Webb et al. (1999) point out, we can readily enhance the teaching of second languages while strengthening the mother tongue; for the learner who is reasonably proficient in a first language has that proficiency increased, not diminished, by studying a second language (cf. Cartwright, 1988; Churchill, 1986; Philips, 1983; Reid, 1988; Baker, 1988; Tosi, 1988; Marcellesi & Elimam, 1987).

Thirdly, a good number of language policies, as Clifford (1971) observes, are not in practice determined by rational considerations and logic. Emotional issues like ethnic identifications, religious loyalties, national rivalries, racial prejudices, and the desire to preserve the elite class, are among the unjustified factors that have influenced vital decisions on language matters (p8). In this respect, Nsibambi (1971) points out that upgrading any of the vernacular languages to a national or official status tends to be associated, rightly or wrongly, with the political and cultural hegemony of the communities so favored (p71). It is difficult for language-in-education policies that are based on sentiments only to be maximally productive. Somalia where, despite the fact that everyone (about 95%) can speak Somali and few people can speak Arabic fluently, which the authorities tried to make the official language, is a case in point. Similarly India at Independence in 1947 had decreed that English should be replaced by Hindi as the official language of the new nation; while the regional languages were to be used as the official languages of the states of India. But the dual language policy failed for two reasons: first, the residual prestige of the English language in the country, and second, the resistance against Hindi which existed in many areas on political, religious and practical grounds. Today India follows a 'three languages formula' policy - the state language, Hindi, and English.

It is argued that if we view society as a dynamic organism where there is an ever-changing national, intra-national, and international landscape, (political regime changes, shifts in international relations, internal and external economic developments, new cultural interests)" then policy-making should be seen as an endless process. Hence, more and better information can continuously be sought and collected for the betterment of existing policies. This perspective provides the opportunity of the successes and failures to serve as invaluable lessons. Many countries are proceeding with experiments to determine which languages provide more favorable results as media of instruction for certain students (Schmied, 1999). The debate about educational language policies seems to be never-ending. Language-in-education policies that could have been appropriate during the early missionaries' education in colonial territories or during the colonial administration can hardly be the best choice for the independent states in the 21<sup>st</sup> century.

## **5.0 WAY FOWARD**

The advancement of school-tailored language-in-education policies could be one of the ways to go for most countries that are characterized by multiplicity of languages which have necessitated bilingual educational programmes, whether Anglophone, Lusophone, or Francophone. This is based on the fact that schools provide the most democratic platform for the implementation of a national language policy (Webb, et al. 1999). Each school would then plan for the language minorities within its community and develop a school-based language policy that is in consonant with the various communities' cultural, social, economic, and educational developmental needs and interests. This might not only take care of such problems as stifling cultural diversity, ethnic identity, social adaptability, psychological security, linguistic awareness, and self-esteem, but would also ensure that social justice is done. The academic performance and intellectual prowess of the children would also generally develop (cf. Crystal, 1987; Vallen & Stijnen, 1987; Moorfield, 1987; Cummins, 1983). Of course there are major financial considerations for (i) organizational structures (ii) motivation of the school leadership and teaching staff to appreciate language-in-education issues (iii) carrying out research into the language needs of each school community (iv) the proper approach to bringing on board the parents, guardians, and the rest of the community representation so that decisions are shared. The policy must be acceptable (in general) to the people in the community.

### **5.1 Approaches to Bilingual Education**

There are two main scenarios with respect to bilingual education: majority first language speakers and minority first language speakers. In the former the teaching and learning process is conducted using a minority language; while in the latter it is carried out in the majority language. Let us consider each of the approaches in turn.

### **5.2 Majority First Language Speakers**

A study that aimed at equipping children with English/Welsh proficiency was undertaken in Wales with four-year olds largely from English-speaking backgrounds. Right from their first year of schooling they were exposed to schooling in Welsh language for half a day up to the end of their primary school under 'The Schools Council Project'.

At the end of the project, it was found that there was no significant difference between the bilingual children and their counterparts who had received a monolingual primary school education in English. In fact according to Price et al (1978), it was noticed that the bilingual children in one social group performed better in their English; while at the same time according to Price (1985), they developed a great deal of skill in Welsh language usage. These findings were in line with those of such other studies like Dodson, (1985), Lambert et al (1972), and Harley (1986) which indicated that bilingual education does not: (a) handicap conceptual development, (b) impede academic progress and general intellectual ability, and (c) does not lead to long term loss in the development of first language proficiency.

### 5.3 Minority First Language Speakers

The common practice is to attempt to induct the children into the majority language. This is the situation where there are linguistic minorities like the Batwa and the Karamojong in South-Western and North-Eastern Uganda respectively, the Turkana in North-Western Kenya, the Maori in New Zealand, the Aboriginal children in Australia, and the American Indian. But as already pointed out, this can permanently hinder their intellectual development and rob them of their educational chances (Webb et al. 1999). A number of studies like Saville-Troike (1987), Chamot (1988), Campos & Keatinge, (1988) are in agreement; although others such as Hagman & Lahdenpera (1988) and Fitzpatrick (1987) have produced contrasting findings arguing that there are no negative educational and social effects.

Related to these studies is Cummins et al's (1986) 'threshold hypothesis' that there may be threshold levels of language competence which bilingual children must attain in their first and second languages in order to avoid cognitive disadvantages and to allow the potentially beneficial aspects of becoming bilingual to influence cognitive functioning.

Unlike children from dominant majority language contexts that benefit from bilingual programmes in which the second language is used most, children from minority language groups profit from bilingual programmes in which their mother tongue plays a leading role (Apple et al. 1987). Thus it is vital that children from minority language backgrounds develop their mother tongue fully in order for them to acquire the skill for manipulating abstractions and performing cognitive operations that are important in second language acquisition. In this respect, Webb et al. (1999) note that there seems to be strong argument for deferring formal bilingual education until quite late in schooling and concentrating on mother tongue development. Nonetheless, whatever the decision, the following policy issues are worth noting: (i) using the minority language as a short-term transitional medium of instruction (ii) teaching the home language as a subject in the school curricula (iii) using the minority language as a transitional medium of instruction for long hours (iv) recognizing the minority languages as media of instruction for much of schooling (v) creating a separate system of education in the minority language (not necessarily separate schools, dual medium of instruction, and schooling system; rather parallel medium instruction in the same school and identical curricula – but in different own language).

Additionally as a guide for designing school-based LIEPs, further consideration should be given to the following: (i) the procedure for finding out the languages represented in the school; the steps that will be followed for staffing arrangements; how minority languages are used in class; the use of materials and resources that represent minority first languages; the importance of literacy in the minority languages; development of staff proficiency through in-service training; the use of community languages in school and the wider community; the role of the school in raising parents' awareness with regard to maintaining and developing home languages.

Finally whatever the approach, planning is critical to the whole process of language policy formulation. Drawing largely from Josef (1991: 187), there are essential elements to language planning. Consideration needs to be given to the sociolinguistic situation because the knowledge and use of a language, as well as people's attitude, inform the political decisions which are the result of sociopolitical evaluations of such functions of language as the need to ensure efficient communication, national integration, industrialization, modernization, cultural identity, and/or promotion of a language for its symbolic value.

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# INCREASING STEM COMPETENCY AMONG CULTURALLY AND LINGUISTICALLY DIVERSE STUDENTS: A 21<sup>ST</sup> CENTURY IMPERATIVE

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## ABSTRACT

*Given the technological imperatives so evident in our modern world, a major challenge of education in the 21<sup>st</sup> century is to enhance student competency in science, technology, engineering, and mathematics (STEM). The pressure to increase competency among American students intensifies in view of the ever-mounting global competition for jobs requiring STEM skills. Unfortunately, often because of systemic failures, too many American students are underperforming in the STEM subjects, rendering these students less competitive than many of their international counterparts. What is more distressing is that culturally and linguistically diverse (CLD) students, namely African Americans and Latinos/as, disproportionately suffer from an educational system that has yet to discover the most effective approach to STEM instruction. This paper addresses the challenge to improve STEM achievement, particularly among CLD students, and proposes effective instructional approaches based on Culturally Supportive Instruction (CSI).*

## INTRODUCTION

The urgency for student competency in the sciences has never been greater than now. At no time before has science, in the form of technology, so dominated the lives of inhabitants of this planet. Moreover, today's rapidly evolving high-tech world drives—and is driven by—science, engineering and mathematics. Given the technological imperatives so evident in our modern world, a major challenge of education in the 21<sup>st</sup> century is to enhance student competency in science, technology, engineering, and mathematics (STEM). The pressure to increase competency among American students intensifies in view of the ever-mounting global competition for jobs requiring STEM skills. President Barack Obama (February 24, 2009) in a speech delivered to a joint session of the U.S. Congress, emphasized: “In a global economy where the most valuable skill you can sell is your knowledge, a good education is no longer just a pathway to opportunity—it is a prerequisite.” Unfortunately, often because of systemic failures, too many American students are underperforming in the STEM subjects, rendering these students less competitive than many of their international counterparts (Phillips, 2009). What is more distressing is that culturally and linguistically diverse (CLD) students, namely African Americans and Latinos/as, disproportionately suffer from an educational system that has yet to discover the most effective approach to STEM instruction. Despite the No Child Left Behind (NCLB) initiatives of the Bush administration (Lee, 2006), African American and Latino(a) students still lag significantly behind their white counterparts in academic achievement (McKinsey and Company, 2009). This paper addresses the challenge to improve STEM achievement, particularly among CLD students, and proposes effective instructional approaches based on Culturally Supportive Instruction (CSI) (Richards & Ford, 2003).

## THE CHALLENGE

Confronting the challenge to improve the STEM performance of American students directly, President Obama's administration has launched a slew of initiatives. The overall objective is to increase the level of STEM competency among students so that they meet benchmarks not only nationally but also internationally. In this post-NCLB era, while all students stand to benefit from this programmatic emphasis on STEM, underrepresented groups, such as African Americans and Latinos(as), are especially targeted to ensure that no group is left behind. In November 2009, President Obama announced an “Educate to Innovate” campaign intended to assist the United States in moving to the top in science and math (<http://www.whitehouse.gov/issues/education/educate-innovate>). Specifically, the campaign is designed to do the following:

- Increase the STEM literacy so that all students can learn and think critically in science, math, engineering, and technology.
- Move Americans from the middle to the top in the next decade.
- *Expand STEM education and career opportunities for underrepresented groups (authors' emphasis), including women and girls.*

The private sector has also weighed in on the challenges confronting American students in a global society that requires STEM skills. The Carnegie Corporation of New York – Institute for Advanced Study Commission on Mathematics and Science Learning released a report in June 2009 based on two years of research by a multi-disciplinary group, consisting of educational professionals, government officials, corporate leaders, and other stakeholders. The report, “The Opportunity Equation: Transforming Mathematics and Science Education for citizenship and the Global Economy,” outlines a course of action for improving STEM education in the American school system. According to the commission, *opportunity equation* means “transforming education in the United States so that every student reaches higher levels of mathematics and science learning.” The commission urges the U.S. to raise the bar on STEM education in order to better prepare future leaders to tackle the challenges of a global economy. As the century progresses, predictable and unpredictable problems will demand innovative solutions and new perspectives. The nation’s citizenry must be equipped with the requisite knowledge to understand and function effectively in a STEM-oriented world. The commission argues that the United States must “do school differently” if the challenges of the future are to be met. The commission calls for the following action:

- Establish common standards and assessments for the nation in mathematics and science—standards that are fewer, clearer and higher—along with high-quality assessments.
- Improve math and science teaching—and our methods of recruiting and preparing teachers and for managing the nation’s teaching talents.
- Re-design schools and systems to deliver excellent, equitable math and science learning.

The success of the renewed emphasis on STEM remains to be seen. Given the poor history of legislative efforts to improve student achievement, particularly among CLD students, facilitating across-the-board achievement presents an uphill battle to say the least.

## CULTURALLY SUPPORTIVE INSTRUCTION

By most accounts, students thrive in instructional environments where the teacher makes learning relevant to their lives (Diez-Palomar, Simic, Varley, 2006; Gay, 2003; Ladson-Billings, 1994). Moreover, teachers who are able to make this connection with their students are better able to facilitate achievement. It behooves teachers, therefore, to create classrooms that are culturally supportive so that all students regardless of their background will have an opportunity to learn. Based on the premise that effective teaching and learning occur in a culturally supportive, learner-centered context (Bransford, Brown, & Cocking, 1999), CSI affirms and utilizes the student’s culture in the instructional process. The cultural and familial strengths that students bring to the classroom are nurtured and supported to facilitate achievement. In a classroom where students experience affirmation of their culture, students are less likely to feel threatened by the contrasting forces of home and school. Such a classroom provides students with a sense of continuity so that school becomes an extension of home—or at least school is not viewed as actively working to sever ties with home. CSI in a STEM classroom should include activities that reflect cultural affirmation (Richards et al., 2004):

- *Acknowledge students’ differences as well as their commonalities.* While it is important for teachers to note the shared values and practices of their students, it is equally incumbent that teachers recognize the individual differences of students. Recognizing these distinctions enhances the ability of the teacher to address the individual needs of the students.
- *Validate students’ cultural identity in classroom practices and instructional materials.* Teachers should use textbooks, design bulletin boards, and implement classroom activities culturally supportive of their students. By utilizing images and practices familiar to students, teachers can capitalize on the strengths students bring to school.
- *Foster a positive interrelationship among students, their families, the community and school.* When students come to school, they bring knowledge shaped by their families and community; they return home with new knowledge fostered by the school and its practitioners. Students’ performance in school will be likely affected by the ability of the teacher to negotiate this home-community-school relationship effectively.
- *Motivate students to become active participants in their learning.* Teachers must encourage students to become active learners who regulate their own learning through reflection and evaluation. For example, by examining his or her learning patterns, a student may come to realize that reviewing materials with visual aids enhances retention, or that studying with a partner helps to process the information better.

The National Council of Teachers of Mathematics (NCTM) echoes the need for a culturally supportive instructional environment. In an Equity Position Statement (2008), the NCTM presented several guidelines in their Actions for Teachers, including the following:

- Learn about the cultural background of students in your classroom.
- Find ways to modify your instruction to ensure that you have a culture-supportive learning environment.
- Connect with students' cultural background to use the information to enhance all students' mathematical and cultural understanding.
- Incorporate students' interests and cultural backgrounds into the tasks and problems you pose.
- Find historical and current contributions of diverse peoples to mathematical knowledge woven into your curriculum.
- Find common threads between academic and conversational language. Using students' prior knowledge of the language in addition to the content and context can support English language learners.

No doubt it is important to eliminate the achievement gap for CLD students if they are to be equally competitive in a world requiring STEM skills, but teachers must first be able to relate to these students, and to keep them motivated. Specific instructional strategies that are culturally supportive hold the most promise for success with these students. If CLD students are not provided the proper instruction to enhance their competency in the sciences, they truly will be left behind.

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# THE GENDER PERSPECTIVE: STUDENTS' PERCEPTIONS OF AND ATTITUDES TOWARD THE ONLINE ENVIRONMENT

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## ABSTRACT

*The promotion of the online environment as a benefit is not merely access but includes educational effectiveness for both male and female students. The purpose of this study was to investigate whether there are gender differences in students' perceptions of and attitudes toward the online environment. Data was collected from 156 students at two historically Black universities. The populations studied at both institutions were sophomore business students enrolled in their institutions' respective microcomputer applications courses. The survey instrument utilized was identical at both institutions and contained a mixture of Likert-scale and yes/no questions. The data collected for the study were analyzed using frequencies and one-way ANOVAs to determine the distribution of responses and to determine whether there were significant differences between gender. The findings of this study suggest that perceptions of and attitudes toward the online environment mostly associated with gender differences.*

**Keywords:** *Gender Disparity, Online Learning, Web-Based Learning, Student Perceptions and Attitudes, Internet Use.*

## INTRODUCTION

Since the late twentieth century, the evolution of distance learning has established a phenomenon that epitomizes the use of Internet-based technologies. Online learning, also referred to as Web-based learning, provides students with new choices, greater flexibility, and increased opportunities.

Researchers and educators alike assert that the online environment facilitates communications and academic feedback as well as improves the learning experience. Concurrent with this debate, is a growing interest in student characteristics, specifically gender, that would likely influence receptivity to particular instructional strategies and influence online learning effectiveness (Rovai and Baker, 2005). Gender disparity in students' abilities and attitudes toward online learning has received considerable interest among researchers (Chen and Tsai, 2007). Many studies have suggested that gender can determine students' use of online learning (Yee, et al., 2009).

A student's affective domain has been the focus of commentary throughout educational research because of the assumed relationships between attitudes and other variables such as academic achievement (Simpson, 1994; Koballa, 1988). Ajzen (1980) argued that the most important reason for studying attitudes is the relationship of attitude to behavior. The behavior a student exhibits during the instructional process can be strongly associated with student satisfaction of a course (Arbaugh, 2000).

Proponents of online learning agree that students' attitude toward the online environment is of vital importance in determining student success (Sampson, 2003; Strambi and Bouvet, 2003). More specifically, the importance of technological preparedness, willingness, and the overall mindsets of students has also been acknowledged by educators as playing a crucial role in online learning success (Sanders and Morrison-Shetlar, 2002). On the other hand, critics assert that there is very little evidence to guarantee that student attitude affect learner outcomes (Maeroff, 2003; Mueggenburg, 2003).

While the subject of online learning has garnered a number of studies, research regarding student perception and attitude towards the online environment is limited. The current study addresses this shortcoming by exploring gender differences based on perceptions and attitudes of those who have taken online courses as well as those who are potential students for these courses. Thus, the following hypotheses are proposed:

**H1:** *There are no significant differences between gender regarding the perceptions of and attitudes toward the online environment.*

**H2:** *There is a significant difference between gender regarding the perceptions of and attitudes toward the online environment.*

## LITERATURE REVIEW

A review of the academic literature illustrates that although research has been conducted in this particular area of study, most of the academic contributions have focused on the perceptions and attitudes of students who have experienced online education firsthand.

Wen and Tsai (2006) investigated university students' attitudes toward and perceptions of peer assessment and online peer assessment. A 20-item survey instrument was administered to 280 students in Taiwan and subsequently revealed that male students had more positive attitudes toward peer assessment than females---The survey consisted of four subscales, Positive Attitudes, Online Attitudes, Understanding-and-Action, and Negative Attitudes were extracted and reliabilities were calculated. The online PA was viewed as a technical tool to facilitate assessment processes, rather than as a learning aid.

The purpose of the study conducted by Tekinarslan (2009) was to investigate Turkish undergraduate students' perceptions of the Web as a learning tool based on gender, socio-economic background, and Web experience. A questionnaire was distributed to 741 students (331 males and 391 females) from various disciplines at Abant Izzet Baysal University. The findings indicated significant differences based on gender, socio-economic background, and Web experience. Significantly higher scores were derived from students with higher socio-economic backgrounds, from male students compared to female students, and from students with higher Web experience.

The majority of the studies indicate female domination in terms of perceptions of and attitudes toward the online environment. Rovai and Baker (2005) examined the differences in social community, learning community, and perceived learning between female and male students in 12 online graduate education courses. The study participants consisted of 162 females and 31 males. Data was collected using an online survey that included the Classroom Community Scale, the self-report measure of perceived cognitive learning and various demographic questions regarding gender, ethnicity, and age. The results revealed that females (a) felt more connected to other students in their courses, (b) felt that their online learning experiences were more aligned to their educational values and goals, and (c) perceived they learned more than their male peers.

Chen and Tsai (2007) explored gender differences of college students' attitudes toward Web-based learning in Taiwan. They developed a Web-based Learning Attitude Survey that consisted of five scales: access, social structure, content, pedagogy, and community relationship toward Web-based learning. The survey was administered online to 1,866 Taiwanese university students (940 males and 926 females). The results point to a significant gender difference in social structure, content, and community relationship involved in Web-based learning. Additionally, females showed more favorable attitudes than males regarding (a) the impact of socioeconomic status on student's performance of Web-based learning and (b) the helpfulness and variety of the content for Web learning.

Using a 2x2 factorial design, Chyung (2007) investigated gender and differences in online behavior, self-efficacy and academic performance in online environments. The participants included 81 students enrolled in "Introduction to Instructional and Performance Technology" masters course at a mid-sized university located in the northwestern region of the United States. The study was conducted using both online and face-to-face sections of the course and span from fall 2004 to spring 2006. The results indicated a significant difference with (a) older students posting more online messages, (b) female students improving their self-efficacy and scoring significantly higher on final exam than male students, and (c) younger male students and younger female students scoring significantly different from each other on the final exam.

Dobbs, et al. (2009) analysis focused on gender differences in perception between students who had taken online courses and those who had not. Data were collected from 280 students enrolled in a criminal justice course at a large 4-year institution located in the Southwest. Of the 280, 180 were enrolled in the traditional on-ground format while the remaining 100 were enrolled in the online version of the course. The results indicate that there were differences in perceptions by online course experience for the total sample and online courses mattered slightly more for females than for males with more significant results for the former group.

Several studies showed that no gender differences were detected when participants are involved in various online activities. Lunan, Fung and Atan (2008) investigated the gender disparity in Internet usage and the attitudes among 152 student teachers (80 females and 72 males) enrolled at the Faculty of Educational Studies, University of Putra Malaysian. The survey results revealed no gender disparity in Internet usage; the female student teachers were found to spend as much time using the

Internet as their male counterparts. The results also revealed that the students exhibited positive attitudes toward the Internet regardless of gender.

Naqvi and Ajiz (2006) explored gender differences in attitudes toward WebCT used as a supplementary learning tool in an "Introduction to Computers in Business" course at Sultan Qaboos University. The population sample consisted of 71 students (37 males and 34 females) and data was collected using a questionnaire assessing accessibility and attitudes toward WebCT. The results showed no significant difference in the overall perception and male and females students towards the WebCT as a tool for learning.

Yukselturk and Bulut (2009) conducted a study in which a self-reported questionnaire was used to analyze gender differences in a self-regulated online learning environment with respect to motivational beliefs, self-regulated learning components and achievement. The study included a convenience sample of 145 students (101 males and 44 females) enrolled in an online computer programming course at Middle East Technical University in Ankara, Turkey. The authors found that there was no statistically significant mean difference between female and male students with respect motivational beliefs, self-regulated learning components and achievement.

Lin and Overbaugh (2009) examined whether gender has an influence on learners' preferences for synchronous or asynchronous modes of computer-mediated communication. The participants were a convenience sample of 80 teacher-education students enrolled in a medium-size 4-year public university in the United States. Eight-five percent (151) of the participants were female and 15% (29) were male and were randomly assigned to 1 of 13 hybrid sections of a foundations course. Cross tabulations showed no significant difference between gender and choice of discussion modes (synchronous and asynchronous). Additionally, a chi-square test indicated that a much larger proportion of the participants preferred the asynchronous format over the synchronous; yet, gender was not a factor influencing their decision.

## **METHODOLOGY**

The purpose of this study is to assess students' perceptions of and attitudes toward the online environment. The population sample includes students from two historically Black universities, Fayetteville State and Tennessee State Universities. Fayetteville State University (FSU) is a constituent institution of the University System of North Carolina. Founded in 1867, FSU is located in Fayetteville, North Carolina and is the second-oldest public institution of higher learning in the state. It serves a student population of approximately 5,300 with a student body that is 73% Black, 18% White, and 4% Hispanic. Tennessee State University (TSU), located in Nashville, Tennessee, was founded in 1912 as a comprehensive urban, land grant institution. TSU serves a student population of 8,254 where 74% are Black, 22% are White, and 4% are reported as other.

The current study spans a period of 3 years beginning fall 2007 through spring 2009. The populations studied at both institutions were sophomore business students enrolled in their institutions' respective microcomputer applications courses. The instructor, who taught all the courses used in this study, is co-author of this research article and holds a doctorate in Instructional Systems Design with extensive pedagogical research in the area of computing.

The survey instrument utilized was identical at both institutions and contained a mixture of Likert-scale, multiple choice, and yes/no questions. The instrument was pilot tested at two historically Black universities on a group of freshmen students enrolled in freshmen orientation courses who were not included in the current study. There were 748 participants, of which 34% were males and 66% were female. The Cronbach's alpha reliability coefficient for the pilot study was recorded for the 31 Likert scale questions at .861, which is considered a "good" rating by social science standards. The data collected for the study were analyzed using frequencies and one-way ANOVAs to determine the distribution of responses and to determine whether there were significant differences between gender. For data analyses, the Statistical Package for Social Sciences (SPSS) was used with the significance level of  $\alpha=.05$ .

## **FINDINGS**

There were 156 students who participated in the study, 102 (65%) enrolled at FSU and the remaining 54 (34.6%) enrolled at TSU. Of that number, 71 (45.5%) were male and 85 (54.5) were female. The majority of the study participants were between the ages of 17-21 (67.9%) while only 12.2% were between the ages of 22-25; 7.1% were between 26-30; 4.5% between 31-35; and 8.3% were 36 and older. The ethnicity breakdown consisted of the following: 17 (10.9%) African; 114 (73.1%) African American; 2 (1.3%) Asian; 18 (11.5%) Caucasian; 2 (1.3%) Hispanic; and 3 (1.9%) listed other.

The analyses for this study were divided into two phases. Phase 1 utilized frequency distributions to determine the number of responses for each survey question by gender. Phase 2 employed the One-Way ANOVA statistic to test the null hypothesis.

During phase 1, Likert scale questions were instituted to determine the extent in which students were amenable to the online environment using the following scale: 5=strongly agree, 4=tend to agree, 3=hard to decide, 2=tend to disagree, 1=strongly disagree. Table 1 represents responses based on gender which indicates that the majority of female students (42.4%) strongly agree with the statement *"I prefer the traditional face-to-face course that uses Blackboard as a supplement"* while male students (32.4%) strongly agree with the statement *"I am comfortable reading on a computer screen"*. On the other end of the scale, the majority of female students (56.5%) strongly disagreed with the statement *"I would prefer my lecture notes and handouts to be sent to my cell phone"* while male students (41.4%) strongly disagreed with the statement *"I prefer fully online courses to face-to-face"*.

**Table 1:** Students' Perceptions and Attitudes Toward Online Learning

Activities	Strongly disagree (1)		Tend to disagree (2)		Hard to decide (3)		Tend to agree (4)		Strongly agree (5)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
An online course provides an adequate level of interaction among faculty & students.	(12) 16.9%	(14) 16.5%	(18) 25.4%	(19) 22.4%	(26) 36.6%	(21) 24.7%	(11) 15.5%	(20) 23.5%	(4) 5.6%	(11) 12.9%
I plan to take a fully online course in the future.	(21) 29.6%	(28) 32.9%	(13) 18.3%	(15) 17.6%	(17) 23.9%	(18) 21.2%	(16) 22.5%	(15) 17.6%	(4) 5.6%	(9) 10.6%
I prefer fully online courses to face-to-face.	(29) 41.4%	(42) 50.0%	(17) 24.3%	(22) 26.2%	(14) 20.0%	(11) 13.1%	(9) 12.9%	(6) 7.1%	(1) 1.4%	(3) 3.6%
I prefer the traditional face-to-face course that uses Blackboard as a supplement.	(0) 0%	(1) 1.2%	(2) 2.8%	(5) 5.9%	(13) 18.3%	(10) 11.8%	(34) 47.9%	(33) 38.8%	(22) 31.0%	(36) 42.4%
I prefer taking exams online rather than pencil/paper tests.	(2) 2.8%	(14) 16.5%	(7) 9.9%	(16) 18.8%	(27) 38.0%	(24) 28.2%	(20) 28.2%	(15) 17.6%	(15) 21.1%	(16) 18.8%
I would rather submit my assignments online.	(7) 9.9%	(13) 15.3%	(10) 14.1%	(12) 14.1%	(16) 22.5%	(26) 30.6%	(24) 33.8%	(16) 18.8%	(14) 19.7%	(18) 21.2%
I would prefer my lecture notes and handouts to be posted on the course website.	(2) 2.8%	(6) 7.1%	(2) 2.8%	(5) 5.9%	(16) 22.5%	(17) 20.0%	(29) 40.8%	(29) 34.1%	(22) 31.0%	(28) 32.9%
I would prefer my lecture notes and handouts to be sent to my cell phone.	(27) 38.0%	(48) 56.5%	(8) 11.3%	(18) 21.2%	(18) 25.4%	(13) 15.3%	(13) 18.3%	(2) 2.4%	(5) 7.0%	(4) 4.8%
I would prefer using electronic textbooks regardless of the price.	(18) 25.4%	(29) 34.5%	(16) 22.5%	(20) 23.8%	(23) 32.4%	(29) 34.5%	(8) 11.3%	(2) 2.4%	(6) 8.5%	(4) 4.8%
I would prefer using electronic textbooks if they were significantly lower than paper-based textbooks.	(9) 12.7%	(14) 16.5%	(9) 12.7%	(9) 10.6%	(23) 32.4%	(20) 23.5%	(17) 23.9%	(25) 29.4%	(13) 18.3%	(17) 20.0%
I am comfortable reading electronic textbooks.	(7) 9.9%	(10) 11.8%	(7) 9.9%	(12) 14.1%	(27) 38.0%	(31) 36.5%	(22) 31.0%	(25) 29.4%	(8) 11.3%	(7) 8.2%
I am comfortable reading on a computer screen.	(2) 2.8%	(5) 5.9%	(4) 5.6%	(5) 5.9%	(13) 18.3%	(8) 9.4%	(29) 40.8%	(43) 50.6%	(23) 32.4%	(24) 28.2%
I am comfortable reading from my cell phone.	(12) 16.9%	(17) 20.0%	(5) 7.0%	(8) 9.4%	(18) 25.4%	(11) 12.9%	(22) 31.0%	(25) 29.4%	(14) 19.7%	(24) 28.2%
I am comfortable downloading music to my cell phone	(7) 10.0%	(12) 14.1%	(8) 11.4%	(9) 10.6%	(15) 21.4%	(11) 12.9%	(21) 30.0%	(21) 24.7%	(19) 27.1%	(32) 37.6%
I am comfortable downloading course material to my cell phone.	(16) 22.5%	(36) 42.4%	(19) 26.8%	(21) 24.7%	(16) 22.5%	(17) 20.0%	(9) 12.7%	(6) 7.1%	(11) 15.5%	(5) 5.9%

The survey also included a range of questions that looked at students' online activities such as methods for seeking information and conducting research, library usage, and experiences with online databases and digital libraries. The second set of data

questions required students to determine the likelihood in which they would go online to perform specific activities using the following Likert scale: 5=almost certain, 4=likely, 3=somewhat likely, 2=not very likely, 1=not at all likely. As displayed in table 2, the majority of female (47.1%) and male (43.7%) students were almost certain of using the online environment to send and receive e-mail messages. Quite the contrary is representative of those activities (wiki collaboration and blogging) that female (59.5%) and male (52.1%) students, respectively, would not at all likely perform online.

**Table 2:** Students' Responses Regarding their Online Activities

Activities	Not at all likely (1)		Not very likely (2)		Somewhat likely (3)		Likely (4)		Almost certain (5)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Academic-related activities	(4) 5.6%	(2) 2.4%	(8) 11.3%	(3) 3.6%	(11) 15.5%	(19) 22.6%	(25) 35.2%	(37) 44.0%	(23) 32.4%	(23) 27.4%
Blogging	(37) 52.1%	(44) 53.0%	(18) 25.4%	(20) 24.1%	(6) 8.5%	(6) 7.2%	(7) 9.9%	(7) 8.4%	(3) 4.2%	(5) 6.0%
Burning CDs	(16) 22.5%	(21) 25.0%	(10) 14.1%	(12) 14.3%	(19) 26.8%	(22) 26.2%	(11) 15.5%	(10) 11.9%	(15) 21.1%	(19) 22.6%
Download music	(11) 15.5%	(15) 17.6%	(8) 11.3%	(14) 16.5%	(14) 19.7%	(15) 17.6%	(15) 21.1%	(21) 24.7%	(23) 32.4%	(20) 23.5%
Download movies	(21) 29.6%	(40) 47.6%	(15) 21.1%	(20) 23.8%	(14) 19.7%	(6) 7.1%	(7) 9.9%	(7) 8.3%	(14) 19.7%	(11) 13.1%
E-mail messaging	(3) 4.2%	(5) 5.9%	(7) 9.9%	(3) 3.5%	(18) 25.4%	(11) 12.9%	(12) 16.9%	(26) 30.6%	(31) 43.7%	(40) 47.1%
Instant messaging	(17) 23.9%	(26) 31.0%	(15) 21.1%	(18) 21.4%	(14) 19.7%	(12) 14.3%	(13) 18.3%	(11) 13.3%	(12) 16.9%	(17) 20.2%
Online gaming	(26) 36.6%	(37) 44.0%	(13) 18.3%	(14) 16.7%	(9) 12.7%	(13) 15.5%	(6) 8.5%	(8) 9.5%	(17) 23.9%	(12) 14.3%
Online shopping	(21) 30.0%	(25) 30.1%	(10) 14.3%	(13) 15.7%	(21) 30.0%	(20) 24.1%	(7) 10.0%	(11) 13.3%	(11) 15.7%	(14) 16.9%
Reading newspapers	(13) 18.6%	(17) 20.0%	(13) 18.6%	(17) 20.0%	(18) 25.7%	(23) 27.1%	(16) 22.9%	(17) 20.0%	(10) 14.3%	(11) 12.9%
Social networking	(10) 14.1%	(14) 16.7%	(6) 8.5%	(5) 6.0	(8) 11.3%	(10) 11.9%	(20) 28.2%	(16) 19.0%	(27) 38.0%	(39) 46.4%
Web surfing	(2) 2.8%	(9) 11.0%	(8) 11.3%	(3) 3.7%	(14) 19.7%	(20) 24.4%	(21) 29.6%	(24) 29.3%	(26) 36.6%	(26) 31.7%
Wiki collaboration	(29) 40.8%	(50) 59.5%	(16) 22.5%	(17) 20.2%	(13) 18.3%	(6) 7.1%	(5) 7.0%	(6) 7.1%	(8) 11.3%	(5) 6.0%
Visiting libraries, journals, databases	(13) 18.3%	(12) 14.1%	(18) 25.4%	(14) 16.5%	(16) 22.5%	(26) 30.6%	(14) 19.7%	(19) 22.4%	(10) 14.1%	(14) 16.5%
Visiting celebrity websites	(34) 47.9%	(31) 36.5%	(20) 28.2%	(23) 27.1%	(10) 14.1%	(11) 12.9%	(4) 5.6%	(14) 16.5%	(3) 4.2%	(6) 7.1%
Visiting news websites	(13) 18.3%	(12) 14.3%	(13) 18.3%	(12) 14.3%	(16) 22.5%	(31) 36.9%	(18) 25.4%	(22) 26.2%	(11) 15.5%	(7) 8.3%

Finally, students were asked a series of yes/no questions to determine their experiences relating to the online environment. As reported in Table 3, the majority of female (70.6%) and male (81.7%) students have used cell phones to access the Internet; yet, 72.6% female and 81.7% male students have never taken a fully online course.

**Table 3:** Students' Responses Regarding their Experiences with the Online Environment

Questions	Yes		No	
	Male	Female	Male	Female
Have you taken a fully online course?	(13) 18.3%	(23) 27.4%	(58) 81.7%	(61) 72.6%
Do you plan to take a fully online course in the future?	(25) 35.7%	(34) 42.0%	(45) 64.3%	(47) 58.0%
Have you ever read an electronic textbook?	(32) 45.1%	(41) 48.2%	(39) 54.9%	(44) 51.8%
Have you ever used your cell phone to access the Internet?	(58) 81.7%	(60) 70.6%	(13) 18.3%	(25) 29.4%
Have you ever used your cell phone to take note for class?	(18) 25.4%	(9) 10.6%	(53) 74.6%	(76) 89.4%

During phase 2, a one-way analysis of variance was employed to determine if there is a correlation between students' perceptions and attitudes toward the online environment and gender. As revealed in table 4, a statistically significant difference was found with students' preference for taking exams online, receiving lecture notes and handouts via cell phones, and downloading course materials to cell phones comfortably. With p values less than .05 (.009, .001, .003, respectively), we reject the null hypotheses and claim that there are gender differences based on the previous statements.

**Table 4:** One-Way ANOVA for Students' Perceptions and Attitudes Toward Online Learning

		Sum of Squares	df	Mean Square	F	Sig.
An online course provides an adequate level of interaction.	Between Groups	2.719	1	2.719	1.867	.174
	Within Groups	224.255	154	1.456		
I plan to take a fully online course in the future.	Between Groups	.004	1	.004	.002	.961
	Within Groups	276.477	154	1.795		
I prefer fully online courses to face-to-face courses.	Between Groups	1.601	1	1.601	1.279	.260
	Within Groups	190.295	152	1.252		
I prefer face-to-face courses that use Blackboard as a supplement.	Between Groups	.263	1	.263	.351	.555
	Within Groups	115.660	154	.751		
I prefer taking exams online rather than pencil/paper tests.	Between Groups	10.221	1	10.221	7.012	.009
	Within Groups	224.472	154	1.458		
I would rather submit my assignments online.	Between Groups	2.040	1	2.040	1.224	.270
	Within Groups	256.652	154	1.667		
I would prefer my lecture notes and handouts to be posted on course website.	Between Groups	.798	1	.798	.685	.409
	Within Groups	179.375	154	1.165		
I would prefer my lecture notes and handouts to be sent to my cell phone.	Between Groups	17.586	1	17.586	11.861	.001
	Within Groups	228.330	154	1.483		
I would prefer using electronic textbooks regardless of the price.	Between Groups	4.954	1	4.954	3.706	.056
	Within Groups	204.530	153	1.337		
I would prefer using e-textbooks if they were significantly lower than paper-based.	Between Groups	.043	1	.043	.025	.874
	Within Groups	262.700	154	1.706		
I am comfortable reading electronic textbooks.	Between Groups	.955	1	.955	.776	.380
	Within Groups	189.353	154	1.230		
I am comfortable reading on a computer screen.	Between Groups	.095	1	.095	.088	.767
	Within Groups	165.822	154	1.077		
I am comfortable reading from my cell phone.	Between Groups	.184	1	.184	.091	.763
	Within Groups	310.483	154	2.016		
I am comfortable downloading music to my cell phone.	Between Groups	.266	1	.266	.141	.707
	Within Groups	287.631	153	1.880		
I am comfortable downloading course materials to my cell phone.	Between Groups	15.073	1	15.073	9.225	.003
	Within Groups	251.613	154	1.634		

As reported in table 5, a one-way ANOVA revealed a statistical significant difference between gender and the following online activities performed, with p values > .05: downloading movies (.024), creating wikis (.029) and visiting celebrity/gossip websites (.041). Thus, we reject the null and further claim that there are differences between males and females with respect to the aforementioned online activities performed.

**Table 5:** One-Way ANOVA for Students' Responses Regarding their Online Activities

		Sum of Squares	df	Mean Square	F	Sig.
Academic activities	Between Groups	.651	1	.651	.588	.445
	Within Groups	169.632	153	1.109		
Blogging	Between Groups	.486	1	.486	.245	.621
	Within Groups	301.099	152	1.981		
burning CD's	Between Groups	.127	1	.127	.059	.808
	Within Groups	326.557	153	2.134		
Downloading music	Between Groups	2.166	1	2.166	1.052	.307
	Within Groups	317.065	154	2.059		
Downloading movies	Between Groups	11.029	1	11.029	5.173	.024
	Within Groups	326.171	153	2.132		
E-mail messaging	Between Groups	2.136	1	2.136	1.567	.212
	Within Groups	209.839	154	1.363		
Instant messaging	Between Groups	.636	1	.636	.290	.591
	Within Groups	335.531	153	2.193		
Online gaming	Between Groups	3.807	1	3.807	1.605	.207
	Within Groups	362.864	153	2.372		
Online shopping	Between Groups	.059	1	.059	.029	.866
	Within Groups	310.503	151	2.056		
Reading newspapers and magazines	Between Groups	.371	1	.371	.214	.644
	Within Groups	265.177	153	1.733		
Social networking	Between Groups	.097	1	.097	.045	.833
	Within Groups	330.252	153	2.159		
Web surfing	Between Groups	1.351	1	1.351	.933	.336
	Within Groups	218.701	151	1.448		
Wiki collaboration	Between Groups	7.997	1	7.997	4.875	.029
	Within Groups	250.996	153	1.640		
Visiting libraries / journals / databases for research	Between Groups	2.355	1	2.355	1.402	.238
	Within Groups	258.639	154	1.679		
Visiting celebrity/gossip websites	Between Groups	6.329	1	6.329	4.231	.041
	Within Groups	230.357	154	1.496		
Visiting news websites	Between Groups	.008	1	.008	.005	.944
	Within Groups	236.986	153	1.549		

A third and final one-way ANOVA was performed to determine if mean differences exist between gender and students' experiences with the online environment. Whether students have taken fully online courses, whether they plan to take fully online courses in the future, whether they have ever read an electronic textbook or whether they have used the cell phone to access the Internet were all found to be non significant ( $p>.05$ ) indicating that there is not evidence to assert that there is a relationship between gender and students' reported experiences with the online environment. The only statistical significance difference was found to be whether or not students used their cell phone to take notes for class ( $p=.015$ ).

**Table 6:** One Way ANOVA of Students' Responses Regarding Their Experiences with the Online Environment

		Sum of Squares	df	Mean Square	F	Sig.
Have you taken a fully online course?	Between Groups	.317	1	.317	1.773	.185
	Within Groups	27.322	153	.179		
Do you plan to take a fully online course in the future?	Between Groups	.147	1	.147	.613	.435
	Within Groups	35.800	149	.240		
Have you ever read an electronic textbook?	Between Groups	.039	1	.039	.154	.695
	Within Groups	38.801	154	.252		
Have you ever used your cell phone to access the Internet?	Between Groups	.477	1	.477	2.598	.109
	Within Groups	28.267	154	.184		
Have you ever used your cell phone to take notes for class?	Between Groups	.843	1	.843	6.045	.015
	Within Groups	21.484	154	.140		

## CONCLUSION

Differential gender perceptions of and attitudes toward the online environment have been discussed in recent years (Rovai and Baker, 2005; Chen and Tsai, 2007; Yee, et al., 2009). Much of the early research reports that female students tended to express negative attitudes and less confidence towards technology use and computer-mediated learning environments when compared to their male counterparts (Wen and Tsai 2006).

A series of one-way analysis of variances were performed to investigate gender differences in perceptions of and attitudes toward the online environment. As revealed in table 4, a statistically significant difference was found with students' preference for taking exams online, receiving lecture notes and handouts via cell phone, and downloading course materials to a cell phone comfortably. The frequency analysis reported in table 1 reveals that male students have a stronger preference for taking online exams compared to females. In contrast, female students were less amenable to receiving lecture notes and handouts as well as downloading course material via cell phone than male students.

The results of the ANOVA expressed in table 5 revealed that gender differences were found with respect to downloading movies, creating wikis and visiting celebrity/gossip websites. The frequency analysis reported in table 2 showed a larger percentage of female students were strongly in disagreement with downloading movies and creating wikis compared to males; while a larger percentage of male students were strongly in disagreement with visiting celebrity websites compared to females.

The final ANOVA confirmed a non-significant difference with students' experiences regarding online courses, electronic textbooks and Internet access via cell phone. Specifically, there were no gender differences with regard to whether students have taken an online course, whether they plan to take an online course in the future or whether they have ever used the cell phone to access the Internet. In other words, female experiences regarding the online environment were comparable with male experiences. The opposite holds true for students' experiences for using cell phones to take notes for class with the majority of female students reporting "no" compared to the majority of male students reporting "yes".

Overall, the data presented herein seems to indicate that gender matters in terms of perceptions of and attitudes towards certain online activities. Clearly, the online environment has its place in higher education and for some provides a viable choice and enriching experience.

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# **E-BUSINESS EDUCATIONAL PROGRAM ENDURANCE: EXPLORING CURRICULA**

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## **ABSTRACT**

*E-business educational program survival has not been easy: evidence suggests that student interest in e-business majors dropped dramatically after the dot-com bust (Scott, 2001). This study drew on previous research to identify e-business master's programs that have survived the past decade. The curricula of these programs were tracked from the years 1999 and 2000 to 2010. Data were collected from college and university web sites. Required courses were categorized according to their apparent emphasis on business, e-business, or technical content. Data were analyzed using repeated measures ANOVA. Results suggested that requirements for business coursework increased over the decade studied while, on average, required non-technical e-business courses decreased. Findings are consistent with literature on e-business success drivers that has identified non-technical business activities, such as strategic positioning and customer service, as critical for enabling e-business to reach its potential.*

**Keywords:** *E-Business; E-Commerce; Master's Degree; Business Curriculum; Education Tracking*

## **INTRODUCTION**

E-business grew rapidly in the late 1990s then steadily expanded since the 2001 dot-com bust (U.S. Census Bureau News, 2009). E-business education has concomitantly grown and evolved as degrees have been introduced, revised, and discontinued (Durlabhji & Fusilier, 2005; 2008; Gunasekaran, McGaughey, & McNeil, 2004; Hemaida, Foroughi, & Derr, 2002). During this turbulence, controversy developed over which topics e-business curricula should emphasize (Durlabhji & Fusilier, 2002). The growing literature on e-business success (e.g., Mukhopadhyay, Mahmood, & Joseph, 2008) has potential to provide empirically based guidance for curriculum content and design. Research has focused on e-business success from the organizational and customer perspectives. Technical factors such as system quality and security as well as technical infrastructure are necessary for e-business success (Brown & Jayakody, 2008; DeLone & McLean, 2004; Eikebrokk & Olsen, 2007; Kumar, Maheshwari, & Kumar, 2004). However, such technical factors may not be sufficient.

Shortly after the dot-com bust, Hirakubo and Friedman (2002) drew attention to the importance of non-technical factors for e-business survival. Subsequent research suggested that e-business success is determined by non-technical organizational and business factors such as strategic vision, information orientation, adequate financing, and IT-business process integration (Eikebrokk & Olsen, 2007; Kim, Song, & Koo, 2008; Korgaonkar & O'Leary, 2006; Lai, Shi, Wang, & Hutchinson, 2006; Weltevreden & Boschma, 2008), information quality and service for customers (Brown & Jayakody, 2008; DeLone & McLean, 2004; Mukhopadhyay et al., 2008), and marketing (Korgaonkar & O'Leary, 2008). Zhu et al. (2006) observed that as worldwide Internet penetration increases, the focus of businesses shifts to advanced integration of e-business technologies, internally and with trading partners. While technology professionals may be dedicated to projects such as web page design and maintenance, those in e-business must have the ability to think creatively about application of new technologies to improve internal operations, customer interface, and to exploit market opportunities.

## **Coursework Emphasis**

Similar to the findings concerning the importance of non-technical factors for e-business success, e-business degree programs appear to include proportionately more non-technical than technical coursework: Burkey (2007) reported that e-business curricula had non-technical emphases in both 2001 and 2005. Gueldenzoph (2006) and Ragothaman, Lavin, and Davies (2007) surveyed educators, employers, and practitioners regarding their perceptions of e-business topics for business education. Findings revealed a consistent emphasis on the importance of non-technical course topics such as ethics,

<sup>30</sup> The author wishes to thank Subhash Durlabhji for help in coding the data and Lekisha Ratliff for assistance with data collection.

advertising, and interpersonal skills. Li, Yen, and Cheng (2008) reported a non-technical emphasis in U.S. e-business master's programs. Business and non-technical e-business topics accounted for 72.37 percent of the courses in these programs.

Conversely, Dhar and Sundararjan (2007) noted a gap between the generally perceived importance of information technology and its presence in business school curricula. The apparent non-technical emphasis may be a response to recommendations of authors such as Hirakubo and Friedman (2002) who cautioned against over-reliance on technical aspects of e-business as a pathway to success. However, evidence is needed concerning the link between educational curriculum characteristics and e-business success.

## Purpose of the Study

A degree program's continuity may be an indicator of its usefulness to students and its contribution to e-business success. Enduring programs are likely to have (a) a reputation for helping students to develop and sustain careers in the field, (b) adapted to the changing demands of e-business, and (c) maintained enrollments through graduates' recommendations and continued attractiveness to potential applicants.

Drawing on previous research, the present study identified e-business master's programs that were established in the early years of e-business education and have endured to the present (2010). The curriculum composition of the enduring programs was examined over time to identify changes that might be associated with the programs' longevity. The present study tracked types of course offerings across the time points studied. Courses were divided into categories following the analyses of Durlabhji and Fusilier (2005) and Li et al. (2008), among others. The main focus of a given course determined the category to which it was assigned: (a) business, (b) technical, (c) non-technical e-business, or (d) technical e-business.

## METHOD

The earliest master's e-business programs were identified by drawing on the data of Durlabhji and Fusilier (2000) for the year 1999 and Durlabhji and Fusilier (2002) for 2000. Data were obtained on the numbers and types of courses in the curricula for these years and for 2001 (Fusilier & Durlabhji, 2003), 2003 (Durlabhji & Fusilier, 2005), and 2007 (Fusilier & Durlabhji, 2010). Programs that endured across all of the time points were then located on their university web sites in January, 2010 and their curricula coded according to course type. This procedure produced two data sets that were analyzed in the present study. One had 1999 as the earliest year and five subsequent data collection years while the other had 2000 as the start year with four subsequent data points. The 2000 start year data set was built because it involved a larger sample size than that for the 1999 start year. A list of the e-business programs that comprised the sample is available from the authors.

## Course Coding

Program curricula were examined according to the (a) number of technical courses included in the program, (b) number of e-business courses, and (c) number of business courses. The e-business courses were further identified as being technical or non-technical in nature. Courses were also classified as required or elective. The purpose of the coding scheme was to provide a general picture of the categories of courses offered in the e-business area and also to explore the extent to which such programs have a technology emphasis.

Course titles and descriptions were used to place courses in the following categories: (1) business, (2) technical, (3) non-technical e-business, or (4) technical e-business. The course titles by themselves were frequently adequate for determining assignment to the categories. In many cases however course descriptions were examined in detail to determine the most appropriate category. For example, a course titled "E-Commerce Strategy," might have a description indicating a focus on strategic considerations in selecting among various e-commerce applications (transaction engines, storefront design, etc.). This description suggests that the course belongs in the *technical e-business* category, rather than the *non-technical e-business* area that the title conveys. The coding scheme's distinction between technical and business content was motivated by the notion that the domain of e-business education is at the interface between traditional business practice and technology. A complete list of programs and course categories is available from the present study's authors. The specific method used for assigning courses to the categories was as follows:

1. **Business:** Regular business offerings found in traditional business programs, such as accounting, finance, etc. with no systems, Internet, e-commerce/e-business, or dominant computer focus, were included in this category. Examples of actual course titles coded as Business include "Cost Analysis", "Administrative Principles", and "Supply Chain Management".

2. **Technical:** Courses that traditional computer information systems programs typically offer and other courses that presume a technical background were categorized as technical courses. Examples include "Database Management," "Practical Computer Architecture," and "Telecommunications Technology."
3. **Non-Technical e-business:** This designation was used for courses that contained e-commerce/Internet in their titles but were non-technical in that they focused on functional areas, such as e-marketing, e-management, and legal issues in e-commerce. Examples of course titles coded as EC-Non-Tech include "Principles of Internet Marketing", and "Legal and Ethical Issues in E-commerce."
4. **Technical E-business:** Courses specifically incorporating e-business/Internet in their titles and also "technical" in nature were classified as technical e-business. Examples include "E-commerce Technology", "Web Programming and Design", and "Computer Security for E-Commerce".

## RESULTS

Four master's degree programs were identified that survived from 1999 to 2010. Eight programs endured from 2000 to 2010. All of the programs in the sample were based in the USA. Repeated measures ANOVA was used to track curriculum variation of required courses in each of the categories over the time points. The repeated measures approach examines measures of the same variables at multiple times. The present study analyzed courses in each category for four programs at six points from 1999 to 2010 and likewise for eight programs from 2000 to 2010.

Required coursework is assumed to have a more consistent effect on student experience than electives which can vary according to individual student choices. For the programs that endured from 1999, within-subjects results suggested statistically significant differences over time for required business courses. See Table 1. Means and standard deviations for required business courses at each time point are presented in Table 2. Results suggest that these e-business programs entailed no required business courses until 2003. After that time, requirements for business coursework were apparently instituted.

**Table 1:** Tests of Within-Subjects Contrasts for Required Business Courses from 1999 onward

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Year	Linear	94.89	1	94.89	9.99	.051
	Quadratic	0.07	1	0.07	0.01	.920
	Cubic	6.24	1	6.24	4.52	.123
	Order 4	7.51	1	7.51	0.59	.498
	Order 5	32.50	1	32.50	1.52	.306
Error(Year)	Linear	28.50	3	9.50		
	Quadratic	18.72	3	6.24		
	Cubic	4.12	3	1.38		
	Order 4	38.03	3	12.68		
	Order 5	64.24	3	21.41		

**Table 2:** Descriptive Statistics for Required Business Courses from 1999 onward ( $n = 4$ )

Year	Mean	s.d.
1999	0	0
2000	0	0
2001	0	0
2003	5.50	6.56
2007	3.00	3.46
2010	5.25	3.10

Repeated measures ANOVA within-subjects results suggested a significant difference for required non-technical e-business courses (see Table 3). Means for the courses are presented over the time points in Table 4. The average number of required non-technical e-business courses appeared to decrease over time.

**Table 3:** Tests of Within-Subjects Contrasts for Required Non-technical e-business Courses from 2000 onward

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Year	Linear	7.81	1	7.81	11.19	.012
	Quadratic	0.44	1	0.44	0.66	.443
	Cubic	0.31	1	0.31	0.24	.637
	Order 4	0.09	1	0.09	0.08	.785
Error(Year)	Linear	4.89	7	4.89		
	Quadratic	4.63	7	4.63		
	Cubic	8.99	7	8.99		
	Order 4	7.64	7	7.64		

**Table 4:** Descriptive Statistics for Required Non-technical e-business Courses from 2000 onward (n = 8)

Year	Mean	s.d.
2000	3.00	1.31
2001	3.00	1.31
2003	2.75	4.89
2007	2.13	1.25
2010	1.88	1.81

## DISCUSSION

The present study found only four master's programs that survived continuously over the past 11 years and only eight over the past 10 years. Previous research attests to the fluctuation in e-business master's level education in North America: 38 new programs were introduced in North America between 2001 and 2003 but from 2003 to 2007, the total number of programs decreased from 107 to 92 (Durlabhji & Fusilier, 2005). Constancy is apparently the exception for e-business master's programs.

Concerning curricula, the present results did not suggest a change over the past decade in required technical or technical e-business courses. However, the number of required business courses in the programs appeared to increase while non-technical e-business courses decreased. Authors such as Levy (2000) and Tassabehji, Wallace and Cornelius (2007) have suggested that the Internet requires new approach to conducting business. This perspective is reflected in the present study's data by the earliest programs that apparently required no traditional business courses. The larger numbers of non-technical e-business courses in the early years also fits with the view of a new paradigm for e-business.

The data collection point following the dot-com bust was in 2003. More business courses were apparently required at that time. The addition of the business courses could have been a response to the notion that e-business failures were caused by a lack of business know-how (Hirakubo and Friedman, 2002; Korgaonkar & O'Leary, 2008). This finding also fits with evidence that e-business curricula include proportionately more non-technical than technical coursework (Burkey, 2008; Li et al., 2008). Also consistent with the trend of grounding e-business in basic business practice, the present data suggested that required non-technical e-business courses decreased during the years following the dot-com bust. This attests to the movement to regard e-business as an inseparable part of the larger business curriculum. Celsi and Wolfenbarger (2001) demonstrated that e-business content can be incorporated throughout the business curriculum by integrating technology and business strategy. But while this approach to curriculum development is possible, it may be rare in reality (Dhar & Sundararjan, 2007).

Shortcomings of the present study should be addressed in future research. The investigation can be expanded to include a larger sample, possibly by constructing data bases with later start years. This would include fewer time points but probably more programs which could improve generalizability of the findings. Other types of courses can be tracked in future research. Given the increasing wave of e-crime, coursework targeted at this problem should be monitored. E-business law, security, and ethics coverage might help future e-business professionals to effectively address e-crime management (Fusilier & Penrod, 2009).

## CONCLUSION

Critics of e-business education contended that such degree programs were simply a means to increase enrollment (Armour, 2001) often with inadequate e-business content (Morrison & Oladunjoye, 2002) or non-standardized core courses (Novitzki, 2002). As many e-business programs have been discontinued, surviving programs may provide guidance and serve as benchmarks to those involved with curriculum design and revision. The present study's findings suggest that the long-term surviving master's degree programs have responded to findings concerning influences on e-business success. Programs should ensure that the necessary e-business content is provided to students. As research findings are emerging on e-business success factors, curriculum evaluation and revision should connect program content to the empirically identified and supported drivers of success.

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# **ELECTRONIC ENHANCEMENTS TO FACE-TO-FACE INSTRUCTION IN POST SECONDARY SETTINGS: REVIEW OF ISSUES AND TRENDS**

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## **ABSTRACT**

*Many of the initial challenges that were part of incorporating new technology to enhance face-to-face instruction still exist today. Technology is an integral part of our current world, especially in the context of education at the Post-Secondary level. Classroom lectures alone are a thing of the past. Enhanced by LMS (learning management systems) students continue the learning process outside of the traditional classroom. But integration and acceptance by faculty and students alike is slow. Instructors are reluctant to learn new technology and spend their own time to develop enticing presentations to draw their students into web-enhanced learning. Course adjunct material that has the potential to improve the students understanding and pedagogical requirements need time to be developed and expertise to create them in eye-catching formats that draw the student to spend the additional time outside the classroom. Is there a benefit, to knowing how faculty and students perceive the LMS tool? How can the institutions support faculty with minimal time available to create these enhancements? The specialized team approach has merit, as does the idea of shared learning objects, one-on-one assistance and peer support. As seen from this literature review the area of technology enhanced face-to-face traditional instruction still has many aspects to explore. The nature of the LMS software as Blackboard that provides a gateway to course web sites linked to in class courses is changing continuously as both the institutions and vendors find out what is working to educate the student best.*

**Keywords:** *Learning Management Systems, Enhancement to Face to Face Instruction, Post Secondary Institutions, Blackboard, One-on-One Mentoring.*

## **INTRODUCTION**

This literature review focuses on the topic of Electronic enhancements to face-to-face instruction building to learning management systems. The literature comes at this broad topic from many angles including: historical use, instructor acceptance, instructor perception of acceptance, enhancement of the student's learning, student acceptance, perception of worth, institutional use, enhancements required for this tool to meet the needs of future learners, and directions for the future.

Overall the focus of this review is to gain some insight into the use of course management system (CMS) or learning management system (LMS) systems as Blackboard and what factors could also affect its acceptance within part-time instructors at colleges.

This literature review is broadly divided into the following subtopics:

- a. Electronic Enhancements
- b. Historical Review
- c. Key tools used within CMS /LMS
- d. Evaluation of key variables affecting acceptance or lack thereof and
- e. Directions for the future

## **ELECTRONIC ENHANCEMENTS**

In the past century, the schoolroom had the well-known slate blackboard, on which teachers wrote out their thoughts and information with chalk. Students recorded their notes on personal sized blackboard tablets, which were replaced by paper bound notebooks. As technology advanced it eventually was incorporated into the classroom. This included the overhead projector, which alleviated or enhanced the use of blackboards. Moving through time to TV instruction in the 70's the classroom was brought to the learner. Distance education and classroom instruction were improved with the introduction of the first personal computers in the 80's. Watson and Watson (2007) state that:

*The history of the application of computers to education is filled with generic terms as computer-based instruction (CBI), computer assisted instruction (CAI), and computer assisted learning (CAL), in which drill and practice programs, sophisticated tutorials and more individualized instruction respectively could be handled. (p. 28)*

From the computer enhanced learning we move to the web in the early 90's, course management tools in the late 90's and early 2000's, evolving into the learning management systems (LMS) we see today (Paulson, 2002, p. 40). Watson and Watson note that "the LMS has its history in another term, integrated learning system, which offers functionality beyond instructional content such as management and tracking, personalized instruction and integration across the system" (p. 28).

Technological enhancements to learning in general were quite expensive to incorporate into the practice of teaching, often being cumbersome and more time consuming for the instructors. Early TV educational networks, videos and satellite were created at a high price (Paulson, 2002, p. 38). They did however cross borders and provided alternatives to the face-to-face traditional classroom. The advent of the World Wide Web (Internet) provided yet another vehicle for some instructors to extend their accessibility outside of regular class time. It provided a means to bring the materials covered in class to the student in their home, library or elsewhere on campus. The initial use of html (hypertext markup language) and web sites, took time and new technical knowledge on the part of instructors, thus deterring most. Then with Pittinsky and Chasen's Blackboard system in 1997, their software and others in a similar vein helped revolutionize and change the face of classroom and distance education according to Yang (2004). The technology did not aim at replacing classroom instruction, but was designed to complement the activities that occur in the classroom. It provided students with one centralized site or "gateway" on the internet to access course outlines, lecture notes, and reading materials, take tests, hand in papers, and communicate with their classmates, and instructors (Yang, 2004, p. 96). Bradford, Porciello, Baldon, Backus (2007) note that "Blackboard's vision was to provide a user-friendly means by which college professors could put course information, including syllabi, reference sites, and study guides, on the Web" (p. 302).

*Blackboard can be accessed from the Internet at anytime and anywhere and if uploaded, students can retrieve all of their course materials including assignments, lecture notes, slides, Internet hyperlinks, and audio or visual aids. They can submit their assignments as soon as they are complete. (p. 303)*

Bradford et al feel that overall Blackboard is improving communications, organizational and time management skills of students, though it can be harder to learn than expected for both faculty and students. (pp. 304-5).

The family of similar products to Blackboard has come to be known as course management systems (CMS), or learning management systems (LMS), or web-enhanced instruction, computer-enhanced learning or a myriad or of other names (Ballard, Stapleton, Carroll, 2004, p. 198). Other CMS / LMS include WebCT™, eCollege®, WinEcon®, ANGEL® and the Sakai® project (open-source project initiated by Stanford University, Massachusetts Institute of Technology, University of Michigan and University of Indiana – free software to budget-conscious schools (Yang, 2004, p. 97)). Use of CMS / LMS to enhance face-to-face instruction is also referred to as "blended learning" (Irons, Keel, Bielema, 2002, p. 2), or "hybrid" or mixed delivery (Woods, Baker, Hopper, 2004, p. 282). Blended learning meshes the in class instruction with the online asynchronous CMS / LMS environment, with relatively limited technical sophistication required on the instructor and students part (Woods, et al., 2004, p. 282). In general the literature agrees that the original course management system morphed into the learning management system. The latter has more advanced and all encompassing features while being more secure and allowing greater ease of incorporation to the instructor, institution and student (Ceraulo., 2005, p. 6). Through one access point or gateway, entrance to materials is straightforward and available from anywhere with an Internet connection. These technological adjuncts to the traditional classroom are being adopted by a majority of Post-Secondary Educational Institutes in the United States (Ballard et al., 2004, p. 197) along with many in Canada and abroad.

## HISTORICAL REVIEW

Access to Post-Secondary education was initially limited to the traditional classroom environment on campus. In order to bring this level of learning to a larger population unable to attend traditional learning centers, distance education was seen as a way to reach these students. One method of delivery implemented in the 70's was satellite campus sites where curriculum was repackaged and delivered (Paulson, 2002, p. 38). This opened the potential to lifelong learning to more people in assorted locations.

Technology changed and was embraced by off-campus students and faculty, increasing the choices and methodology available for instruction. TV, video, satellite transmission allowed these off-campus sites to come into the home. There was a high cost in creating this type of course ware. Overall the learner gained access anywhere and through correspondence

anytime, including across borders (Paulson, 2002, p. 38). This technology also slipped back into the traditional classroom. Education was leaving the classroom, at the same time as the world was starting to join the traditional classroom.

The creation of the Internet in the early 1990's in effect dissolved borders and the world became the educational playground of the learner. It provided access not only to course material, but to research conducted by others and posted to the World Wide Web. It allowed contact with diverse people now taking courses whenever and wherever they liked. There were and are drawbacks to the Internet including profusion of non-validated and invalid materials, as well as biased unprofessional statements on topics of any and every type. The latter is a topic for another paper, but it does raise questions. How to access this broad new world of information and misinformation and bring the valid materials back into the traditional classroom? How and why can this access benefit students?

Original instructor participation in course material available on the Internet was limited to the few adventurous souls that embraced new technology and persevered in transferring their ideas into html and accessible web pages. Their students gained access outside the traditional classroom to the instructors prepared notes, announcements, copies of assignments and links to websites, which their instructors felt were helpful. These early sites were unsecured and available to anyone. The student too needed to be as adventurous as the instructor. The Internet was new and early on awkward to access. To make e-learning a part of the evolving educational world there was a need to educate faculty, administrators and students not only in the technologies used, but also in the pedagogical approaches that work in learning at a distance, on campus and within the face-to-face environment (Paulson, 2002, p. 41). Paulson further stated "learner centeredness is one of the keys to making this new hybrid method of learning work for both the student and faculty" (p. 41). To facilitate this or as a result of the need to make the medium available and easier to interface with, individuals / companies / educational institutions created course management systems. CMS provided faculty with "an array of user-friendly tools for rapid publication of course content and management" (Weigel, 2005, p. 55). The downside being that faculty creativity now was forced into the e-learning shells of the packages usually retaining the general classroom presentation formats and not addressing the pedagogical effectiveness and required skills development that the learner within this hybrid system of classroom and CMS required (Weigel, 2005, p. 55).

The CMS evolved. Student need for connection with their peers, and faculty in order to get the full benefit to their learning experience was seen as an integral requirement to the learning process (Salter, Richards, Carey, 2004, p. 208). Learning management systems (LMS) helped to provide some of the tools. It limited the access to the student body of the course, adding a level of security. It allowed communications via discussion groups and chats between students and students, and students and faculty in a contained environment. Yet the LMS allowed interaction with the outside world through the Internet. It still has its limitations.

Continued evaluation of the acceptance and use by faculty and students leads to a better understanding of the requirements that the software must have in order to meet a list of key needs; such as ease of use, accessibility, skill development, interactivity and communications. Where the technology will go is being explored at a variety of institutes as University of Waterloo, and University of Kansas amongst many (Salter, Richards, Carey, 2004, p. 211, Gerdes, Kuhr, 2004, p. 75).

## **KEY TOOLS USED WITHIN CMS / LMS**

In recent years there has been extensive research done on the use of CMS/LMS systems as Blackboard from the perspective of faculty and students. Most has been from the aspect of full-time day faculty and students. Owen and Allardice (2007) cited a study by Stockley that reiterated "there is no proven system to guarantee the painless integration of information and communication technology (ICT), although guidelines do exist" and further cited Bonk, Cummings, Hara, Fishcler & Lee who said that "awareness of these key principles, along with sensitive change management, can make the transition smoother" (p. 179).

There is a learning curve for blackboard that precludes full and timely utility. One-on-one assistance initially may help reduce the steepness of this learning curve (Bradford, Porciello, Balkon, Backus, 2007, p. 305). Kariuki and Duran (2004) note:

*One of the advantages of providing individuals with on-demand learning is that it allows them to immediately apply their newly gained knowledge. Immediate application cements the knowledge gain and makes it far more likely that the knowledge will be retained and used in future. (p. 442)*

Brill and Galloway (2007) found that participants in their study felt "discrete, just-in-time training in the use of newer technologies enabled them to integrate these technologies into their teaching practices" (p. 100).

King's (2007) research and literature review shows that faculty is perceived as being more competent if they use technology and use it smoothly. She implied that when faculty mishandled content they were thought to be less effective than if they had stuck to lectures and use of the whiteboard or chalkboard. This included overuse of PowerPoint™, fumbling with equipment and software, and failing to make good use of course management systems and tools, while being poorly trained (p. 60). Brill and Galloway (2007) found that in their studies key barriers to technology use included "poor classroom environments, lack of or limited availability of equipment, even basic equipment such as overhead projectors" (p. 101). In their study instructors spoke of "having to maintain two sets of facilitation materials in order to adapt accordingly to what specific classrooms had to offer in terms of technology" (p. 102) implying an increase in preparation time. Kotrlik and Redmann (2005) further elaborate that "barriers to integration of technology include: lack of funding and cost, lack of training or expertise, lack of time, access to technology, resistance to change, teachers' attitude, and organizational structure of the adult basic education" (p. 203). Their study showed that time is a major barrier to adult basic educator instructors integrating technology into their teaching. This included time to develop lessons, and to have technology available for students. Other factors acting as barriers, according to Kotrlik and Redmann, include reliability of technology and administrative supportiveness (p. 216). Their study showed that these adult basic educator instructors though given workshops, conferences, college courses, dialogue with colleagues and self directed learning as part of their technology training, continued to feel anxiety about using technology. "As these teachers felt barriers increase, their technology integration decreased, while it increased when availability of student email, connectedness to the World Wide Web and the number of labs increased" (pp. 215-216). Van Woudenberg in her thesis found that the main issues holding faculty back from using technology in their teaching, included "instructor reluctance to learn new technology and spend their own time to develop enticing presentations to draw their students into technology and web-enhanced learning. This requires training so that the teachers may become confident and skilled users of technology" (p. 15). In her thesis she found that personal time constraints reduced the teacher's motivation to integrate technology into their classroom practice (p. 20). King (2007) felt that to help overcome the barrier of time constraints faculty should, "set small goals, develop small chunks of content, conduct small(er) internet searches and use small, rich cases in the classroom – tying classroom instruction to the "real world"" (p. 59).

A review of the literature shows that almost across the board where technology was used as an adjunct to the traditional classroom, faculty used the same features of the LMS. Few ventured to use the more advanced tools available to them. "A survey of Canadian and American colleges and universities found 69% of faculty used web content for lecture preparation, but only 15% used online group work for discussion to optimize learning outcomes (McGraw-Hill Ryerson, 2003)" (as cited in Salter, Richard and Carey, 2004, p. 208). In other research by Gerdes and Kuhr (2004), they found that "Blackboard was used extensively to post documents, pictures, graphics, web site links, videos, assignments and other information" (p. 73). Posting materials for student access was selected by 97% of respondents as the most widely used tool / feature. Their study found "few faculty used the more advanced tools and features of Blackboard, including communication (22%) and assessment (32%)" (p. 73). Faculty in Gerdes and Kuhr's study were motivated to use blackboard because they felt it improved student learning (75%) and enhanced their own teaching and technology skills (63%). The lack of time was the main reason for not doing more with Blackboard (61%) and the lack of technical expertise a close second with most faculty wanting to learn how to "incorporate instructional activities that increase the interactivity of student to student, student to instructor and student to content" (p. 73).

The different courseware products provide basically the same features. Whether Blackboard, WebCt, or others. Announcements, document posting, drop boxes to allow assignment submission, gradebooks, course information and course calendar are a part of the software tools available (Ballard, Stapleton, Carroll, 2004, p. 199). Discussion boards, chat sessions, virtual classroom features are available as well as other more advanced tools though as yet used by only a few. These features can assist according to Bradford, Porciello, Balkon and Backus (2007) to meet the needs of the various learner styles: as the "auditory and verbal learner who prefers words, written language and spoken explanations" whereby "lecture notes, audio recordings, animations, learning activities, case studies and video clips" (p. 307) can all be incorporated into blackboard; Reflective learners "who prefer to reflect, observe, view or watch" (p. 307) and see the answers, can review explanations given on blackboard, discussion boards and gain clarification from the instructor; the visual learner who "prefers diagrams, flowcharts, timelines, pictures, films and demonstrations" (p. 307) finds that these can be linked to blackboard content sites. The fourth type of learner, they discuss, is the one who learns best by doing. "Simulations, role play, creative movements dramatization, and hands on projects" (p. 307) can be included as simple games, crossword puzzles, etc. Bradford et al. found that Blackboard as a tool "provides the opportunity for students to use the familiar environment of the internet for educational purposes" (p. 312).

## EVALUATION OF KEY VARIABLES AFFECTING ACCEPTANCE OR LACK THEREOF

Kotrlik and Redmann (2005) state that, "learners need to acquire lifelong-learning skills and the ability to cope with constantly changing workplaces. Technology must be used to support instruction, and adult learners should be able to use technology as

an important tool to meet their learning needs" (p. 202). Masoud (2005) found that regardless of the policies of an organization, faculty members vary greatly in their use of computer technology in instruction, some embrace the new technology readily and look for opportunities to learn more about and implement it in their teaching whereas others refuse to use it (p. 16). He further found that "teachers are more willing to implement computer technology in instruction when they were convinced that its use enhances their teaching and student learning, and they are given adequate support" (p. 30).

Salinas (2006) suggests that "in order for instructional technology to be widely accepted and used by faculty, the value of this technology to improve classroom instruction has to be proven" (p. 652). Faculty are often unclear on the "pedagogical principles that should underlie the incorporation of these new technologies" (p. 653). "In most cases, the computer is used as a fancy substitute for the overhead projector, and the Internet as an expansion of the school library, severely limiting the educational value of the technology" (p. 653). Salinas reflects that this is partly due to the introduction of "new innovations into old education models" (p. 653) and therefore there is a need "to shift from the lecturing model to a mastery model" (p. 653) that is more student focused. Salinas charts how instructional objectives are directly linked both to the role of the instructor in the classroom and the function technology can play. At one end of the spectrum is faculty, that function as lead or expert in the classroom who tend to lecture, demonstrate and assign tasks and tend to use PowerPoint™. At the other end of the chart are faculty that tend to facilitate by guiding, delegating, providing resources and support that tend to use more collaborative and creative technology including threaded discussions, instant messaging and authoring software. Faculty in the middle moving from one end of the spectrum to the other are seen as co-learners, managers, coordinators of the educational process, and tend to use interactive software as browsers, email, and simulations (p. 654).

Anderson (2003) in his study found professors felt better organized and brought a new level of interaction among the students and between the students and themselves (p. 22). The pattern indicated that Blackboard and technology in general is perceived to improve communications, foster community, increase productivity and increase the expectations of students and faculty (Anderson, 2003, p. 22, Morgan, 2003, p. 2). Anderson's research suggests that faculty feel the LMS provides a user-friendly intuitive tool, while providing freedom and flexibility for access to both the faculty and perception for the student. It is perceived by faculty to increase communication, provide new challenges and opportunities, increase productivity, increase discussion and sense of community while providing an intrinsic motivation to the students. Overall the perception by faculty is that it is a very useful tool with useful features (pp. 9-10). In another faculty study Woods, Baker, Hopper, (2004) found the faculty perceived that the LMS tool assisted students in their learning. They tended to minimally use the features of the software available primarily posting course syllabi, sending email and posting grades. The majority of faculty surveyed in the study did not use the interactive functions of Blackboard as virtual office, collecting/returning assignments or online discussion groups. The faculty with more experience with Blackboard tended to use it more and felt they were more effective instructors by using the tool to supplement their classroom activities. Some interesting perceptions on the part of the faculty came out of this particular study. Faculty felt that this tool in an in class mode did not need to deliver the same interactive experience of an online course. The perception was that if students wanted such they would have signed up for an online course. As well faculty did not perceive that this mode of learning fostered additional social networks than experienced and set up between students in the class (pp. 10-11).

Influence of peers' recommending use of a CMS and pressure or persuasion of campus administration along with availability of training helped promote adoption of CMS into faculty teaching according to a study done by Morgan (2003, p. 2). Faculty in her study increased use when they saw increased need for technology in their teaching. As they used the CMS they uncovered other ways to incorporate the technology. Discussion with colleagues and practical examples in training sessions helped uncover other potential applications (p. 3). Some of the faculty within Morgan's study decreased their use of a CMS as they found "the technology was time consuming, inflexible and difficult to use" (p. 3). Morgan found that:

*even in face-to-face classes enhanced using a CMS, the use of and support required by the technology can make faculty feel that they do not control important parts of their teaching environments and that they are subject to the vagaries of technology administrators and technology reliability. (p. 5)*

Wernet, Olliges, and Delicath (as cited by Ballard, Stapleton and Carroll, 2004) found "that students' satisfaction with the use of course Web sites depends on adequate access to the Web site, more so than with prior exposure to Web-assisted instruction" (p. 199). Further Ballard et al. cite Osika and Sharp in their findings that though students are coming to college with more computer skills they "perceive that they do not have the technical computer skills that they need to be successful in Web-based learning environments" (p. 199). Ballard et al.'s research further found that students felt the software increased their communication, interest and learning, facilitated independence and self-motivation. Some of the features of the software that students seemed to appreciate were the 24 hour access to course information, announcements, e-mail and in a format most students are familiar with as well as communications with students and instructors outside class time. Additional advantages of

the software was perceived to be that it saves paper as material is posted to the site, it provides access anytime, and extends learning outside the classroom (p. 200-201). Some of the disadvantages that came to light included the time required to develop and maintain sites by instructors, and that instructors were still maintaining parallel systems for grading and copying of assignments to hand back (pp. 201-202). Overall however the study supported previous research that indicated positive student attitudes toward course Web sites (p. 207). The results of the study also suggest that “students may have a perceived greater learning with the use of Blackboard” (p. 209).

From another angle research has been done on whether mandatory versus optional use of a LMS by students has an affect on acceptance, use and perception of usefulness when used as an enhancement to face-to-face instruction. Garland and Noyes (2004) state “mandatory use implies that the package is an integral part of the course” (p. 271). They found that students in this situation seemed to perceive that the learning material was of an appropriate quality and had relevance to their learning. They also found that the perception was that the material was approved by the instructor. Optional use students viewed the materials as a supplement to their course, and had lower motivation to use it, partly because reduced stipulation by the faculty to use the material and partly the lack of encouragement, as well as having difficulty in quantifying the returns for their efforts (p. 271). An interesting observation by the authors was that those students who responded “felt this form of learning should not replace standard lectures” (p. 264). Computer-based learning was viewed as a supplement to their course work (p. 264). Yaghi and Abu-Saba (cited by Garland and Noyes) found that “the instructors’ attitudes have also been shown to play a major role in influencing student attitudes”, “with encouragement from lecturers an important motivation for students using computer-based learning packages” (p. 265).

In yet another study by Iron, Keel and Bielmena (2002), it indicated that “increased use of the Blackboard LMS implemented as a learning portal, resulted in higher estimates of learning activity, higher degrees of satisfaction, and higher student/teacher communication than in courses not using the portal” (p. 11). The authors felt that “the more students that are exposed to learning portals like MyGateway, the higher their estimation of its positive affects” (p. 11). The authors felt that similar findings would be “likely in any learning portal implementation when students get accustomed to using it especially when the course blends traditional classrooms with asynchronous, computer-mediated learning portals” (p. 11).

## DIRECTIONS FOR THE FUTURE

The directions for the future are multilayered. They include direction for the software, direction for training of faculty in designing and using the CMS /LMS software and direction for course creation that attains the most beneficial learning for the students.

Blackboard over the years has evolved through multiple versions and currently is nearing completion of its NG version or Blackboard 9 as the company calls it (Blackboard Inc., 2009). When this rendition of the software is finished it will bring Blackboard into the true LMS realm as defined by Watson and Watson (2007). This newest version will include the updated Grade Centre along with a significantly enhanced user interface, Safe Assign for the detection of copied work, blogs and journals and social networking software. It will allow for the coexistence of open source and other CMS / LMS applications allowing instructors more flexibility with the potential to choose the platform most suited to their teaching style, while remaining within their institutions networked gateway (Blackboard Inc. 2009).

How can these CMS / LMS tools best be used? Gerdes and Kuhr at the University of Kansas (2004) summarized in their research paper an experiment that teamed “experts” with instructors in redesigning their course content on Blackboard sites. Their study found that these revamped Blackboard sites were received positively. The experts did much of the work and thus did not impinge on the instructors time significantly, but conceptually achieved a far better learning product for the students making the content more interesting and relevant. It will be interesting to see studies on the results of research on the perception that faculty and students have once students have taken these revamped courses. The design team felt the “make-over” was an innovative and successful project based on the instructor willingness to experiment with new Blackboard tools, including communication and assessment features and the fact that experts were available to assist through the design and implementation process. The perception viewed by the authors was that faculty were willing to explore other software to integrate into blackboard in order to enhance content delivery and create more interactive exercises and activities for their students (p. 75).

Weigel (2005) summarizes that the CMS is evolving with the need for additional focus on learner requirements and less on simply a tool for posting material online and providing access to student grades. The author highlights, through literature review and reflection, that a “capabilities approach to learning could provide us with a forceful and intuitive means for envisioning what the next-generation CMS might look like” (p. 55). The author proposes a heuristic model, presenting four learner-focused

capabilities and four capabilities that could be incorporated into new and improved versions of the CMS. The Learner-centered capabilities include: critical thinking, self-confidence, peer learning, and knowledge-management. Whereas changes to the CMS include CMS curricular capabilities of: discovery-based learning, 360 degree out-of-the-course, knowledge asset, and teach-to-learn (p. 55). Weigel feels no single CMS currently or in the next revision will have all the required features to fully prepare and achieve what the author feels are key student learning capabilities (p. 66).

University of Ottawa's Germain-Rutherford and Blanchette in an internal presentation (2004) discussed the potential for development of a peer training model for the integration of technology into teaching. Their hope was to reach a larger number of faculty members, and positively impact their teaching assisting faculty members to become autonomous, while creating support structures in-line with university culture. In their study they found that various teaching traditions exist and with this the university culture has lead to a differentiation in PD and different support. They hoped to create a community of practice whereby participants would recognize colleagues working on similar issues, share their experience and better "understand that e-learning is a process with a life-cycle." (slide 17). McGraw Hill-Ryerson carried out a survey in 2006 on the role of technology in teaching. They found that faculty in 2006 were less concerned with access to technology resources, equipment and facilities for both students and teachers, and more concerned with PD focused on planning for, integrating and implementing technology into their teaching. The survey participants indicated that "additional financial support and more release time will be needed as additional challenges will be faced between work and time devoted to adapting new technologies into their teaching, with the anticipation to an improved teaching experience" (p. 8). Interestingly the more pessimistic teachers seem in the minority preferring traditional face-to-face teaching with human interaction. A key element for not adopting technology is the fear of an inferior teaching experience, with lower standards, class sizes that are too large and a feeling that technology is not effective or suitable for the face-to-face interaction (p. 9). The one technology widely endorsed by university/college faculty is email which the survey indicated enhances teacher student communication. In reference to technology in general some of the quotes given in the McGrawHill-Ryerson study include:

*It is commonly believed that teachers will change from "lecturer" to one of facilitator to "guide on the side." (p. 9) We will expect faculty members to offer on-site courses that have web support. . . . They will be expected and need to use more current information technologies. . . . With so much extra work being piled on it, I'm sure we will have to rely on more efficient ways to educate (e.g., Blackboard). . . . They will need to understand how the brains of the new generation work. We have laptops in the classroom in many programs and many "old timers" have trouble with the students who multi-task while in class, using their laptops during lectures. . . . These students are coming to us with shorter attention spans yet an uncanny ability to multi-task. . . . (p. 10). Faculty are not fully appreciating that the use of online materials should lead to developing different materials for each student relative to their background, ability and interests. . . . The wide range of student needs and learning styles will also become more of a factor, with the need to provide "something for every learner" in classes. The results are giving students frequent opportunities of critiquing themselves and of allowing for and encouraging more personal responsibility in terms of analysis, self correction and pacing. (p. 11)*

Salter, Richards, Carey, (2004) created a model for use with the University of Waterloo's LMS. Their feeling was that use of a LMS alone in the traditional sense of use to post announcements, post class materials, assignments, and grade book will not enhance the learning achievements of students. From their literature review they found that discussion groups, task completion prior to class would add depth to the knowledge acquired by students. They further feel that the current setup of their LMS without additional model components will lead students through behaviorist / short term knowledge, but not acquisition of long term skills and long term knowledge (pp. 208-209).

## **CONCLUSION**

Many of the initial challenges that were part of incorporating new technology to enhance face-to-face instruction still exist today. Technology is an integral part of our current world, especially in the context of education at the Post-Secondary level. Classroom lectures alone are a thing of the past. Enhanced by LMS students continue the learning process outside of the traditional classroom. But integration and acceptance by faculty and students alike is slow. Instructors are reluctant to learn new technology and spend their own time to develop enticing presentations to draw their students into web-enhanced learning. Course adjunct material that has the potential to improve the students understanding and pedagogical requirements need time to be developed and expertise to create them in eye-catching formats that draw the student to spend the additional time outside the classroom.

Is there a benefit, to knowing how faculty and students perceive the LMS tool? I believe there is. How can the institutions support faculty with minimal time available to create these enhancements? The specialized team approach has merit, as does

the idea of shared learning objects, one-on-one assistance and peer support. As seen from this short literature review the area of technology enhanced face-to-face traditional instruction still has many aspects to explore. The nature of the LMS software as Blackboard that provides a gateway to course web sites linked to in class courses is changing continuously as both the institutions and vendors find out what is working to educate the student best.

This review becomes a stepping stone in research as to where colleges then take technology in their efforts to train the workers of the future, keeping the faculty current while providing part-time students with as many tools as possible to enhance their learning, and keeping part time faculty instep with their full time faculty counterparts.

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# THE RURAL TO URBAN MIGRATION DECISION IN CHINA: AN EMPIRICAL INVESTIGATION

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## ABSTRACT

*This paper explores the determinants of rural to urban migration decision in China. I use Logit models to examine the effect of variant different factors on both individual migration choice and household migration choice. The empirical analysis is based on the data of Chinese Household Income Project (1995). I find that males are more likely to migrate. Age has an inverted-U shaped effect on migration. Marriage has negative significant effect on migration. The rural individuals with professional school and middle professional school educational levels are less likely to migrate. Household head in the family is more likely to migrate. Membership of Communist Party or national ethnic minority has negative effect on migration decision. Individuals with non-farm working experiences are more likely to migrate. In addition, the probability of migration declines as farm income increases. The access to telephone service in the village has significant negative effect on migration. To my surprise, the larger the household size, the less likely to migrate. Finally, some policy implications are derived such as rural urbanization strategy, social facility provision in the rural areas and clear definition of land property rights.*

**Keywords:** Migration Decision, Rural, Urban, Individual Characteristics, Household Characteristics, Human Capital Investment

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## 1. INTRODUCTION

One of the most prominent phenomena in China has been that tens of millions of rural labourers migrate to urban areas since the mid-1980s. Unlike some other developing countries, approximately 70 percent of China's labour force is in the agriculture sectors. Recently, in China's largest cities, for instance, Beijing and Shanghai, it is often estimated that at least one out of five people is a migrant who comes from rural areas. Migrants maintain a close connection with their original rural areas by sending back most of the money earned from the urban job. Many of them go back home for marrying, raising their kids or investing in business in the rural areas. International as well as Chinese experience indicates that the temporary migration generated many social, economic and political issues in the country. "Uncontrolled, large scale population movements are a source of concern for a number of reasons, among which are worries about transportation bottlenecks, urban housing, water, and power shortage, rising crime rates, labour disputes, and difficulties in enforcing China's one-child policy" (Hare, 1999). They are regarded as "blind blow" (*mang liu*) because they leave their farm without definite prospects and "most rural workers on blind job-hunting trips find themselves going here and there for nothing. Some of them cannot find any work and have nothing to live on for a long time." (Ministry of Labour, 1997). Moreover, the largest portions of migrants compose of younger and better-educated people. This may affect agricultural productivity. The agricultural production efficiency and the crop income may decline mainly due to the aged and less educated labourers working on farms in the villages (Chen, Huffman and Rozelle, 2003). It will further threaten China's food security. In addition, the huge flow of the labour force drives unequal regional development and income distribution disparity in China.

However, most of researchers provide positive views on rural to urban migration in China from different economic development perspectives. For example, rural to urban migration is important for efficient allocation of labour resources through labour transfers from low productive to high productive (Knight and Song, 2003). It is known that rural to urban migration could reduce the amount of labour and human capital allocated to agricultural production, but it may possibly boost rural productivity. This perspective, addressed by a recent genre of research, known as the “new economics of labour migration”, suggests that “remittances from migrants allow rural households to overcome credit and risk constraints, enabling them to invest in more productive technologies” (Taylor and Martin, 2001). Because of the large scale of rural to urban migration in China, these remittances have strong potential to achieve a powerful impact on rural income, rural development and social welfare. Rural migration will eventually contribute to the process of China’s economy shifting from agriculture to industry and rapid economic expansion (Taylor and Martin, 2001; Hare, 1999). Moreover, the mobility of skilled workers, economies of scale in manufacturing as well as the declined transport cost lead to a core-peripheral equilibrium pattern of regional economic development in China (Krugman, 1991).

Therefore, it is important to realize the determinants of the migration decision for individuals from rural to urban areas. It has impressive implications for the whole economic development and social welfare of the country because more than 0.9 billion people live in rural China (Chen, 2004). A better understanding of temporary rural-to-urban migration in China could help the policy makers to formulate more reasonable and effective policy regarding this phenomenon and its socioeconomic consequences (Li and Zahniser, 2002). In fact, it is complex to make migration decision for rural individuals in that it is closely related to both individual characteristics (e.g. gender, age, marital status, educational level, the relationship to the household head, membership of Communist Party, national ethnic minority and employment before migration) and household characteristics (e.g. farm income, access to telephone service, household size, expenditure on rural taxes and fees and land holdings). Nevertheless, empirical analysis of determinants of the rural to urban migration in China has been limited “mainly due to lack of data” (Ma, Liaw and Zeng, 1997). Because migration was well controlled by the government so authorities did not include information on migration in the official census until 1990. The “migration” was first introduced in the Chinese population census at that time. However, migration research in China is still at an early stage (Wu and Zhou, 1997). This backwardness is manifested in two ways. One is most researches are not quantitative but remain qualitative. The other is that many migration surveys are made to pursue specific governmental policies instead of being designed for scientific research (Zhu, 2002).

This paper augments the empirical research on the determinants of rural to urban migration decision in China. I focus on the temporary migration of individuals from rural areas who leave their household for at least one month, either to work or to search for work in an urban area. I use a large national data set from the Chinese Household Income Project (CHIP). This data set based on a rural household income survey in 1995, which includes 7998 households and 34,739 individuals covering 19 provinces. It contains information about migration behavior of rural individuals. With these data I estimate an individual-choice logit model and a household-choice logit model to examine the influence of a series of different explanatory variables on the rural to urban migration decision in China. In addition, when I estimate the individual-choice model, I create other two models to examine the determinants of rural to urban migration decision respectively for males and females. The age group in this sample is limited from 16 years old to 45 years old.

Through empirical analysis I find that males are more likely to participate in migration than females. Age has an inverted-U shaped effect on migration. Marriage reduces the probability of migration; in contrast, when males and females are estimated separately, marriage is insignificant for males mainly due to the “bread earner” positions of males in the rural household. The probability of migration has negative relationship with educational levels of professional school and middle professional school for all rural individuals. However, only middle professional school has a significant negative effect on female. Household heads are more likely to migrate. But when I separate the males and females, the household head factor has insignificant effect on migration. Members of Communist Party or the national ethnic minority in the rural areas are less likely to migrate but the membership has little impact on female migration because there are few females who are members of Communist Party or the national ethnic minority in my sample. And non-farm employment has a positive effect on migration for all rural individuals. Moreover, several household characteristics also have significant effect on household migration choice. I find that the probability of migration declines as farm income increases. And the access to telephone service in the village has significant negative effect on migration decision. To my surprise, the larger the household size, the less likely to migrate. This result could be explained by the specific policy in rural households.

The rest of the paper is organized as follows. Section 2 introduces the human capital model of migration. Section 3 contains specific characteristics of migration background in China. Section 4 reviews the literature. Section 5 offers a descriptive analysis of my sample. The methodology and an overview of the logit models are provided in section 6. Section 7 presents the

empirical results. And the last section summarizes my main conclusions and contains a brief discussion of the implications for macro policies.

## 2. THEORY OF MIGRATION AS HUMAN CAPITAL INVESTMENT

I will introduce the theory of migration as human capital investment according to << Regional Economics and Policy>> (Armstrong and Taylor, 1985). Migration incurs many costs including both pecuniary and distinctly non-pecuniary or psychic cost (Sjaastad, 1962). The pecuniary costs contain expenditure on the non-movable assets such as houses and other necessary property needed in a new place and transporting fees. In addition, the migrants may spend a long time to look for a job in new places so they have to live without any income temporarily. It is known that the separation from families and friends, the difficulties of settling into an unfamiliar place and the discrimination by the local people all result in huge non-pecuniary costs which is essentially strong deterrent to migration. Many people cannot stand the non-pecuniary cost of migration so that they choose to participate in long-distance commuting for every day instead of migration (Jackman and Savouri, 1992b; Cameron and Muellbauer, 1998).

The simple classical model of migration reveals that given perfect information and the lack of cost or other barriers to migration, the movement of labour results from the real wage differential. Labour migration will continue until wage rates are identical in both regions. (Armstrong and Taylor, 1985). However, regional wage differences indeed play a role, but it is not so strong a determinant as is often thought (Jackman and Savouri, 1992a; Hughes and McCormick, 1994). Traditionally people considered the characteristics of the origin and destination regions (e.g. wages, employment opportunities, climate and environment) as the main factors that affect migration decision. More recently, researchers pay much attention to the “institutional framework within which migration takes place” and “the personal and family characteristics of migrants” (Armstrong and Taylor, 1985).

It is important to understand that the institutional framework affects the migration decision, which suggests that labour and other (e.g. housing) markets are imperfectly competitive (Armstrong and Taylor, 1985). Migration decision is greatly influenced by the behaviour of institutions. Recruiting and promotion policies of employers have significant impact on the behaviour of large numbers of migrants, especially within-firm job mobility or “autonomous” migrants (Sell, 1990; Salt, 1990). There are also other institutional factors playing a part in migration, for instance, local authorities and financial institutions operating in the housing market; recruitment agencies and government job centres operating in the labour market; and the government itself through its taxation and unemployment benefit policies (Armstrong and Taylor, 1985).

The personal and family characteristics of migrants are also recognized as strongly affecting migration behaviour. The lifecycle effects such as migration at an old age, the effects of marriage or divorce, family ties, the consideration of employment opportunities for one's partner and his or her own are all important factors when people make decision of migration (Mincer, 1978; Snaith, 1990 and Green, 1997). Migration is also intensively determined by personal characteristics, with younger and better-educated individuals being more likely to leave their home region (Antolin and Bover, 1997). Moreover, the social network plays a role. Migrants tend to follow previous generations of migrants. They can get direct and reliable information from the earlier migrants, in which way the migration cost is reduced at a large scale.

Migration is clearly more complex than is suggested by the classical model. One of the most enduring of the theories is human capital theory (Sjaastad, 1962; Cooke and Bailey, 1996). The human capital model prevails in that the migrant is regarded to respond to the higher earnings that can be expected from migration over his remaining working life. It is based on that migrants have a positive time preference. The sooner migrants could benefit from migration, the more attractive will be the migration. “For this reason, the higher earnings which the migrant can expect to enjoy are expressed as a present value, with a discount rate being used to incorporate the influence of a migrant's time preference” (Armstrong and Taylor, 1985). This can be written as follows,

$$R_{ij} = \sum_{t=1}^T \frac{y_{jt} - y_{it}}{(1+d)^t}$$

Where

$R_{ij}$  = gross present value of the lifetime increment to earnings expected to result from the migration from region  $i$  to region  $j$ ;  
 $T$  = number of years of working life remaining;

$1/(1+d)^t$  = discount factor;

$d$  = discount rate (measures the time preference of migrants);

$y_{jt}$  = expected earnings of the migrant in region j (the destination region) in year t;

$y_{it}$  = expected earnings of the migrant in region i (the origin region) in year t" (Armstrong and Taylor, 1985).

In addition, the factors such as risk and uncertainty undoubtedly play a crucial role in migration decision. The existence of risk and uncertainty results from poor information about economic and social conditions in other regions and from potential dangers of being unemployed. The greater the risk and uncertainty, the less attractive the migration becomes. (Pickles and Rogerson, 1984).

Another advantage of the human capital theory is that it incorporates all the costs and benefits of migration. "Potential migrants are assumed to weigh all the costs and benefits of migration, and the net present value of migration from one region to another is expressed as follows:

$$PV_{ij} = R_{ij} - C_{ij}$$

Where

$PV_{ij}$  = net present value of migrating from region i to region j;

$R_{ij}$  = gross present value of the time stream of expected benefits (pecuniary and non-pecuniary) of migrating from region i to region j.

$C_{ij}$  = gross present value of the expected costs (pecuniary and non-pecuniary) of migrating from region i to region j" (Armstrong and Taylor, 1985).

If  $PV_{ij}$  is positive, the discounted value of the benefits exceeds the discounted value of costs, thus making migration possible. The benefits of migration consist of higher earnings and non-pecuniary benefits such as better working conditions in the destination region. The costs of migration comprise both money cost and psychic costs. (Armstrong and Taylor, 1985).

### **3. BACKGROUND: SPECIFIC CHARACTERISTICS OF CHINA**

Todaro (1969) formalized the hypothesis that rural to urban migration in developing countries responds to expected earnings gains. Since then, many empirical studies have provided evidence supporting this model (Taylor, 1987; Todaro, 1976). China is such a large and diverse agricultural country that the endowment of natural resources and economic development among different regions are of great unbalance and inequalities. For example, the eastern coastal urban regions are relatively developed while those western inland rural regions are less developed. Thus these specific characteristics of the Chinese situation provide an environment for labour mobility, which is different from that in both of developed and other developing economies to some extent. However, due to political factors the history of labour migration from rural to urban China is not so long. I will choose five factors in shaping the rural to urban migration decision to explain as follows.

#### **3.1 Persistent Rural to Urban Income Gap**

China was famous for its extremely tight control of rural to urban migration for a long time. Because the government aims to guarantee enough labourers to produce cheap agriculture products on the farm to prevent food shortage. This was in response to the devastating famine that occurred between 1959 and 1961 which was responsible for at least 30 millions deaths. Also the government does not want to spend too much on a large increasing number of people living in the urban area. The government either avoided or controlled the flow of funds and resources between the rural and urban sectors through administration, finance and resource distribution. (Knight, Shi and Song, 2004). Further, the government took two ways to achieve these objectives. One way was called *gongfenzhi*. The labourers in the rural areas were required to participate in the collective daily farm work assigned by the leader in the village to get earnings for their lives. So it made the opportunity cost for leaving rural areas quite high. The other way for controlling rural to urban migration was called *hukou* system. According to the regulations of China, an individual gets the local *hukou* of the same areas where his or her mother is registered when he or she was born. That means if a person was born in the rural areas, he or she was kept away from cities because the chance to change the registration locality in his or her entire life is very little. If the individual wants to move to urban areas, he or she has to get permission both from origin place and destination place. Before 1978, one's urban household registration status was closely linked to many benefits such as employment opportunities, food rationing, housing, good education opportunities and other necessities. This system essentially makes it almost impossible for outsiders to live in urban areas. The result of limited rural development and long-time restriction of rural to urban migration is the income gaps between the rural and urban areas persist and increase greatly. (Zhu, 2002). "The income gap widens until 1978, declined between 1978 and 1984, and widened again

afterwards. The ratio of urban to rural per capita income was 2.57 in 1978, dropping to 1.86 in 1985, and then rising to 2.50 in 1994. From then on, it fluctuated around 2.50" (Department of Comprehensive Statistics of National Bureau of Statistics of China, 1999). The huge income disparity between rural and urban areas provides enormous incentive for the rural individuals to migrate to the urban areas in search of greater economic gain.

### 3.2 Agriculture Market Reform—Household Responsibility System (HRS)

In order to increase peasants' incentives to engage in agricultural production, Chinese government enforced a rural market reform in the late 1970s. It is named as the household responsibility system (HRS), which returns land to individuals under long-term leases in the rural areas and eventually replaces the collective production-team system (Zhu, 2002). At the same time, agricultural procurement prices were increased in order to elicit more farm production. Although the rural market reforms increased rural incomes compared to urban incomes, the rural to urban migration did not seem to decrease with the HRS. Another factor cannot be overlooked. The reforms indeed raised the average income of rural households. However, the reforms decreased the opportunity cost for rural individuals to migrate to urban areas by decreasing the marginal contributions of individual household members to household income (Zhu, 2002). It makes migration possible. In addition, "the HRS had two far-reaching and unintended effects on the ability of the central government to control migration. First, it made it possible to buy food without urban registration status. The HRS increased the food supply dramatically, which led to the availability of food on the free market in cities and eventually led to the abandonment of food rationing. Second, the HRS returned personal freedom to rural people. Rural labourers could freely allocate their time, choose their profession and their mode of production" (Zhu, 2002). The development of HRS in rural areas has lead to increases in productivity in rural agriculture and resulted in a very large stream of farm labourers redundant in the rural areas. Therefore, a large number of peasants have found themselves no longer needed in agricultural work and so have to look for the job in the urban areas (Lin, 1989). Also the higher returns to labour in non-farm sectors made farmers incline to migrate out of farm (Cook, 1999).

However, despite the problem of food shortages has been solved, there are several restriction methods taken by the government on rural to urban migration. For instance, the urban government put quotas on the number of migrants that each company can employ and levy fees on the recruitment of migrants. The migrants almost impossibly attain the same living standards including housing, employment opportunities, medical insurance and education opportunities for their children as the local urban people. One reason is that the government does not want to spend more money on the added urban infrastructure (Zhu, 2002). Another is the urban unemployment induced by state owned enterprise (SOE) reform became a serious issue (Zhu, 2002). The government worried about the job security of the residents in the urban areas and prevented tough competition from migrants in the urban areas. So the conflict between official policies and farmers' aspirations has led to two consequences: (a) "growth and prospering of the rural non-agricultural sector, which provides job opportunities for rural surplus labour" (Zhao, 1999b) and (b) "development of an urban informal sector and aggravation of urban labour-market segmentation" (Wang and Zuo, 1999).

### 3.3 Development of Township and Village Enterprises (TVE) in Rural Areas

The gradual abolition of institutional obstacles has been the key for increased labour mobility since 1980s (Cai and Wang, 2003). In the early mid-1980s, in order to provide rural non-agriculture jobs as an alternative way to alleviate large rural to urban migration and address the rural surplus labour problem, the Chinese government admitted, promoted and then sponsored rural non-farm activities (Liang and White, 1997). One of the most systematic and wisely organized strategies was to encourage the establishment of township and village enterprises (TVE) run by rural individuals. A large investment shift to township and village enterprises (TVEs), with the distribution of employment in rural areas shifting away from primary employment in farming, towards secondary and tertiary employment in villages and towns (Yan, 1990). The government provides not only technical expertise but also tax privileges and loans for these newly established rural enterprises. In addition, the products made in TVEs have promising markets because of the labour cost is low .As a result, the TVEs have developed dramatically and became an outstanding phenomenon at that period. Some scholars have stated that the growth of rural enterprises in China provides enormous opportunities for the employment of peasants (Fei, 1989). "In 1979, there were 1.48 million rural enterprises that employed 29 million rural peasants. By 1993, however, there were 23.2 million rural enterprises that employed about 112.3 million workers." (Statistical Yearbook of China, 1993). The rise of TVEs is partly responsible for the continuous rise of rural household income, which in some ways compensates slower income growth in agriculture during the late 1980s. However, the growth of employment in rural TVEs has declined significantly since the late 1980s. This can be explained by the fact that many TVEs lack experience and expertise, which is necessarily important in a modern market-oriented economy. Although the price of the product made in TVEs is low, the quality and service turn out to be a disadvantage. They faced strong competition from state-owned enterprises, joint ventures, and private enterprises, which have much better reputation and more stable customers. So TVEs faced such a situation: new technologies have to be introduced

and the quality of products needs to be improved through investing more capital instead of employing more labour (Cai and Wang, 2003). As a result, TVEs absorbed less rural surplus labour than before, pushing rural labourers to migrate to urban areas.

In 1983, the government started to allow farm labourers in the rural areas to sell their products beyond local market places. The Chinese farmers get the legitimate right to engage in business in urban areas outside their rural hometowns responded to the demand for consumer goods for the first time. In 1988, the government further allowed farmers to work in enterprises or run their own business in cities under the condition of self-sufficient staples (Cai and Wang, 2003). Since 1990s, the governments have adopted various policies and methods to encourage rural to urban labour mobility. They cancel rationing, expand urban non-state sectors, and improve the distribution system of housing, employment policies and social security system (Cai and Wang, 2003). These reforms with an increase of welfare provide a better environment for rural labour migrants to manage to live in the cities.

### 3.4 Emergence of Informal Sector in Urban Areas

The basic characteristics of "informal sector" are described as "low wage", "small and family-based", "freedom of entry", "lack of a stable employer-employee relationship" and "being ignored by the authorities" (Todaro, 1969; Fields, 1975). In the urban areas, the development of the special economic zones, the expansion of the non-state sector and the loosening of the urban employment policy made rural migrants in a great demand (Meng and Zhang, 2001). With the development strategy from capital-intensive industries towards more labour-intensive industries, many jobs such as building skyscrapers and other basic infrastructure have been created in cities (Knight, Shi and Song, 2004). Moreover, urban economy grows quickly while the urban labour force grows slowly. It causes a large demand of rural workers in the urban economy. However, "most of rural migrants arrive in cities to take up marginal jobs that are characterized by long hours, poor working conditions, low and unstable pay, and no benefits, such as housing and food subsidies, education for children, medical insurance and other social insurance" (Wang and Zuo, 1999). In fact, there have already been many rural migrants work in such situations in urban areas. Although there are so many major disadvantages, it can be said that the situation of migrants in China's "informal market" is better than that of migrants in many other developing countries (Zhu, 1998).

### 3.5 An Increase in Urban Unemployment

Massive reforms toward market economy were introduced in urban areas. The state-owned firms were strongly competed by the TVEs and private sector development because of their over-investment, higher cost and inefficiency of workers. So it caused urban unemployment in almost all cities in China from 1995. According to the Chinese Labour Minister, 8.14 million urban workers lost their jobs in 1996, and 5.62 million in the first 6 months of 1997 (South China Morning Post, 1997a). It is estimated that there are as many as 30 million redundant workers in the state owned enterprises (SOE). Few young people were recruited, many workers of middle age had to retire early, and many employees in the SOE were laid off with hardly any social security such as housing subsidy and medical insurance. The 2000 Census reveals that the real unemployment rate in urban China was over 8 percent (Cai and Wang, 2003). The crucial unemployment in urban areas has greatly decreased the job opportunities in urban formal sector for rural migrants who are less educated and less socially connected. In response to this problem, the governments started a re-employment program, which helps the laid-off urban workers to find a job. At the same time, the city governments implement strict and rigid control of migrant workers through quota and occupation-specific restrictions (Cai and Wang, 2003). The rural migrants find themselves in direct competition with the urban unemployed workers and in disadvantaged conditions. As a result, it reduces the probability of migration for rural residents.

In conclusion, Huang and Pieke (2003) divide the migration policy evolution in China into 4 periods. I summarise it in the following table with the factors that affect the rural to urban migration in China.

**Table1**

Period	Government Policy	Factors
1979-1983	Prohibit migration	Labour surplus (HRS)
1984-1988	Little migration	Development of TVEs
1989-1991	Large migration	Erosion of hukou system
1992-1995	Encourage – Restrict migration	Informal sectors in urban
1995-2000		Urban unemployment

## 4. LITERATURE REVIEW

Many researchers have been interested in examining the factors that determine the rural to urban migration in China. The literature on labour migration within China develops quickly and already includes a large number of studies of the individual's migration behavior. To have a better understanding of the specific characteristics of labour migration behavior in China, it is important to realize the motivations for migration and the conditions the migrants face when they choose to do so. For example, several papers address the determinants of migration and some of them have different points of views. Liang and Chen (2004) explore the effect of development of rural industry on migration decision. They focus on the 'push factors' for migration and find that the rural people are reluctant to migrate if they could work in the rural non-farm sectors with high salary. "Push factors reduce income prospects and /or expected utility in the origin areas with little or no change in alternative prospects" (Fearn, 1981). In contrast, Chen (2004) focuses on the 'pull factors' of urban destinations. "Pull factors increase income or net advantages in the destination areas or lower relocation costs with income and other advantages in the origin areas remaining constant" (Fearn, 1981). They find that it is not the high income but the good living standard in urban areas that contributes to rural to urban migration (Small, 2002). In this section I will review the literature on the various factors including individual and household characteristics that may affect the rural to urban migration decision in China.

### 4.1. Individual Characteristics

#### 4.1.1 Gender

Most studies reveal that gender is one of the most important variables on the migration decision. Zhao (1997a) finds that the probability of migration reduces by 7% for females and Hare (1999) finds that the probability of migration increases by 30% for males. Using the data collected from surveys in Sichuan province, Zhao (1999a) finds females are 55.3% less likely to migrate compared to average. Male migrants are more likely to move to urban areas than female migrants and are also more likely to transfer from agricultural jobs to nonagricultural jobs. Moreover, male migrants are more likely to work in prestigious occupations. Perhaps the reason is that female migrants face disadvantages in earnings when compared to migrant men and local women. This is concluded by Wang and Shen (1999) based on the 1995 Survey of Floating Population in Shanghai and Huang (2001) using data from the 1990 Chinese census. In contrast, using data from Hubei province, Goldstein, Liang, and Goldstein (2000) indicate that migration provided better economic opportunities and a degree of freedom in the urban area for women.

#### 4.1.2 Marital Status

Marital status also has important effect on the decision of migration. Zhao (1997a) and Hare (1999) indicate that marriage reduces the probability of migration respectively by 2.8% and by 10%. Zhao (1999a) claims that married people are 37.6% less likely to migrate compared to average and the migrants tend to be unmarried. Using the data from Shanghai floating population survey, Meng and Zhang (2001) also find that marital status is positively related to rural migrants' earnings. And Zhu (2002) suggests marriage greatly decreases the likelihood to migrate. This finding could be explained by that married people have higher migration cost including both monetary cost and physic cost.

#### 4.1.3 Age

Hare (1999) finds that the younger people who are older than 16 years old and younger than 35 are most likely to migrate. Zhao (1999a) finds the likelihood of migration decreases as age rises, which can be explained by the higher psychological cost for old people to migrate (Zhao, 1997a). Tuan, Somwaru, and Diao (2000) suggest that the probability for rural young people to engage in non-farm work is higher than old people. Zhao (2001) indicates that single young male is more likely to migrate in rural areas. Zhu (2002) states that age has an inverted U effect on the probability of migration, which means that age has a positive but age squared has negative effect. However, Zhao (1997b) finds age has a positive effect on migration, which results from several restrictions implemented on young people in rural areas.

#### 4.1.4 Education

Existing literature on rural to urban migration in China reflects different perspectives on the role of human capital in migration decision. Parish, Zhe and Li (1995) indicate that when the rural labour market turns up, the returns to education are modest in rural China. Their study is based on data, which is collected from a survey of ten counties randomly chosen from all over China in 1993. Zhao did many researches on migration behaviors in rural China and got different results about the effect of education on migration decision. She finds that most educated rural people would like to work in local non-farm sectors rather than to migrate (Zhao, 1997a) and formal education has insignificant effect on raising the probability of migration but significant positive effect on shifting from farm work to local non-farm work (Zhao, 1999a). Liang and White (1997) find less educated rural workers are more likely to migrate than better educated who can find jobs in the rural enterprises. In a household level model,

Zhao (1999b) indicates that household mean education level of labourers has significant negative effect on the migration decision according to survey in Sichuan province in 1995. Rozelle et al. (1999) suggest that the probability to migrate increases for younger and relatively well-educated rural residents with a survey in 200 Chinese villages. Using the data collected in a county of Henan province, Hare (1999) concludes that there was no close relationship between formal education and migration decision. Knight, Song, and Jia (1999) find that the professional training was rather important for migrants while the role of education was not mentioned.

When Tuan, Somwaru, and Diao (2000) study how the structure of the rural **labour** force affects the possibility to work outside farm, they conclude that younger and better-educated individuals in the rural areas are more likely to work in non-agriculture sectors because they already get the needed skills learned from secondary school or higher schooling. Roberts (2001) finds that individuals who have finished at least junior middle school were inclined to choose non-farm work while illiterate ones were more likely to work on farm in the rural area of Shanghai with a 1993 sample of migrants in Shanghai. Using data collected from population survey conducted by institute of population studies at Shanghai academy of social sciences in 1995 and 1996, Meng and Zhang (2001) applied multinomial logit model to examine the occupation attainment for rural migrants and urban residents. It was found that for rural migrants, education increases their probability of getting a white-collar job and higher pay.

However, the findings of Zhu (2002) are mixed in that education only plays a positive role for males, but not for females. The possible reason maybe education has different effect on migration decision for males and for females. Zhang, Huang, and Rozelle (2002) indicate that education has a significant positive impact on participating in off-farm work and high education level increases the job opportunities and possibility for higher income in urban areas.

#### **4.1.5 Rural Non-farm Employment**

Using the data of 1990 census, Cai (1996) finds that percentage of the number of farmers employed in township and village enterprises to that of all residents in the village has a significant positive effect on the migration decision. Zhao (1999a, b) indicates that the availability of rural non-farm employment is an important factor for people to stay in the rural areas. When Meng (2001) examines job attainment for migrants, he indicates that individuals with higher labour market quality such as more trained in the rural areas are more likely to be self-employed in the informal sector. And when Meng (2001) uses a Heckman two-step model to analyze the wage differentials among formal sector, wage-earned in informal sector, and self-employed in formal sector, he states that rural non-farm work experience has significant positive effect on wages of formal sector and wage-earned informal sector.

### **4.2 Household Characteristics**

#### **4.2.1 Household Size and Distance**

Zhao (1999b) and Zhao (2001) use the data from surveys in Sichuan province and other six provinces to examine the migration status. She finds that single young male from families with more members are most likely to migrate. Tuan, Somwaru, and Diao (2000) obtain similar findings. They state that the probability for members in large households to migrate increases so at least one member in such a big family is a migrant. Wan (1995) concludes that the distance between the origins and destinations of migrants has a positive effect on migration. This phenomenon results from the structural unemployment problem and unbalanced resource distribution across rural China (Wan, 1995).

#### **4.2.2 Village Income Level**

Knight, Song, and Jia (1999) find that the possibility of migration increases as village income level declines. Rozelle et al. (1999) has similar findings. He concludes that the percentage of labour force that participates in migration has negative relationship with per capita income in the village. Bhattacharyya and Parker (1999) indicate the production efficiency of labour in the rural areas has been greatly improved by growing rural urbanization and rising rural income. So it reduces migration. Zhao (2001) states that the village income level per capita has an inverted-U effect on the household migration decision. Zhu (2002) reveals that the rural and urban wage disparity is such an important factor that determines the probability of rural to urban migration, especially for males. More interesting, some studies reveal different findings. Xiang (1996) suggests that the rich with higher education level and more skills are most likely to migrate. Hare and Zhao (1996) find that the likelihood for the poor rural individuals to be migrants is greater. Nevertheless, Zhang, Zhao and Chen (1995) claim migrants are mainly those who are neither too rich or too poor in the rural areas.

#### **4.2.3 Land Size and Taxation**

One possible reason contributes to the large stream of rural to urban migration in China is that the amount of arable land is not adequate to be cultivated for all the rural farm labour (Zhao 1999b; Zhao 2001). Using the data from Chinese 1990 census, Cai

(1996) states that per capita land allocation has a positive impact on migration decision. Zhao (1997a, 1999a and 1999b) and Zhu (2002) find the probability of migration has great negative relationship with the amount of land owned by rural household. Further, Zhao (1999a) and Zhao (1999b) indicate that the probability of migration decreased respectively by 4.4% and 2.8% if adding one *mu* (a measurement unit in China) in every household. However, Hare (1999) reveals that the land allocation has no significant effect on the migration decision in the household level model. In contrast, Rozelle, Taylor, and de Brauw (1999) show that land holdings per capita has a significant positive effect on the migration decision and the number of migrants in a household. Moreover, Zhao (1999b) finds that rural taxation has significant effects on the migration decision.

## 5. DATA

### 5.1 Chinese Household Income Project-1995

The empirical analysis is based on a detailed and representative national rural household survey conducted in 1995 named the Chinese Household Income Project (CHIP), which is a major socioeconomic study of households throughout China. The purpose of this project is to measure and estimate the distribution of personal income in both rural and urban China (ICPSR, CHIP-1995). This large project is a joint research sponsored by the Institute of Economics, Chinese Academy of Sciences, the Asian Development Bank, and the Ford Foundation and other agencies including the East Asian Institute and Columbia University (ICPSR, CHIP-1995). This survey data was collected at both household and individual levels from a sample of respondents, generally through structured interviews or self-administered questionnaires covering 7998 households and 34,739 individuals in 19 provinces. The data collection consists of two distinct samples of the urban and rural populations of China, which were selected from significantly larger samples (approximately 65,000 rural households and 35,000 urban households) drawn by China's State Statistical Bureau (ICPSR, CHIP-1995). CHIP- 1995 contains detailed information about migratory behaviour of individuals and households in China. Because my study concentrates on the rural to urban migration, so I choose two datasets of rural individual data and rural household data. In data file 1, the individual is the unit of analysis while the household is the unit of analysis in data file 2. Thus I can examine the effect of both the individual characteristics and household characteristics on rural to urban migration decision in China.

Individual rural respondents reported on their gender, age, relationship to household head, employment status, level of education, Communist Party membership, type of employer (e.g., public, private, or foreign), type of economic sector in which they were employed, occupation, whether they held a second job, retirement status, monthly pension, monthly wage, and other sources of income. Rural households reported extensively on the characteristics of the household and residence. Information includes geographic position, type of house, availability of electricity, and the sources of household income (e.g., farming, industry, government, rents, and interest), taxes paid, value of farm, total amount and type of cultivated land, financial assets and debts, quantity and value of various crops, amount of grain purchased or provided by a collective, use of chemical fertilizers, gasoline, and oil, quantity and value of agricultural machinery, and all household expenditures (e.g., food, fuel, medicine, education, transportation, and electricity). (ICPSR, CHIP-1995)

### 5.2. Summary Statistics

The data set I use is a part of CHIP-1995 survey. It includes two samples, in which information about rural individual and household characteristics is reported. In order to analyze the influence of individual characteristics on migration decision, a sample of rural individuals was constructed using the following criteria: (1) between 16 and 45 years old because individuals who are older than 16 years old have the right to work according to the labour law in China and most people in this survey are under 45 years old; (2) having valid personal data available (age, gender, relationship to household head, membership of Communist Party, national ethnic minority, education level and occupation category). The above selection criteria yielded 7038 observations on individuals, of which 869 were migrants and the remaining 6169 were non-migrants.

**Table 2:** Individual characteristics of migrants and non-migrants (N=7038, Age 16-45)

Variable	Migrants (N=869)		Non-migrants (N=6169)	
	Mean	Std. Dev.	Mean	Std. Dev.
Gender (male=1)	0.728	0.445	0.460	0.498
Household head (head=1)	0.270	0.444	0.268	0.443
Age (years)	26.199	7.697	31.280	8.835
Marital status (married=1)	0.457	0.498	0.721	0.448
Education level (1-8level)	5.145	0.799	5.385	1.062
Communist Party Membership (member=1)	0.024	0.154	0.047	0.213
Ethnic minority membership (member=1)	0.012	0.107	0.030	0.171
Employment (farmer=1)	0.311	0.463	0.748	0.434

Table 2 presents individual mean characteristics of migrants and non-migrants. Among the variables, gender, relationship to household head, marital status, membership of Communist Party, membership of ethnic minority and employment are all dummy variables while age and educational level are continuous variables. According to the summary statistics, among all individuals who are between 16 and 45 years old, only 12% are migrants. Compared with non-migrants, migrants are predominantly male, younger and unmarried. Migrants are 5 years younger than non-migrants on average. Marriage seems a distinctive deterrent to migration. Most married people stay in the rural areas. The individuals who are not members of Communist Party or ethnic minority are likely to migrate. Education levels are measured in eight different values. Level 1 corresponds to college or above, level 2 corresponds to professional school, level 3 corresponds to middle level professional, technical or vocational school, level 4 corresponds to upper middle school, level 5 corresponds to lower middle school, level 6 corresponds to four or more years of elementary school, level 7 corresponds to one to three years of elementary school and level 8 corresponds to illiterate or semi-illiterate. I should point out that in this sample the higher the education level, the less schooling individuals have, which is opposite to our intuition. The means of education level of migrants and non-migrants are respectively 5.145 and 5.385, somewhere between 4 or more years of elementary school and lower middle school. Migrants receive more schooling than non-migrants. According to China's First National Agricultural Census, 42 percent of the people in agricultural households had obtained a middle-school education without continuing further studies (National Agricultural Census Office of China, 1998, Table 4.6). Difference in whether or not farm-employed is remarkable. Farm labourers are more likely to be non-migrants. The individuals with non-farm employment, for example, ordinary worker, skilled, professional or technical workers, owner or manager of enterprise, village cadre, official of party or government office or institution, ordinary cadre in an enterprise, temporary or short-term contract worker, non-farm individual enterprise (such as retailer, driver, etc) in the rural household have larger probability to migrate.

In addition, in order to examine the influence of household characteristics on migration decision, another sample was constructed, which has detailed information of household data on total number of residents in the household, total income associated with household farming operations, whether there is telephone service in the village, whether the village is the suburb of middle or large sized city, expenditure on taxes and fees, and total amount of land controlled by the household. After selection for valid information, it yields 4191 household cases. The descriptive statistics are revealed as follows.

**Table 3:** Household characteristics of migrants and non-migrants (N=4191)

Variable	Migrants (N=333)		Non-migrants (N=3858)	
	Mean	Std. Dev.	Mean	Std. Dev.
No. of household members	4.586	1.469	4.418	1.414
Farm income (yuan)	7132.25	4958.18	7322.09	7211.80
Telephone service (access to telephone=1)	0.538	0.499	0.576	0.494
Geographic position (suburb of city=1)	0.045	0.208	0.033	0.180
Expenditure on taxes and fees (yuan)	439.09	488.30	422.95	589.06
Land (mu)	7.749	6.507	7.646	6.284

Table 3 represents the household mean characteristics of migrants and non-migrants. Among all the variables, the access to telephone in the village and the geographic position of the village are dummy variables. And the number of household members, farm income, expenditure on rural taxes and fees and land holdings by the household are all continuous variables.

The average number of residents in the household, which has migrants is 4.586 persons. This is a little larger than that of non-migrant family. Income from household farming operations of non-migrant family is more than that of migrants by 200 yuan on average. The households with no telephone connections and who live in the suburb of middle or large sized city are more likely to migrate to urban areas. Compared to non-migrants, the migrant households have much heavier burden of taxes and fees. The likelihood of being migrant family increases with more land holdings in a household, which can be partially, but not entirely explained by the fact that migrant households are larger and contain more labourers.

## 6. METHODOLOGY

Researchers used different econometric models to study migration behavior. Based on the method used in the analysis of the determinants of migration in China by Li and Zahniser (2002), in this paper I estimate Logit models to predict the probability that an individual will be a migrant from rural to urban China. In my study, the unobservable variables can be thought of as the difference in expected utility from staying in the rural area and migration to an urban area. The actual migration decision depends on a series of explanatory variables including both individual and household characteristics. The dependent variable in the model is binary, which is defined as one if the individual left the household for at least one month in 1995, either to work or to look for work in an urban area. Otherwise, the dependent variable equals zero. The potential determinants of migration decision were grouped into two categories: individual characteristics such as gender, age, marriage status, relationship to household head, membership of Communist Party, membership of national ethnic minority, education level and occupation category; household characteristics include household size, farm income, access to telephone service in the village, distance to middle or big city, expenditure on taxes and fees, and land holdings.

I use dummy variables to estimate the influence of gender and household head on migration decision. The probability of migration for males maybe higher than females in rural areas. The possible reason is that females are mainly responsible for family housework and taking care of children in rural households. It is also well known that there are disadvantaged positions for female migrants compared to local females and male migrants in many big cities. As for the household head position in the rural household, the likelihood for migration increases. Because it is the fact that male is usually the household head in rural areas and the household head is responsible for the family earnings.

I take both age and age squared as explanatory variables in order to examine whether there is an inverted U-shaped relationship between age and migration. If the money cost including the lodging, transportation fee for both migrants and their belongings and non-money cost including not only opportunity cost while searching for and learning a new job but also psychic cost are significant for the very young and the very old then they should have less inclination to migrate. Thus, starting from young adult, the probability of migration should increase with age at a decreasing rate. Then after a certain age, the probability of migration should decline.

I use a dummy variable to estimate the effect of marital status on the migration decision. It could be either positive or negative. Married individuals may be more likely to migrate because they have to earn more money to support the family and children or they maybe less likely to be involved in migration in order to spend more time at home with family members. The decision is determined by how individuals value the benefit and cost of migration.

To estimate the influence of education on the migration decision, the models contain a series of discrete dummies of 8 educational levels, in which the level of illiterate or semi-illiterate is the reference group. The individuals with higher levels of education maybe more likely to migrate because it is easier for them to find job in the urban areas. However, it is also possible for the educated to stay in the rural areas. The opportunity for them to have a good job and comfortable life is greater compared with the less educated.

I also include a dummy variable to predict the impact of membership of national ethnic minority on migration decision. Being a member of national ethnic minority the probability of migration may declines. China is a large country with many minorities and most minorities live in different certain regions. They are familiar with the culture of the region where their families have resided for a long time. So the physic cost for them to migrate is relatively higher.

The effect of membership of Communist Party in rural areas on migration is difficult to predict. On one hand, being a member in Communist Party means to have more authority, higher position and better economic opportunities in the local area. Thus the likelihood of migration may decrease. On the other hand, the members of Party have many opportunities to participate in social activities in big cities so that they may have more propensities to migrate.

To examine the effect of employment before migration on the migration decision, I use a dummy variable to indicate whether individuals work on farm. It is easier for individuals who have working experiences in the rural enterprises to find a job in the cities. So individuals maybe more likely to consider migration if they were employed in non-farm workplace in the rural area. However, if the rural area contains many opportunities for household members to work in township and village-owned enterprise (TVE), the probability of rural to urban migration from that community should be smaller.

Another logit model I estimate also contains several household characteristics such as household size, farm income, access of telephone service in the village, whether or not the village is the suburb of big cities, expenditure on rural taxes and fees and land holdings.

I include the number of residents in each household as an independent variable to examine the impact of household size on the migration decision. Larger households have more labour forces so they can allocate them relatively freely. Besides the required labourers working on farm, other household members could choose to leave home and work in the cities. Thus the probability of migration for household with large size should be larger.

I also want to investigate the effect of household farm income on migration decision. In the survey, the total household income associated with farming operations includes income from grain, economic crops, forestry and other agricultural activities. If the objective of rural to urban migration is to pursue higher income, then the probability of migration is lower as farm income grows. Nevertheless, if the objective of rural to urban migration is to pursue higher living standard in the urban areas, then the relationship between migration and household farm income may not be negative.

The net effect of telephone service in the village on migration decision could be either positive or negative. If there is telephone service in a village, it reveals that the village is not so poor as some national impoverished counties in China. So the individuals are not likely to migrate. There is another possible outcome. Because people in the village could have much access to the outside world through telephone service, so they could get job information from their relatives and friends in the cities. Therefore, the probability for them to migrate may increases.

I also include a dummy variable of whether the village is a suburb of middle or big cities to estimate how the distance between the origins and destinations influences the migration decision. If a village or county is very close to a developed city, then the social network for migration should be more pronounced. People can easily get the information of destination and save traveling cost. In addition, the uncertainty of destination is also decreased. Thus the probability of migration is greater because there is less pecuniary and non-pecuniary cost of migration.

The expenditure on rural taxation and fees charged by the local government may affects the migration decision because it reduces the amount of income derived from agricultural production by the last farm labour. In recent years, rural taxation has become an increasingly serious issue in China. Peasants are reluctant and even refuse to pay local taxes and fees. As a result, the farm work is left to the women, either elderly or children while able and strong labourers incline to work in non-farm sectors. So rural individuals maybe likely to participate in migration if more tax is levied in rural areas.

The total amount of land controlled by the household may also have impact on migration. If a household owns a large amount of land, more labour forces should be allocated to farm work. So the probability of migration for household members is lower. However, if the household's available labour for the amount of land is more than required, then the extra household members are likely to participate in migration.

The basic Binary logit model I use is  $Y=1$  if individual chooses to migrate;  $Y=0$  otherwise. The logistic distribution is,

$$\text{Prob}(Y=1) = \Lambda(X\beta) = \exp(X\beta) / [1 + \exp(X\beta)]$$

A set of factors that determine migration decision gathered in a vector,  $X$ . The set of parameters  $\beta$  reflects the impact of changes in  $X$ . We use the notation  $\Lambda(\cdot)$  to indicate the logistic cumulative distribution function. (Greene, 1990, pp.664)

The first individual-choice model is

$$\begin{aligned} \text{Migration} = & \beta_0 + \beta_1(\text{Male}) + \beta_2(\text{Age}) + \beta_3(\text{Age squared}) + \beta_4(\text{Married}) + \beta_5(\text{College}) + \beta_6(\text{Profsch}) + \beta_7(\text{Midprof}) + \beta_8(\text{Uppmsch}) + \beta_9(\text{Lowmsch}) + \beta_{10}(\text{Elemsch}) + \beta_{11}(\text{Lowesch}) + \beta_{12}(\text{Household head}) + \beta_{13}(\text{Member of Communist Party}) \\ & + \beta_{14}(\text{National ethnic minority}) + \beta_{15}(\text{Farm employment}) + \varepsilon \end{aligned}$$

Where

Male = a dummy variable that equals 1 if the individual is a male and 0 if the individual is a female

Age = age number

Married = a dummy variable that equals 1 if the individual is married and 0 otherwise

Education level includes 7 dummy variables (illiterate or semi-illiterate as reference group)

College = a dummy variable equals 1 if the educational level of an individual is college or above and 0 otherwise

Profsch = a dummy variable equals 1 if the educational level of an individual is professional school and 0 otherwise

Midprof = a dummy variable equals 1 if the educational level of an individual is middle level professional, technical or vocational school and 0 otherwise

Uppmsch = a dummy variable equals 1 if the educational level of an individual is upper middle school and 0 otherwise

Lowmsch = a dummy variable equals 1 if the educational level of an individual is lower middle school and 0 otherwise

Elemsch = a dummy variable equals 1 if the educational level of an individual is 4 or more years of elementary school and 0 otherwise

Lowesch = a dummy variable equals 1 if the educational level of an individual is 1-3 years of elementary school and 0 otherwise

Household head = a dummy variable that equals 1 if the individual is a household head in the family and 0 otherwise

Member of Communist Party = a dummy variable that equals 1 if the individual is a member of Communist Party and 0 otherwise

National ethnic minority = a dummy variable that equals 1 if the individual is a national ethnic minority and 0 otherwise

Farm employment = a dummy variable that equals 1 if the individual works on the farm in the village and 0 otherwise

Moreover, because gender is a significant independent variable that affects the migration decision, I will use the above model to examine the effect of various factors on the probability of rural to urban migration for both male and female respectively.

The second household-choice model is

Migration =  $\alpha_0 + \alpha_1$  (Household size) +  $\alpha_2$  (Farm income) +  $\alpha_3$  (Telephone service) +  $\alpha_4$  (Suburb of cities) +  $\alpha_5$  (Expenditure on taxes and fees) +  $\alpha_6$  (Land) +  $\varepsilon$

Where

Household size = number of residents in the rural households

Farm income = number of income earned from agriculture in a household

Telephone service = a dummy variable that equals 1 if there is the telephone service in the village and 0 otherwise

Suburb of cities = a dummy variable that equals 1 if the village is the suburb of the middle or big cities and 0 otherwise

Expenditure on taxes and fees = number of expenditure on rural taxes and fees

Land = number of land holdings owned by the rural household

In the binary logit model, the pseudo R squared is a measure of goodness of fit. And I should also perform a likelihood ratio test for each model. The marginal effect is the effect of increasing the value of an explanatory variable by one on the absolute value of the probability of migration. In a linear regression model the slope coefficient of a regressor measures the effect on the average value of the regress and for a unit change in the value of the regressor. The marginal effect for a continuous independent variable is evaluated at the sample mean and that for a categorical variable is evaluated against the reference category. (Gujarati, 1995, pp.569)

## 7. EMPIRICAL RESULTS

**Table 4:** Model 1.1 Logit model of migration choice for all rural individuals (N=7038)

(Dependent variable: migrant=1; non-migrant=0)

Variable	Coefficient	S.E.	Marginal Effect
Constant	(***)-2.597	0.731	-0.174
Male	(***) 0.920	0.097	0.063
Age	(***) 0.128	0.048	0.009
Age squared	(***)-0.003	0.0008	-0.0002
Married	(***)-0.640	0.138	-0.048
Professional school	(*)-2.057	1.078	-0.063
Middle professional school	(*)-0.749	0.441	-0.037
Household head	(***) 0.588	0.134	0.044
Member of Communist Party	(***)-1.001	0.248	-0.046
Ethnic minority	(***)-0.966	0.348	-0.044
Farm employment	(***)-1.728	0.084	-0.161
Loglikelihood			-2118.548
LR chi-squared (degrees of freedom)			1024.332 (15)
Pseudo R squared			0.19

(\*\*\* denotes significant at 1% level; \* denotes significant at 10% level; for educational level variables, the reference group is illiterate and semi-illiterate)

The results from logit model for all rural individuals are shown in Table 4. In previous analysis I also used the probit model. The result of the probit model, which is revealed in the appendix, is similar to that of logit model. Then I will analyze the effect of different factors on the rural to urban migration decision.

### 7.1 Gender Effect

From the result of regression, we see that the estimated coefficient for male is statistically significant at 1% level. Gender has a significant effect on rural to urban migration decision. Males are more likely to migrate than females. Because females are less educated and have to stay at home if the household is short of labour. This can be explained further by particular background in rural China.

First, female migration is constrained by the culture and customs. In the rural areas especially vast poor places, all decisions are made by the household head who is normally the elder male in the family. Females are required to do housework including cooking, looking after children and old household members. So the chance for them to go far away to work is really little.

Second, the land plot assigned to each household bases on the total number of household residents. Even if rural people can get higher income from migratory work, they would not give up land, from which they can be self-sufficient on food supply. Moreover, they are not so confident in the sustainability of non-farm earnings. Thus, the household leaves the female labourers to look after the plot.

Third, there may exists the gender-specific job factor that deters the female migration. Most migrants work in dirty and dangerous conditions and mainly engage in construction, building and transportation jobs. Some of them even live in big halls and train stations because they could not afford to the high rent of house in the big cities. Such working and living circumstances in the urban areas are not appropriate for females.

### 7.2 Age Effect

The result from the logit model shows a significant positive coefficient for age and also a significant negative coefficient for age squared. Age has an inverted U-shaped effect on migration decision. For all the rural individuals, the probability of migration increases with age and then after a certain age, it gradually declines. It can be estimated that most migrants in our sample is from age group 25-30. Because young people like this age have a higher return to migration in the long run while the older

people have fewer years to reap the benefits of migration. From the labour supply perspective, people of this age are more active and more adventurous so they have higher propensity to migrate. From the labour demand perspective, many jobs need strong and young labourers in big cities.

### 7.3 Education Effect

Model 1.1 indicates that when educational level is measured as discrete form, the educational levels of professional school and middle professional school have significant effects on migration for all rural individuals. The individuals, who are in these two higher educational levels, are less likely to migrate. The other category of educational levels has insignificant effect on migration decision so the results are not reported in the table. These findings contradict my predictions. It may result from that low skill labourers are in large demand in the urban areas while rural development highly needs skilled labourers. Rural enterprises recruit better-educated people to take charge of management, administration and decision-makings. So the most qualified and educated individuals may have good jobs with respect and privilege in the rural areas. Thus they do not like to participate in migration.

### 7.4 Household Head and Marriage Effect

According to the result of model 1.1, household head effect is statistically significant and positive in migration decision. The finding is consistent with my prediction. In rural China, male is normally the household head. Also the household head is mainly responsible for earning money to support the family. So they incline to migrate. And marriage strongly reduces the probability of migration: setting up a family and bringing up children increase the opportunity cost of migration. The attractiveness of urban jobs is greatly reduced if married people have to separate from family.

### 7.5 Membership of Communist Party and Ethnic Minorities Effect

Model 1.1 indicates that ethnic minority has significant and negative effect on migration decision. The physical cost of migration, which may include uncertainties in the destination cities and discrimination by others, for them is higher compared to majorities. Membership in the Communist Party also has a significant and negative effect. Members of Communist Party have better economic and social positions in the rural areas so they are less likely to migrate.

### 7.6 Rural Non-farm Work Effect

From the result of model 1.1, we see that rural non-farm work has significant and negative effect on migration. Those with rural non-agricultural working experience are more likely to migrate because it is easier for them to obtain a job in the urban area. They own some specific skills which were learned from being employed in the rural enterprises or being cadres in the rural areas. So it is an advantage to work and get higher pay in cities compared with the farm labourers.

To examine the effect of various factors that determine rural to urban migration decision for both males and females, I create other two logit models of similar independent variables as model 1.1.

**Table 5:** Model 1.2-1.3 Logit models of migration choice for males and females  
(Dependent variable: migrant=1; non-migrant=0)

Variable	Male (N=3470)			Female (N=3568)		
	Coefficient	S.E.	M.E.	Coefficient	S.E.	M.E.
Constant	-3.419 (***)	0.986	-0.436	-1.306	1.313	-0.017
Age	0.195 (***)	0.057	0.025	0.138	0.096	0.002
Age squared	-0.004 (***)	0.0009	-0.00005	-0.358 (**)	0.002	----
Married	-0.222	0.161	-0.029	-1.217 (***)	0.274	-0.021
Middle professional school	-0.509	0.680	-0.055	-1.538 (**)	0.637	-0.010
Member of Communist Party	-0.956 (***)	0.248	-0.092	----	----	----
Ethnic minority	-0.961 (**)	0.386	-0.089	-0.748	0.776	-0.007
Farm employment	-1.321 (***)	0.097	-0.189	-2.676 (***)	0.189	-0.087
Loglikelihood			-1477.211			-581.256
LRchi-squared (degrees of freedom)			342.387 (14)			575.441 (14)
Pseudo R squared			0.11			0.33

(\*\*\* denotes significant at 1% level; \*\* denotes significant at 5% level; for educational level variables, the reference group is illiterate and semi-illiterate)

Table 5 presents the results from logit models respectively for male and female. I will briefly indicate my findings. Age has significant and inverted-U shaped effect for male while it has insignificant effect for female on migration decision. Marriage strongly reduces the probability of migration for female but it does not have significant impact for male. This results from the fact male is the main “bread earner” in a family. Educational level of middle professional school has significant and negative effect on female migration. However, it has insignificant impact on male migration. Because female with higher education level may have a better job in the rural areas than in the urban areas. So they are less likely to migrate. Membership of Communist Party and national minorities has significant negative effect on migration for male. But it has insignificant impact for female. This is partly because the members of female Communist Party or minorities are too few in our sample. Similar to the result of model 1.1, farm employment has significant negative effect on both male and female migration. Nevertheless, in contrast to the result of model 1.1, the household head and educational level of professional school have insignificant effect on migration respectively for male and female.

**Table 6:** Model 2. Logit model of migration choice for rural households (N=4191)

(Dependent variable: migrant family=1; non-migrant family=0)

Variable	Coefficient	S.E.	Marginal Effect
Household size	(**)-0.395	0.029	-0.029
Farmincome (yuan)	(**)-0.00003	0.0001	---
Telephone service	(**)-0.601	0.013	-0.047
Suburb of city	0.189	0.285	0.015
Expenditure on taxes/fees (yuan)	-0.0006	0.0001	---
Land (mu)	-0.010	0.010	-0.0007
Loglikelihood			-1248.473
LR chi-squared (degrees of freedom)			175.873 (5)
Pseudo R squared			0.07

(\*\*\* denotes significant at 1% level; \*\*denotes significant at 5% level)

## 7.7 Household Size Effect

From the results of model 2, the number of household residents has negative and significant effect on the likelihood of migration. This result is interesting in that it contradicts my estimation that large household size means more labour supply. It can be explained in this way. In rural China, the family planning policy permits households to have a second child if the first-born is a girl. The household size varied due to this policy and the tradition of living with the elderly in rural households. So if there are several old people and females in a family, even if the size of the household is large, it is less likely to migrate.

## 7.8 Farm Income Effect

Household income from agriculture has a negative and significant effect on migration. Although it is understood that rural individuals choose to migrate to file the income gap between the urban and rural sectors. However, when the rural households could earn more income from the agriculture, they would not like to participate in migration. Farmers in the villages that have higher agricultural productivity tend to remain on their farm. Because two major sources of implicit psychic costs associated with migration: personal safety and the separation from families.

## 7.9 Telephone Service Effect

Whether there is the telephone service in the village is an important factor on the rural to urban migration decision. The access to telephone service has a significant and negative effect according to model 2. As what I have mentioned before, the economy in the village with telephone service is normally better than those without the telephone service. So the individuals may choose to work in the rural enterprises over migration. Therefore, the probability of migration declines with the access to the telephone service.

But the results of logit model 2 indicate that whether the village is a suburb of the middle and big cities has insignificant effect on migration. This is partly because the existence of many institutional constraints or regulations on entering cities from nearby villages in China. The expenditure on taxation and fees in the rural households also has insignificant effect on migration

decision. The possible reason is that the expenditure on taxes and fees is not too much in our sample so that rural households could afford. Then this is a less important factor when the households make decision on migration. In addition, the household landholdings do not appear to have significant impact on the rural to urban migration decision. This can be explained in this way. The large migrants in our sample are temporary and seasonal so the magnitude of the land holdings effect on migration is shown to be little. These results are not consistent to my prediction.

## 8. CONCLUSION

This study analyses the rural to urban migration decision made by individuals and households in China. The dataset I use comes from CHIP-1995. About 12 percent of rural individuals who are between 16 years old and 45 years old left their household for at least one month in order to work or to search for work in urban areas in 1995. I constructed two Logit models to examine the effect of individual characteristics on individual migration choice and effect of household characteristics on household migration choice. Moreover, I make analysis on the distinction of determinants of migration between the male and female.

The main findings of this paper are summarized as follows. Males are more likely to participate in migration than females. The very young and very old people in the rural areas have smaller likelihood to migrate. Marriage has a negative effect on migration decision for all rural individuals but it does not have significant impact on male. Educational levels of professional school and middle professional school have negative and significant effects for all rural individuals on temporary migration. However, only middle professional school has a significant negative effect on female migration. Household heads are more likely to migrate. But when I separate the male and female, the household head factor has insignificant effect on migration. Being the members of Communist Party or the national ethnic minority in the rural areas, individuals are less likely to migrate but the membership has little impact on female migration due to the few female members in my sample. And non-farm employment has a significant positive effect on migration for all rural individuals. In addition, several household characteristics also have significant effect when households make migration decision. I find that the probability of migration declines as farm income increases. And the access to telephone service in the village has significant negative effect on migration decision. To my surprise, the larger the household size, the less likely to migrate. This result could be explained by the specific policy in rural households. Moreover, I find the amount of land owned by a household, the expenditure on rural taxes and fees and the distance to the middle or big cities generally do not have significant effects on migration decision, which contradict my predictions.

Since the Chinese government faces a serious problem of urban unemployment in big cities recently, it is likely that the restrictive policy to control rural to urban migration will continue. They will adopt a rural urbanization strategy and improve the development of small and medium cities. From my study on rural to urban migration decision, the following policy implications can be derived. First, development of rural enterprises must be given some priority. They should be planned to establish in small and medium cities to accommodate rural labour surplus. This is helpful for family or permanent migration. It will reduce the cost of transportation, road construction and perhaps pollution in the long run. Second, social facility provision should be taken into account. This is necessary to sustain the rural migration. Government-provided facilities and services such as boarding schools, social security payments, subsidized public transport, medical services and telephone services should be available in the rural areas. This will improve resource allocation particularly human resource between rural and urban areas, thus decreasing the rural and urban income gap. Third, land property rights should be clearly defined in the rural areas. It will promote agriculture productivity and farming scales. So these lead to achieve scale economies then contribute to increase of income level from farming for rural labourers. However, the control of migration will make some economic efficiency loss, reduce the productivity of labour and then leads to a prominent loss of social resources.

Because I use a binary logit model to examine the determinants of rural to urban migration and many issues such as the dynamics of migration, impacts of migration in China and determinants of job choice by rural labour migrants in the destination cities cannot be fully studied. These topics need methods beyond probit or logit models. Moreover, due to limited data availability some possible explanatory factors for migration decision such as social networks and some village characteristics cannot be examined. Further research can be done about more issues about rural to urban migration in China.

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## APPENDIX

**Table 7:** Probit model of migration choice for all rural individuals (N=7038)  
 (Dependent variable: migrant=1; non-migrant=0)

Variable	Coefficient	S.E.	Marginal Effect
Constant	(***)-1.316	0.395	-0.189
Male	(***) 0.532	0.053	0.078
Age	(**) 0.060	0.026	0.009
Age squared	(***)-0.001	0.0004	-0.0002
Married	(***)-0.357	0.076	-0.057
Professional school	(**) -0.993	0.456	-0.069
Middle professional school	(**) -0.443	0.219	-0.046
Household head	(***) 0.312	0.072	0.050
Member of Communist Party	(***)-0.495	0.120	-0.051
Ethnic minority	(***)-0.491	0.177	-0.050
Farm employment	(***)-0.926	0.045	-0.172
Loglikelihood			-2117.064
LR chi-squared (degrees of freedom)			1027.301 (15)
Pseudo R squared			0.20

(\*\*\* denotes significant at 1% level; \*\* denotes significant at 5% level; for educational level variables, the reference group is illiterate and semi-illiterate)

# ORGANIZATIONAL PSYCHOLOGY AND AMERICAN POLICING

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## ABSTRACT

*This paper evaluates the need for an organizational psychologist for police departments. The evaluation examines the need to hire a full time psychologist or just contract an organizational psychologist on need basis. The paper analyzes the need for the police psychologist to be not only just a counselor but to be an active partner in all aspects of the law enforcement establishment.*

## INTRODUCTION

The authors examine first the Evaluation Process as roadmap for Police leaders to better understand their subordinates. The process is important to the mental health of the police officers and to improve their performance. As mentioned later on, the paper will address three programs: the strategic assessment and evaluation, stress management, and the leadership program.

The strategic assessment and evaluation comprises an initial evaluation, and a strategic assessment process at the heart of current decisions on alternatives. The Stress Evaluation program will enable to identify the specific causes of stress of the Police officers. Finally the leadership program will give officers the opportunity to Police Officers to develop their own leadership styles. The objectives of the program are to enhance the self confidence of police officers and share best practices with their officers. The benefits of the program are covered, and also ethical issues are addressed.

## ASSESSMENT AND EVALUATION PROCESS

Selecting police officers is a costly and time consuming process. This paper serves to provide an argument for the benefits of a continual evaluation process of police officers as they serve on the force. Pre-selection of police officers is very beneficial when matching personality traits to job fit. However there is an apparent lack of follow-up in terms of assessing police officers once they are on the job and how environmental factors play a role in their job performance. The environmental factors of police stations can vary markedly from station to station. Thus elements such as leadership, culture, and conflict can play a huge role in the working conditions of each police station within a geographic location. A continual follow up evaluation of police officers is necessary once the pre-selection process has been performed. This is highly recommended and currently is not standard practice within the law enforcement community. Evaluations are extremely important to the psychological health of a police officer. There are several benefits to a follow-up evaluation process after the police officer has been hired. A formal evaluation process serves as a roadmap for station chiefs to better understand their organization and to continuously assess their own managerial efforts. As well, police officers operate within a very rigid and bureaucratic structure with little opportunity for them to express their opinions. Many officers deal with complicated situations and have many stakeholders to please. Some many feel conflicted on the job and have authoritarian style leadership that is not willing to listen to the individual needs of the police officers. This tightly controlled working environment can be a source of stress for officers. In an evaluation, an officer who has been on the field for several years may have an opportunity to give feedback to the evaluator which does not serve to threaten their own job security. There are a variety of problems which could occur in the workplace; common work related problems such as work overload, conflict amongst other officers, boredom, bad relationships with superiors may contribute to long term negative effects on police officers. Evaluations serve to prevent job-related burnout in police stations. Symptoms of burnout are apathy, lack of motivation, feelings of frustration and insubordination. An evaluation would serve to thwart the effects of burnout before it occurs. Evaluations also provide valuable information from an unbiased third party which allows the upper management within a police station to receive this information objectively. As well, an evaluation/assessment method should also be a basis to train leaders in law enforcement to assess their own organizations and detect police officers who are stressed, unhappy or feel overwhelmed by their job demands. By doing so, the deputy chief who has the responsibility to oversee several police stations within a certain county can better understand the personalities that represent their police force within a certain jurisdiction. This is important to retaining police officers as some police stations have better employee morale

than others. For many police officers go through formal training in the police academy but find that their working conditions are very different when they are on duty. Many officers deal with complicated situations and have many stakeholders to please. Evaluations form the basis of helpful interventions to police officers who need assistance. Since there is very little in the way of evaluation programs, this paper serves to provide some insight to the various types of organizational development evaluation programs that can be instituted. In this paper, the authors have explained three programs: strategic assessment and evaluation, stress management and the leadership program.

## I. Strategic Assessment and Evaluation

The one thing that psychologist must understand to be successful is the police culture and sub-culture which also encompasses the officers dependents. Without this understanding the psychologist most likely will not form strong partnerships that need to take place in order to be successful. These cultures affect the working conditions of police officers and their overall attitude on the job. A high level of job satisfaction allows police officers to be more effective in their place of work.

An initial **evaluation** of the police organization allows the organizational development psychologist to understand the culture of the station. This entails an onsite visit by the organizational psychologist. This intensive assessment includes consultation with the law enforcement administrators, police officers, along with a review of pertinent records, and in general an overview of the status of the police station. A summary report is prepared by the consultant that prescribes the mode and manner of assistance which can be provided by the Consultants to contribute to the effective operations of the police station.

The presentation of the evaluation is made both orally and in written format. At the same time the organizational consultant will also submit a proposal for the development of a formal recommendation and implementation plan which will include among its recommendations, specific strategies for issues uncovered in the Strategic Review process. The heart of the **Strategic Assessment Process** is the identification and analysis of current decision alternatives made by the upper administration of the police stations, in view of their probable effects on the future of the organization. A strategic plan provides a purpose and direction for the station as it deals with the internal dynamics of its police officers. In turn, this leads to the development of objectives, strategies and action programs for the upcoming year. These, when implemented by a strong and effective organization structure, provide a distinct competitive advantage. The psychologist will conduct a review of the leadership, an assessment of workplace stressors and examine the culture of the organization. All records would be kept confidential by the psychologists to insure the police officers that there is not a violation of trust and information divulged would not be used to on performance appraisals. The consultant must present the findings to the Chief of Police and Law Enforcement Administrator. Upon the organizational assessment the policy will be as follows:

1. Chief of Police reads the assessment report
2. Law Enforcement Administrator reads the assessment report
3. Both Chief of Police and Law Enforcement Administrator discuss with the Organizational psychologist the recommendations for improvement and intervention.
4. Psychologist meets with Chief of Police and Law Enforcement Administrator to review the strategic process.

A decision is made to go further with on-site training, leadership coaching or individual counseling. Additionally, the organizational psychologist serves as a resource to outside support agencies and could recommend further intervention and treatment for the officers that can keep the identity of the officer private. With the help of the organizational development consultant the agency takes the assessment and can go on to further intervention. Also, if there are further recommendations such as diversity training or trying to understand the cultural problems within stations, these issues would come to light within an organizational assessment. Some action programs which are necessary result in the stress evaluation program and the leadership coaching program; these will be explained further in the following sections.

## II. Stress Evaluation Program:

Police Officers are faced with long hours and uncertain environments on their jobs. Research has shown that increasing levels of stress can reduce job performance and cause irrational decision making, impatience and aggressive behavior on the job. Due to the increasing demands placed on officers it is imperative that an officer have an avenue to relieve their stress and tension. Many stations do not have programs whereby there is a periodic assessment of stress levels of their police officers. The first part of the program would be for the organizational psychologist to distribute a workplace stressor test. This test would determine what specific factors are the causes of the stress to the officer. By isolating the causes of stress such as work overload, violence, or unresolved conflicts, the consultant can better suggest recommendations to alleviate the symptoms of stress. The organizational psychologist used for implementing the workplace stressor test is often contracted and not a

member of the police department. Several police departments, for example, contract the tests and the personnel to administer the tests. Furthermore, this program would involve continual follow up and management of stress levels for officers. The goal of the program is for officers to help themselves in terms of identifying their own stress and be made available counseling or group trainings to discuss stressful issues that are common to officers. The main role the organizational psychologist is to be responsible for assessing stressors on the job, and provide ongoing assessment of the strengths and weaknesses of the police station thereby making organizational recommendations for improvement. Often times a department will experience issues with a police officer. That officer might be suffering from a personal problem or work related problem affecting the job. Additionally, the environment of a police station may also serve as a stressor. There are various treatments that are used to help the officer. Those treatments can be counseling, psychological testing, and risk or non risk assessment. Follow up assessment is used to uncover difficult situations and help the officer discuss possible alternatives to problems in a non-threatening environment. If it is found during the course of the organizational assessment that several police officers encounter similar issues, than a training program could be started that serves the entire organization to prevent further stress among its workforce. A stress reduction program can be further instituted. There are methods and procedures the psychologists are required to take when dealing with these issues. Number one is confidentiality. It is hard enough for individual officers to admit they have problems and not have the whole department know the officers personal issues. The major issue that the police seem to be having is domestic violence abuse situations and the excessive force problems resulting from these abusive situations. Personal stressors can easily translate into workplace stressors when emotional difficulties go untreated. This is why there is a great deal of concern regarding the need for organizational psychologists to help out with the problems of the police. The department does not want these officers out in the community with possible anger management problems. Also there may be a culture within the police station that is very aggressive and verbally abusive. This can easily carry forth to the police officers themselves. Many police officers are not too keen on the idea of dealing with a psychologist. This is due to the very nature of how the police system is set up.

Larger police departments will often hire a psychologist as an employee, in order to tap into other resources. Those resources might be stress management, counseling for officers and their families, hostage and interrogation issues, criminal profiling, community organization, and countless other situations that might benefit the police in the long run. The presence of an organizational development psychologist can increase the morale of the police department as they serve as a resource of emotional and psychological support. Organizational assessment has benefitted many public service organizations in providing an understanding of right person-job fit as it interacts with its "police culture" thus reducing turnover and developing a strong work force over time (No Author, 2008).

### **III. Leadership Program**

The leadership program would provide police officers to develop their own styles of leadership. The program would be a 2 week intensive training program whereby officers would learn different techniques of communicating effectively, increase their negotiation and conflict resolution skills. In this program, police officers would attend 3-5 workshops in which they given opportunities to role play situations and discuss difficult situations they have been faced with on the job. The trainer would give feedback to the officer as to what was done well and make suggestions for improvement. In this setting, police officers are also encouraged to bring in situations they have encountered on the job and share best practices amongst their fellow colleagues. The leadership program would be very interactive and allow team building among police officers from the same or various stations. The objective of the program would be to instill confidence to police officers in terms of handling a variety of situations and provide the tools to communicate effectively in stressful encounters. Additionally for senior police officers, this program provides ongoing career development for police officers. Many police officers are able to retire after being on the force for twenty years however many do not. They continue to remain on the force and often become a strain on the station due to several reasons. First, they feel that their entire identity is encompassed by the profession which is being a police officer. They feel that there are no other career options for them. A program which explores transferable skills for police officers and provides them with support on entering other fields post retirement is valuable. Another part of this leadership program will also train police officers to lead with more emotional sensitivity. Much of the leadership in law enforcement does not characteristically allow for police officers to express emotions of discomfort, conflict or stress to their superiors. They are taught to suppress their own feelings and continue with the job. Over time if this authoritative culture continues, than the police chiefs are blind to the personal issues of police officers. This program would train station chiefs to be more approachable and flexible in their leadership style. This would be beneficial to the overall effectiveness and responsiveness of the police station. Some station commanders may have an imposing leadership style that does not allow for expression of feelings. Whereas other station commanders are flexible in personality and welcome police officers to share in the challenges that occur on the job. Personal stressors can easily translate into workplace stressors when emotional difficulties go untreated.

## Benefits

Based on the needs of the local police department, an organizational psychologist will be contracted instead of being hired on a full time basis. As the law enforcement administrator, he or she should consider the relationship the psychologist will have with the police department. The relationship can be an advantage or disadvantage for police. There are some departments who use consultant psychologists and full time psychologists. This helps keep complaints down and eliminates the conflict of interest problem. Some administrators do not want the same individual counseling the officer who may or may not be unfit for duty. The consultant may just do fitness for duty evaluations, while the full time psychologist will do all other remaining duties required. "In any case, the relationship between an agency and a police psychologist is most productive when it is based on good communication, trust, and confidence." (Janik, 1994 pg. 24)

This is why there is a great deal of concern regarding the need for organizational psychologists to help out with the problems of the police. The department does not want these officers out in the community with possible anger management problems. Also there may be a culture within the police station that is very aggressive and verbally abusive. This can easily carry forth to the police officers themselves. Many police officers are not too keen on the idea of dealing with a psychologist. This is due to the very nature of how the police system is set up.

## ETHICAL ISSUES

There are certain legal and ethical questions in regards to confidentiality that must be considered. A critically important aspect of any helping relationship is the consultant's need to maintain absolute integrity. This is not only a matter of being honest with the observations, observing the rules of the organization, and respecting the responsibility and authority of different people, but also avoiding misperceptions. The policy of the agency is that every member of the police department needs to be able to get confidential counseling for personal and job related problems. There are several ethical issues that police officers face every day in terms of making sound and reasoned decisions. Some ethical dilemmas faced would be during an arrest procedure, whereby the police officer may not feel confident in terms of their decision to arrest an individual or not. Another ethical problem would be if a police officer witnessed their colleagues perform a wrong doing. Of course, there are different ways to counsel based on different problems. The main goal is privacy. Police officers have a difficult time already with balancing the effects of stress on the job with family life. Many police officers bring their stress of work home to the family resulting in domestic violence. These are all ethical issues that police officers face in which an evaluator must be aware of. An assessor must be careful to avoid being seen as more friendly with some people than others and especially as being a pipeline to higher law enforcement administrators. The hardest thing is getting an officer to understand is the organization psychologist will remain neutral and not be the eyes and ears of station commander. The assessor must resist the pressure from officers to get information from upper management in terms of promotions, hiring's and firings. Another aspect of integrity is the need to protect the client from him or herself. Sometimes, in a rush to demonstrate the intention to be open, the police chief may share information too prematurely without further investigating all the causes of the problem. The problem with this is that there is no legal or ethical confidentiality with that behavior. The agency must tell officers that all counseling sessions will be confidential. The agency must maintain the confidentiality it promises. The assessor must keep silent what he or she hears that is not directly relevant to the assessment process. There is a clause that must be addressed in the agency handbook and to officers; that any serious personal problem proven to be a criminal act or illegal to cause against another person will be cause for concern and brought to the attention of the Chief of Police. This is not a violation of the rule but a matter of public safety for the agency.

## CONCLUSION

This has been a brief explanation of why there is a need for an organizational psychologist for a law enforcement agency as well as a review of the procedural aspects of the assessment and evaluation process. With the rise of domestic violence and domestic abuse issues among our officers and litigation problems, there is a clear need for the services of a contractual or permanent psychologist to assess the viability of the organization. The process of on-going evaluation is an extremely important activity for police officers who are on the force. This paper has served to address the benefits of developing an evaluation program and provides specific activities during this process. With all of the problems occurring in our communities and throughout society in general, police agencies must perform at the highest level and keep a high level of employee morale. There is no room for mistakes whether it is in the community or in the agency building. It is important that each officer understand the importance of an on-going organizational assessment and evaluation of police officers while they are on the job. Evaluations would serve to reduce stress and burnout, provide additional job skills to officers via leadership training, and give upper management feedback on the state of the psychology health of their police work force. This information could best serve the community overall by managing the deployment of police officers more effectively.

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# RELIGIOUS ACTIVITY AS A COPING MECHANISM FOR TIME STRESS

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## ABSTRACT

While many studies have been conducted about stress in a variety of disciplines, and there have been a number of studies about various aspects of religion, a notably smaller number have examined stress and religion. Even more scarce are the number of studies dedicated to examining the relationship between components of job stress and specific aspects of religious coping. The current study proposes to conduct a preliminary examination of the relationship between job stress and engagement in religious activities. Participants, emergency response personnel from firehouses in the Rio Grande Valley (Texas), were surveyed about their perceptions of job stress (using the 1983 Parker and Decotiis scale) and about their participation in specific religious activities (attending church, visiting with a priest, visiting with a spiritual healer). Results indicate that attendance at a formally organized service is related to lower levels of perceived time stress. There was no significant relationship with other measures of religious coping mechanisms. The sample, predominantly male, Hispanic, and in highly-demanding jobs, provided a glimpse into the potential impact of religious coping on job-related stress. Limitations are briefly discussed and future research is solicited.

**Keywords:** Job Stress, Religion, Firefighters, Hispanic

## RELIGIOUS ACTIVITY AS A COPING MECHANISM FOR TIME STRESS

Studies have been conducted about stress in a variety of disciplines, ranging from the broad sociology, psychology, medical, and business disciplines, to those directed toward a specific group (e.g., law enforcement, military, and nurses) (Agür & Pérez, 2007; Lazarus & Folkman, 1984; Lewis-Fernández et al., 2008; Parker & Decotiis, 1983; Regeher et al., 2007; Varvel et al., 2007; Walsh et al., 2009). In business, there is a focused concern on job stress; stress that is caused by elements of the job. While stress created by buying a house, attending school, and having trouble with your in-laws certainly interferes with your ability to cope, researchers and practitioners in business are more concerned with the ills wrought upon individuals because of occupational characteristics and the coping mechanisms best suited for employee well being.

There have been many studies about various aspects of religion, with most of these occurring within the sociology and psychology disciplines. For example, a number of recent articles have been inspired by the tragedy of the 9/11 attack on the nation. Others focus on youths and adolescents in disadvantaged situations. Still more examine religion with respect to serious illness, and to bereavement. While there have been investigations into life stress and religion (e.g., Park, Cohen, & Herb, 1990; Powers, Cramer, & Grubka, 2007), much less frequently have job stress and religion been studied together, even though turning to religion is an established method of coping (Sigler & Thweatt, 1997).

In a review of religion and spirituality literature, there has been a marked increase in the inclusion of these topics within the context of stress (Weaver, Flannelly, Garbarino, Figley, & Flannelly, 2003). While this is only one journal, the results seem to reflect the increase seen in society for an orientation toward religion and religious expression. The current study proposes to conduct a preliminary examination of the relationship between job stress and engagement in religious activities. To summarize, while there has been some research into job stress and religion as a coping mechanism (e.g., Sigler & Thweatt, 1997), much is unknown about this relationship. This paper proposes to begin the illumination of that area of research. The rest of this manuscript is formatted as follows. The following sections include a brief literature review, a methodology section, results, discussion and limitations.

## LITERATURE REVIEW

Parker and Decotiis define job stress as a "feeling of a person who is required to deviate from normal or self-desired functioning in the work places as a result of opportunities, constraints or demands relating to potentially important work-related

outcomes" (1983: p. 165). Job stress, as conceptualized by Parker and Decotiis (1983), consists of two dimensions: time stress and anxiety stress. The first dimension is time stress, that is, feelings of being under constant pressure. The second dimension is anxiety stress, which consists of job-related feelings of anxiety. In this study, we will focus on the time dimension of job stress.

The context in which events occur is also relevant in the stress literature. In this study, emergency response personnel, mostly firefighters, are the participants. The situation in which these individuals perform their work duties is unlike the average worker. These situations often contain potential life-and-death consequences that require the appropriate response in a very short timeframe. The nature of their job is such that they must respond to sudden, emergency-oriented demands and must remain professional in their actions (Pendleton, Stotland, Spiers, & Kirsch, 1989). In addition to the short timeframe for action, it has been noted that these emergency situations can occur at any time and for extended periods (Carlier, Voerman, & Gersons, 2000).

Time stress studies among emergency personnel suggest that time pressure has different outcomes. For example, police officers report that the encroachment of family time due to work pressures creates conflict and officers report this as one of the most stressful characteristics of their jobs (Violanti & Aron, 1994). Firefighters, however, may benefit from time pressure since the job requires focus thinking under time limitations in order to process the scene quickly and make life saving/death decisions (Ganster, 2005). In a study comprised of 1314 nurses providing home health care Höge (2008) found that time pressure was correlated with work-family conflict, psychosomatic complaints, cognitive and emotional irritation. Time pressure studies are also associated with burnout due to the lack of time to fulfill work roles (Hatinen, Kinnunen, Pekkonen, & Kalimor, 2007) or when studied in the family domain, work-family conflict (Hatinen et al., 2007). Thus, the literature cannot clearly explain what, if any, time pressures emergency personnel may experience due to their occupations.

Religion as a coping mechanism has been studied in previous literature. For example, religion as a coping mechanism was formalized with the five part conceptualization of coping strategies by Klauer and Filipp (1993). Reliance on religion was identified in their factor analysis, which also included seeking social integration, rumination, threat minimization, and seeking information. Studies that have examined the religion as a coping mechanism (Beaton, Murphy, Johnson, Pike, & Cornell, 1999) and an introspective coping mechanism (Backus, Backus, & Page, 1995) have served to demonstrate the importance of religion for firefighters. Prati, Palenstni, and Pertrantoni (2009) examined the relationship between coping strategies and quality of life. In their factor analysis, the religion item failed to load on a single factor, which suggests that it may need to be considered separate to be able to draw conclusions about its role. Folkman and Moskowitz (2004), in a review of coping mechanisms, did note that religious coping research has only recently become a focus of research; this should serve as a call to action.

## **METHOD**

This research employed a single administration of a survey. The data are self-reports of the participants' own perceptions. The survey asked respondents to reply to questions about job stress (both time and anxiety), as well as activities in which they engaged that might relate to coping mechanisms. The responses were analyzed to examine the relationship between time stress and religious coping.

The data for this paper were collected as part of a larger, more comprehensive research project in the 4 counties in the lower valley area of Texas. Emergency response personnel from virtually every firehouse in the surveyed area completed the instrument. Two hundred sixty-five of the total number of respondents is used for the analysis in this study.

The sample was eighty eight percent Hispanic and nineteen percent was Non-Hispanic White and other. The mean age was between the ages of 26-35 ( $\mu = 2.07$ ;  $SD = .96$ ). Sixty-two percent of the sample had at least a high-school education and twenty nine percent had earned a Masters degree. Thirty-five percent of the sample was married. Forty-two percent had no children, fifteen percent of the sample had two children and the remaining sample had three children or more.

Emergency response personnel completed the survey. The job stress measure used was developed by Parker and Decotiis (1983). The measure uses 13 items to measure job stress along two dimensions; the relevant dimension for this study is time stress (measured using all 8 of the time items). Participants responded using a 5-point Likert-type scale where 1=strong disagreement and 5=strong agreement with the time stress statements. The religion measure consisted of several single-item questions of how frequently the participant attended an organized service, visited with a religious leader, and visited with a spiritual healer.

The data was analyzed using an independent samples t-test to determine statistically significant differences between those individuals who engaged in religious activities more frequently than those who did not in regard to reported time stress responses. The results of the analysis are presented in the following section.

## RESULTS

Table 1 presents the correlations between the study variables. Time stress is negatively related to church attendance. Visit with religious leader is positively related to church attendance. Visit with spiritual healer is positively related to visit to a religious leader. Time stress was not significantly related to either visit with a religious leader or with a spiritual healer. These two variables will be dropped from further analysis.

**Table 1: Correlations**

	N	Church attendance	Visit religious leader	Visit spiritual healer
Time stress	252	-.131*	.040	-.047
Church attendance	255		.308**	.031
Visit religious leader	252			.225**
Visit spiritual healer	254			

\* $p < .05$ ; \*\* $p < .01$

Respondents were asked the extent to which they perceived time stress on their jobs. The findings are presented in Table 2. Those respondents who attended religious service more than once a month experienced significantly less time stress relative to their jobs. Visit with a religious leader and with a spiritual healer were dropped from this analysis.

**Table 2: Perceptions of Time Stress**

	Low participation <sup>a</sup>			High participation <sup>b</sup>			t
	N	M	SD	N	M	SD	
Attend church	87	34.28	12.72	168	30.83	12.30	2.076*

\* $p < .05$ ; \*\* $p < .01$

<sup>a</sup> Low participation corresponds to 1 or fewer times a month attendance

<sup>b</sup> High participation corresponds to 2 or more times a month attendance

## SUMMARY & DISCUSSION

The negative correlation between time stress and church attendance, while expected, run counter to intuition in a larger sense. Taking time to attend a religious service should increase the amount of stress, again, perhaps in a larger “life” sense. However, what is being examined here is the relation to job stress. The inverse relationship supports the use of religion as a potential coping mechanism.

Visits with a religious leader and church attendance are statistically related. With the sample, largely Hispanic and likely Catholic, this is an indication of perhaps a trip to confession in conjunction with or in preparation for attendance at the religious service. Alternatively, the firefighters may be availed of the services of a chaplain as part of their jobs. This, also, would constitute visiting with a religious leader.

The connection between religious leader and spiritual healer suggests that some participants may be relying more heavily on ethereal sources for coping than others. Spiritual healers, also called curanderos in Hispanic America, use natural/supernatural methods to heal body and spirit. In this instance, the respondents were asked if they visited a spiritual healer/curandero to clarify the religious nature of the item. A respected and highly spiritual member of the community is not unlike a member of the clergy. Seeking assistance from a religious leader and from a spiritual healer could serve the same purpose. If this is the case, then either there is considerable overlap or these are complementary roles.

Approximately twice as many participants reported they attended church services two times or more a month than once or not at all. While this may be at odds with popular reports more individuals turning to inner spirituality and away from organized religion, attendance in this particular group of individuals could be expected to be higher because of cultural differences. The

largely Hispanic sample is likely to be substantially Catholic by religion. For Catholics, religion tends to be an action-based concept (see Park, Cohen, & Herb, 1990), which would include attending religious services on a regular basis. The corresponding difference in reported time stress on the job is notable. While both mean scores are toward the upper end of the time stress scale, there is still a measurable difference for those individuals attending an organized religious service at least twice a month. Two hours of non-work time could potentially reduce work-related time stress by a noticeable increment. This mechanism, along with other coping techniques, could appreciably serve to mollify some of the deleterious effects of stress encountered on the job.

Since this is a preliminary study, there is room for development of the knowledge about the relationship between job stress and religious coping mechanisms. Thus, there are several limitations to be noted. First, the sample should be expanded to include a variety of individuals; this sample was largely Hispanic and male. Similarly, inclusion of a variety of jobs would broaden the applicability of findings; current respondents were all in high demand jobs. Third, the level of detail of religious involvement, strength of religiosity, and diversity of religious beliefs can be increased.

Despite these limitations, this study has made a contribution to the literature by focusing on job-related stress in contrast to the more general life stress. It also focused on a group of workers that is inundated with situations in which the routines of their jobs can become quite unusual. More research into these matters will undoubtedly increase our understanding of the complexities within.

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## **SECTION 4**

# **ABSTRACTS & POSTERS**

# WATER TRADE AND DIVERSION ACTIVITY IN THE TEXAS LOWER RIO GRANDE BASIN

**Andrew J. Leidner<sup>1</sup>, M. Edward Rister<sup>2</sup>, Ronald. D. Lacewell<sup>3</sup>, Megan J. Stubbs<sup>4</sup> and Allen W. Sturdvant<sup>5</sup>**

Texas A&M University<sup>1,2,3,4</sup>, USA and Texas AgriLife Extension and Research Center<sup>5</sup>, USA

## RESEARCH MODEL & FRAMEWORK

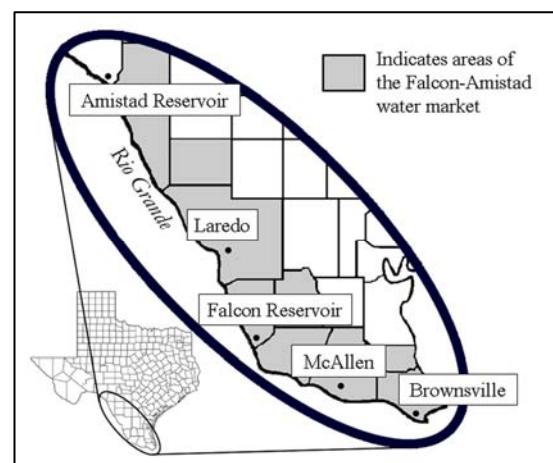
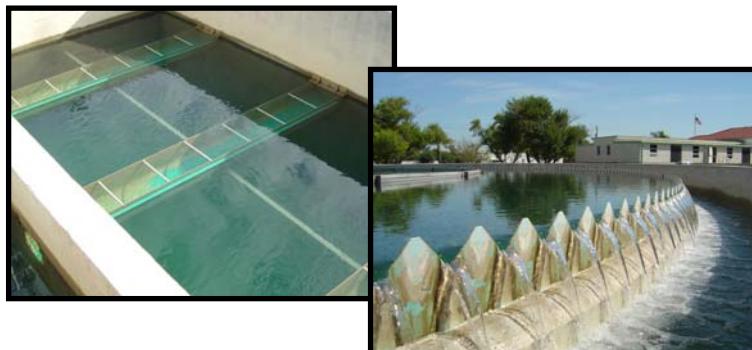
*This research follows the form of a descriptive case study of the water marketing institutions and recent water marketing activity in the Texas Lower Rio Grande Basin, with econometric analysis of secondary data on water market prices and quantitative analysis of primary data on water diversions and the characteristics of recent water market transactions.*

## ACKNOWLEDGMENTS

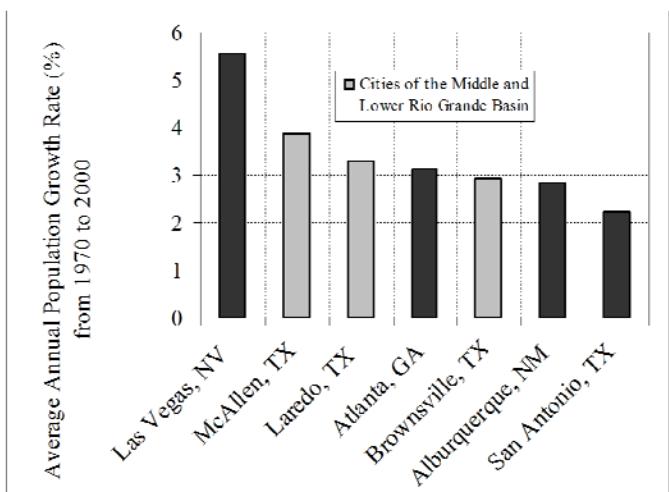
Funding provided in part by the Rio Grande Basin Initiative, Texas Water Resources Institute, CSREES project 06-118407-89531.

## INTRODUCTION

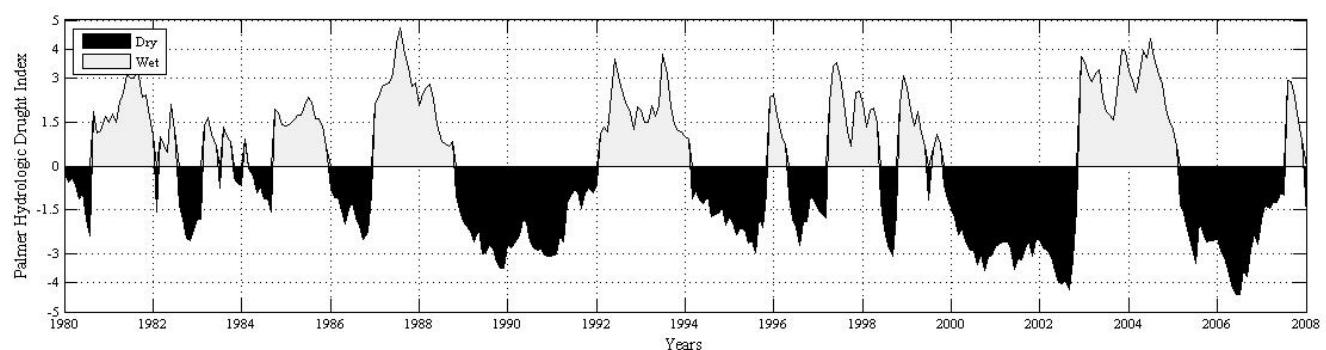
- Water scarcity around the world, often in conjunction with climate change, is spurring interest in a variety of alternative water supply projects and innovative water demand management strategies.
- The middle and lower portions of the Texas Rio Grande basin have experienced (and are experiencing) several issues, which can put stress on a regional water management system (Figure 1).
- Those conditions are rapid population growth (Figure 2), periodic drought (Figure 3), and demographic change from agricultural to urban and suburban.
- WATER MARKETS are one of the many tools that regional water managers may implement to solve disparities in water supply and water demand.
- Such a water market services the lower and middle portions of the Texas Rio Grande Basin -- the Falcon-Amistad water market.



**Figure 1:** The location of the Falcon-Amistad water market area.



**Figure 2:** Metropolitan statistical areas of the Falcon-Amistad water market area and elsewhere. Source: U.S. Census Bureau, 1993 and 2007.



**Figure 3:** Palmer Hydrologic Drought Index for Cameron and Hidalgo Counties from 1980 to 2007. Source: NCDC, 2007.

## OBJECTIVES

- Examine the water market in the middle and lower portions of the Texas Rio Grande basin and report on any qualitative and quantitative findings.
- Examine market operations and identify any institutions which promote the effectiveness or ineffectiveness of the market's operations.
- Review historical trends of water raw water delivery prices, water quantities transacted through market operations, and river diversions within the market area.

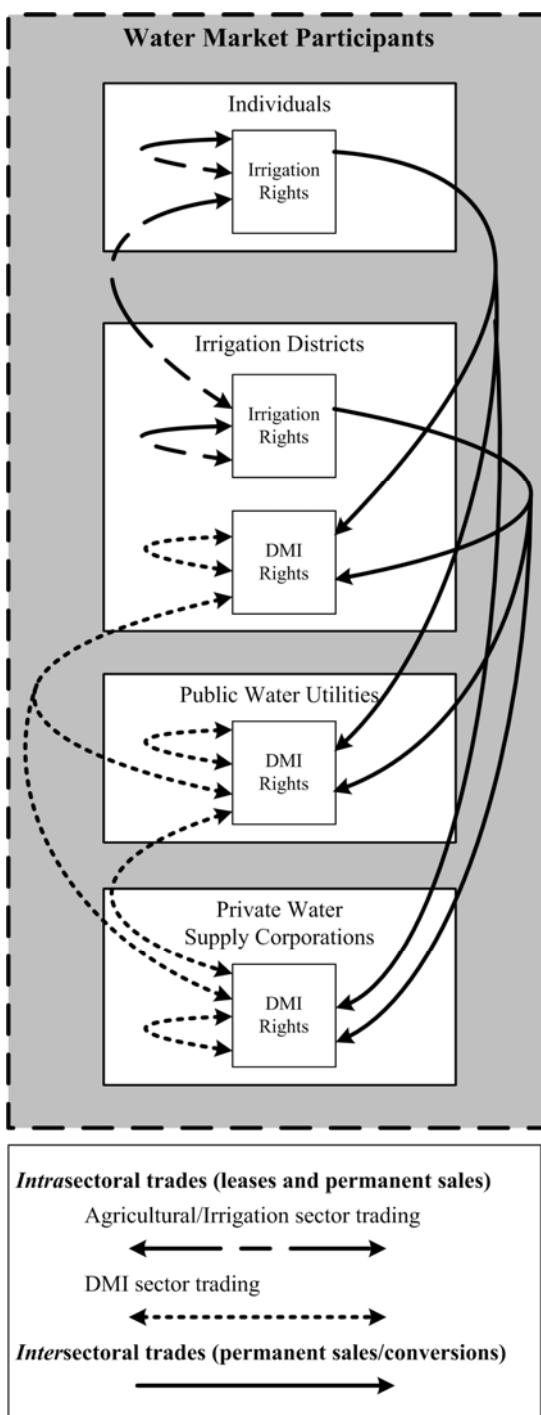
## METHODOLOGY

- Conduct literature review, tabulate historical prices for water rights and water rights allocations, and develop schematic model of water market operations.
- Collect and tabulate data on water rights allocations and water rights transactions from the Rio Grande Watermaster's Office of the Texas Commission on Environmental Quality.

## FALCON-AMISTAD WATER MARKET DESCRIPTION

- Participants in the market include: Individuals, Irrigation Districts, Private and Public Municipal Water Suppliers, Government Agencies, and Environmental Groups.
- Water rights are categorized by different uses for the water, such as irrigation, mining, industrial, municipal and domestic. Domestic, Municipal and Industrial rights are afforded a higher priority than Irrigation rights.
- Within use-type, additional tiers of priority classes exist. These classes are Class A and Class B, with Class A rights afforded a higher priority.
- The Office of the Watermaster, under the Texas Commission on Environmental Quality (TCEQ), keeps the water right records for the Falcon-Amistad water market.

- Water right transactions without changing the water right's use-type are simple relative to a transaction which changes the use-type.
- Figure 1 shows the trade opportunities available between different water market participants, illustrating the complexity of the Falcon-Amistad water market.

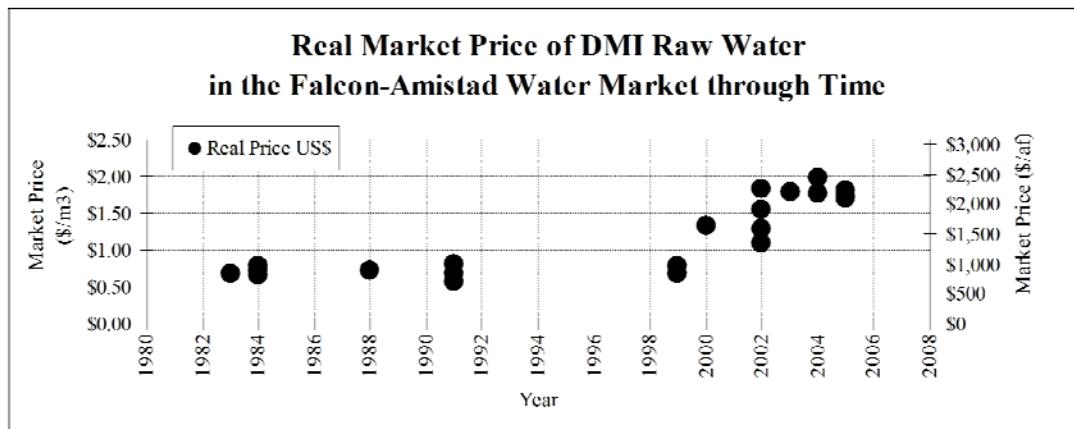


**Figure 4:** Schematic of the water market trading opportunities between the different water-market participants.

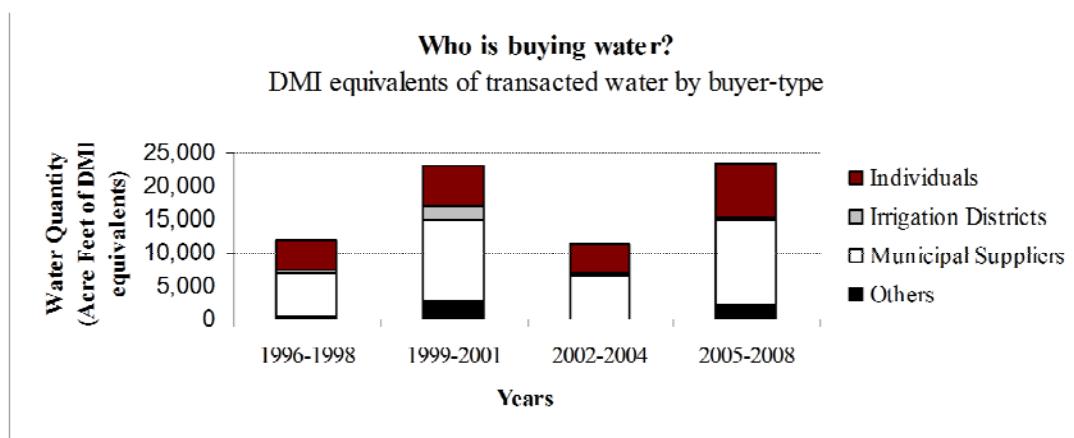
## RESULTS

- Since the late 1980s, levels of multi-use rights (Domestic-Municipal-Industrial) are increasing, while levels of Irrigation (primarily used by agriculture) rights are decreasing.
- During the last 30 years, the real price of a water right in the Falcon-Amistad water market has increased from just less than \$1,000/acrefoot to approximately \$2,300/acrefoot (Figure 5).
- Municipal suppliers and individuals are the most common buyers of water rights (Figure 6).
- Irrigation districts and individuals are the most common sellers of water rights (Figure 7).

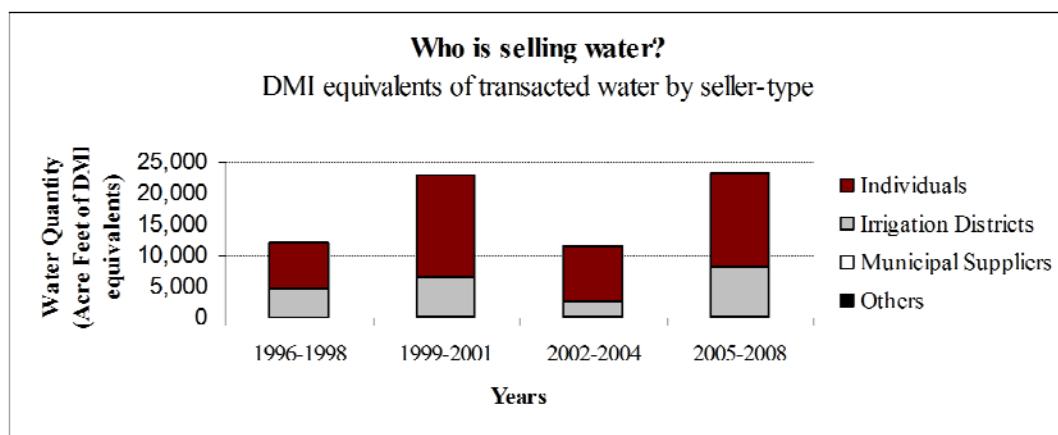
- As sellers, irrigation districts tend to be involved in fewer transactions than individuals, but each transaction tends to include a much greater quantity of water.



**Figure 5:** Historical trend of DMI water rights real\* price in the Falcon-Amistad water market. Multiple sources cited in Leidner, et al., 2009. \*Inflation rate = 2%; Base year is 2008.



**Figure 6:** Quantity of water transacted by buyer-type. Source: Records from TCEQ, Watermaster Program, 2009.



**Figure 7:** Quantity of water transacted by seller-type. Source: Records from TCEQ, Watermaster Program, 2009.

## CONCLUSIONS

- The increase in the real price of a water right may arise from the following: an increase in the demand of municipal water, increased risk aversion to future droughts, as well as speculative purchases of water rights.
- Municipal border expansion into land previously being irrigation cropland with water right held by an irrigation district has established a trend in market transactions, characterized by irrigation districts as sellers and municipalities as buyers.

- Successes of the market can be attributed to the following:
  - Full consumptive use of diverted water in the Texas Lower Rio Grande Valley, which results in minimal 3<sup>rd</sup> party effects and return flow externalities to market transactions
  - Successful enforcement and monitoring of water diversions by the Watermaster Program
- Future concerns for the Falcon-Amistad water market may include:
  - The Gulf Coast Aquifer: as groundwater pumping accelerates, water tables may fall and reaches of the Rio Grande may see increased seepage
  - If instream flows in the Rio Grande are determined to be insufficient, then additional reservoir diversions may be required to maintain instream flow levels, which would reduce the amount of water available to diverters and market participants

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# ANALYSIS OF NONPARAMETRIC KAPLAN-MEIER ESTIMATOR IN OFDM SYSTEMS

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## ABSTRACT

*This paper proposes a simple and efficient method for OFDM channel estimation using non-parametric Kaplan-Meier Estimator (KME). Orthogonal frequency division multiplexing (OFDM) communication systems is one of the most used schemes for achieving high data rates, channel estimation techniques has been a very active research area recently. Channel estimation accurate performance compensate for arbitrary time dispersion, attenuation, and phase shift caused by the signal propagation through the noise channel in a OFDM communication systems. Parametric channel estimators are the most common communication channel estimator, but require constant channel knowledge that impose high computation complexity compare to non-parametric estimator. In this paper, non-parametric Kaplan-Meier (KME) is implemented as a channel estimator technique to improve the performance and reduce the complexity of channel parameter estimation. The non-parametric KME is compared to conventional parametric minimum mean squared error (MMSE) and least squares (LS) estimator techniques as a channel estimator. Both performance and computational complexity implementation are analysed to establish a non-parametric Kaplan-Meier (KME) solution for channel estimation in OFDM communications systems. The most attractive advantage is that the complicated calculation is replaced with a significantly lower complexity implementation which can estimate the channel without significantly increasing the complexity of the system with comparative negligible performance degradation.*

**Index Terms:** Channel Estimation, OFDM, Kaplan-Meier Estimator.

## EXTENDED ABSTRACT

Recent trends in the wireless communication world suggest the ever increasing demand for high speed data communications (Migdadi, Unggul Priantoro, & Faizal Mohammad, 2007). Orthogonal Frequency Division Multiplexing (OFDM) is becoming widely applied in wireless communications systems due to its high rate transmission capability with high bandwidth efficiency and its robustness with regard to multi-path fading and delay (Edfors, Sandell, Van de Beek, Landström, & Sjöberg, 1996).

OFDM communication systems need accurate channel estimation in order to compensate for the distortions caused by propagation through the dispersive channel (Golovins & Ventura, 2007). From previous literature, it is known that an accurate estimation using standard parametric algorithms for channel estimation are still very difficult to achieve (Mehlhuhrer, Caban, & Rupp, 2008). Generally speaking, parametric estimation methods make more assumptions than non-parametric estimation methods. If such assumptions are correct, parametric methods could produce more accurate and precise estimates. However such estimates are not always true. Despite these facts, parametric channel estimators are the most common communication channel estimator, requiring constant channel knowledge. By contrast, non-parametric estimators requires minimal or no channel knowledge. Moreover, non-parametric statistics have the advantage of being independently distributed as well as insensitive to extreme values or outliers (Thatcher, North, & Biver, 2005). Efficient channel estimator techniques are essential for coherent detection of a received signal under noise (Shen & Martinez, 2006).

This paper analyses viable non-parametric Kaplan-Meier (KME) (Kaplan & Meier, 1958) alternative as a channel estimator technique to improve the performance and reduce the complexity of channel parameter estimation. The non-parametric KME is compared to conventional parametric minimum mean squared error (MMSE) and least squares (LS) estimator techniques as a channel estimator. The non-parametric KME effectiveness is demonstrated through a computer simulation in a simplified OFDM transmitter and receiver system in additive white Gaussian noise (AWGN).

In this paper, we extend the channel estimation technique proposed in a simplified OFDM system. First, we construct a signal comparison representation of minimum mean squared error (MMSE), least squares (LS) and non-parametric KME technique to identify the "best" estimator over an AWGN channel. Second, the symbol error rate (SER) versus the signal-to-noise ratio

(SNR) is plotted for each estimation techniques over an AWGN channel. A signal throughput performance versus the SNR is also plotted.

Computer simulation results show that the proposed non-parametric estimator offers comparable efficient estimation accuracy compared to existing parametric estimators. The non-parametric estimator significantly reduces the complexity of the channel estimation at the expense of negligible performance degradation. An alternative communication channel estimation strategy is presented for future developments of next non-parametric communication channel estimator for communication systems. Computer simulation results are given to demonstrate effectiveness of our investigation.

We have proposed a method of channel estimation that uses the non-parametric KME estimator and extended it to OFDM systems. The most attractive advantage is that the complicated calculation is replaced with a simple implementation which can estimate the channel without significantly increasing the complexity of the system with comparative negligible performance degradation.

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# INFORMATION AND TECHNOLOGY IMPERATIVES UPON HIGHER EDUCATION AND JOB-ORIENTED MULTILITERACY SKILLS IN URBAN SETTINGS

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## ABSTRACT

*The impact of information and digital technology on the evolving nature of texts such as multimedia and multimodal texts as well as the skills associated with the consumption, production, evaluation, and distribution of those texts require a paradigm shift from traditional literacy to multi-literacy. Many theorists, researchers and scholars prefer a broader definition beyond the traditionally-held concept of literacy, namely, prose literacy, document literacy, and quantitative literacy, and they claim that a new concept of literacy, multi-literacy, does a good job of providing a clearer picture and systematic framework from within which to examine each aspect of modern literacy. In this study, multi-literacy is a dynamic concept incorporating the traditional literacy skills of prose literacy, document literacy, and quantitative literacy with the new literacy skills of computer literacy, information literacy, technology literacy, mass media literacy, digital/visual literacy, and scientific literacy.*

*The notion of multi-literacy was first positioned by The New London Group, an aggregate of 10 multidisciplinary scholars from the fields of linguistics, education, literacy analysis, the sociology of education, and cultural studies, to give attention to the phenomena of literacy collision with new technological modes of representation and shifting heterogeneous demographics. The construction of the multi-literacy theory has been developed in particular by a series of essays. The function of multi-literacy builds upon the progressivist perspective of education in conjoint with "affect theory" through a concern for expiatory power in education. Cultivating new literacies poses the issue of restructuring education.*

*The 1999 National Survey of Information Technology in Higher Education at 378 colleges and universities proclaims that our educational settings are becoming computer- and technologically-mediated. The rapid integration of new technologies into the fertilization of knowledge and economic activities has empowered the workplace and workforce, but at the same time has undermined the credentials of those affected by the digital divide and interrupted the relationships between employers and employees. The technologization of American society has impacted the higher education curriculum. The information and technology imperatives and higher education curriculum constraints have impacted the disparity between the employers-expected skills and the actual skills of urban workforce including college graduates regarding their workplace multi-literacy skills. 115 relevant references of literature cited suggest that the impacts of information and technology imperatives upon the future of Higher Education and the disparity between the employers-expected skills and the actual workplace skills of the workforce have drawn the attention of researchers, policy-makers, and practitioners worldwide to the vital role of multi-literacy in the dynamics of urban economic, political, and social development as well as in adult citizens' lifelong learning, employability and performativity to live a sustainable comfortable life. The demand for multi-literacy skills in the workforce and workplace is rapidly increasing, but little scientific research on workplace literacy has been published.*

*This study of a quantitative, nonexperimental design using correlational analysis and path analysis is to investigate the higher education curriculum constraints in relationship to college students' job-oriented multi-literacy development and address the disparity between the employers-expected skills and the actual skills of urban workforce regarding their workplace multi-literacy, given the conceptual framework of current multi-literacy theory and practices under the increasingly technology-driven environments. This research focus is four-fold: (a) the pressures of information and technology upon higher education curriculum and employers' expectations of employees' job-driven multi-literacy skills; (b) the higher education curriculum constraints under the knowledge-economy and technology-driven environments; (c) employers' perceptions and satisfaction regarding their workforce and workplace multi-literacy skills; and (d) the causal relationships among the variables of information and technology imperatives, higher education curriculum constraints, employers' expectations and satisfactions, and adults' job-oriented multi-literacy skills.*

*Statistic methods such as bivariate correlation and multiple regression will be run to measure the degree of relationship between (a) employers' expectations/satisfactions and their workforce actual job-oriented multi-literacy skills and (b) higher education curriculum and the entering workforce job-oriented multi-literacy skills. Another statistic technique, path analysis, will be used, and a path diagram will be developed for the hypothesized causal model to calculate the direct and indirect effects of information and technology imperatives, higher education curriculum constraints, and employers' expectations/satisfactions on adults' job-oriented multi-literacy skills. Two out of the eight universities in Mississippi State located in the Mississippi Metropolitan Statistic Areas (MSA)*

will be identified as sites to collect data from faculty and students on information and technology imperatives, higher education curriculum constraints, and the entering workforce job-oriented multi-literacy skills. The major industries, businesses or state government agencies with a total workforce population of 100 and over respectively in the two Mississippi MSAa will be identified as sites for data collection on employers' expectations/satisfactions on adults' job-oriented multi-literacy skills. The subjects or participants taking part in this study will be faculty and college students, the coordinators or supervisors or CEOs in the targeted employers, representatives or leaders in the state agencies, and the range of age will be 16 years and older with no gender discrimination. Three researcher-developed instruments using the questionnaires on a 6-point Likert Scales will be designed to measure the data on 38 job-oriented multi-literacy performance inventories/indicators.

This study will direct research attention towards the parameters of multi-literacy as the survival or pragmatic values, as an empowerment for employment opportunities, and as a catalyst for urban economy and community capacity building. In the first place, this study will provide statistical justifications for higher education institutions to rethink their roles in enhancing multi-literacy capacity and for higher education institutions' curriculum committees to adjust and enrich their curricula in response to the public outcry for greater accountability in preparing the market-driven workforce. Meanwhile, it will awake the workforce to retool their deficit multi-literacy skills in order to be marketable. In addition, the envisioned long-term impact of this study will be the building of healthy job-market supply-demand relationships between the employers and the workforce.

The results of this study will add to the emerging scholarly research in the field of connecting multi-literacy development and higher education to prepare the knowledge-based and technology-driven market-demanded workforce. The findings might be utilized by employers to predict their workforce capacity and plan the retooling strategies for their enterprise productivity and by higher education institutions to establish the purview of the humanities in negotiating standards and multi-literacy pedagogies for a model of transformed education or restructured education in this endeavor.

# EFFECTIVENESS OF SOCIAL MEDIA SIMULATION TO TEACH INTRODUCTORY ECONOMIC PRINCIPLES

**Michael H. Lau and Michelle Mullins Santiago**

Sam Houston State University, USA

## ABSTRACT

*In order to provide the most appropriate curriculum for economic students in the 21<sup>st</sup> Century, it is important for educators to understand the changing communication style among students entering college. Technology must be used to enhance teaching and learning in economic courses. Using an online social media simulation can assist in economic knowledge retention and complement materials taught in the classroom. Economics has historically been taught in a traditional lecture style. In Facebook, an economic social media simulation tool is readily available called Farm Town. Farm Town simulates the management of costs and marketing of a diversified farm enterprise using introductory economic principles. Farm Town, a free simulation tool, provides educators with a viable option to digitally teach introductory economic principles. Educators are able to meet students' digital way of life using a digital environment.*

*The primary objective of this research was to determine student perceptions of using Facebook's Farm Town simulation as an instructional tool in an introductory economic course. Additionally, student retention of introductory economic principles was measured after the Farm Town simulation. An online survey instrument was developed to measure student perceptions toward the use of Farm Town in an introductory Agricultural Economics course. A Likert Scale was used in this study to determine the rank of student perceptions. The survey was analyzed using statistical summaries, correlation coefficients, and tests of statistical differences.*

*Initial analysis shows Farm Town is an effective tool for teaching introductory economic principles. Students felt Farm Town enforced the understanding of introductory economic principles and provided an outlet to apply materials in a simulated digital life situation. Based on these initial results, social media simulations such as Farm Town can be used as an effective teaching tool for introductory economic principles.*

**Keywords:** *Simulation, Social Media, Economics, Education*

## PROBLEM STATEMENT

In order to provide the most appropriate curriculum for students in the 21<sup>st</sup> Century, it is important for educators to understand the changing communication structure among students entering college. The learning experience of today's students, *Millennial* or *Generation 'Y'*, must compliment specific information styles associated with the digital age. These students are technologically savvy, visual learners, and are dependent on the use of technology to communicate in their everyday lives (Gladden, 2006).

The importance of technology is the diffusion of knowledge to increase students' competencies and to expose instructors to different learning delivery systems for their subjects (Tough, 2009). For example, the use of Web 2.0 technologies will be vital for today's digitally-inclined student making it necessary to have the technology to support learning outcomes. The end result of using technology is to not only to maximize students' ability to learn, but to be the catalyst and model for other programs to develop greater use of digital learning environments such as social media simulations.

Technology must be used to enhance teaching and learning in economic courses. Economics is a historical discipline where concepts are slow to evolve. Traditional methods of teaching using standard lectures and paper assignments are insufficient to meet the learning styles of today's students. Educators have been using online simulations such as Stocktrack for trading and ProStar for management to enhance course materials. However, these programs are quite expensive and are not a part of today's social media culture. Using online social media simulation will assist in expansion of knowledge retention and complement materials taught in the classroom. With students already accepting technology as the cultural way of life, digital inclusion will be necessary to increase teaching content outside the confinements of the classroom through virtual learning, which increases students' engagement.

Facebook is a popular social media site with over 400 million active users and 35 million user updates per a day. In Facebook, a popular digital simulation is available called Farm Town. Farm Town is based on introductory economic principles and can be used as an economic social media simulation. Farm Town simulates the management of costs and marketing of a diversified production agricultural enterprise using introductory economic principles. Each month there are over 11,000,000 million active participants on Farm Town. Farm Town is free and only requires a Facebook account. Being free is advantageous as Farm Town gives educators a viable option to teach introductory economic principles to students in a digitally inclusive environment, while not requiring the student to spend additional funds, which could act as a disincentive to participation.

## OBJECTIVES

The primary objective of this research was to determine student perceptions toward knowledge of introductory economic principles using Facebook's Farm Town simulation. Additionally, student retention of introductory economic principles was measured after the Farm Town simulation. This research provides a gauge on how a free social media simulation can be used to teach these principles. Specific student learning outcomes and understanding of key economic concepts were determined. Effectiveness of using Farm Town can be useful in determining the correct direction and focus of the incorporation of technology to improve student knowledge retention.

## PROCEDURES AND DATA

An online survey instrument was developed to measure student perceptions towards the use of Farm Town in an introductory Agricultural Economics course. The survey determines student experiences with Farm Town and how well knowledge of basic economic concepts were ascertained after using Farm Town. A Likert Scale was used in this survey to determine student perceptions. Student grades from Farm Town assignments will be used to determine comprehension of introductory economic principles.

The survey will be analyzed using statistical summaries, correlation coefficients, and tests of statistical differences. These tests will assist in determining if Farm Town is an effective teaching tool for introductory economic principles and if students feel Farm Town is effective in assisting their retention of key concepts. Future analysis may include logistic regressions for more in depth analysis.

## RESULTS AND CONCLUSION

Sixty out of seventy-five students completed the online survey. Initial analysis shows Farm Town is an effective tool for teaching introductory economic principles. Students who completed the assignment perceived the simulation as beneficial to understanding these principles in conjunction with course lectures. Students felt it enforced the understanding of introductory economic principles and provided them an outlet to apply materials in a simulated digital life situation. Based on assignment grades, students were better able to comprehend principles relating to cost of production, opportunity cost, and marginal revenue.

Based on these initial results and analysis, social media simulations such as Farm Town can be used as an effective teaching tool for introductory economic principles. In the case of this course, students enjoyed the digital inclusion of this teaching method as it reinforced concepts from course lectures. When given a choice, students expressed greater interest in completing the digital assignment than completing a traditional textbook assignment. Further analysis of the data is needed to determine if there is significant difference between students of different backgrounds. Additionally, correlation between student grades and perception on Farm Town use may provide further insight. However, the initial results are positive in teaching introductory economic principles using social media simulations. Further analysis should be complete by the time of the conference.

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# MINORITIES IN HEALTH CARE PARAPROFESSIONALS IN HOUSTON: A SOCIO CULTURAL STUDY OF ETHNIC MINORITIES

***Uma Pochampalli***

*University of Houston – Victoria, USA*

## ABSTRACT

*Minorities from African countries like Ghana, Nigeria and other places have found a niche for a successful business in the Emergency Medical Service area. We like to see who are doing this type of business.*

*This study will be conducted to enrich the knowledge base of Sociology, in understanding the societies and cultural change it is experiencing. This study will help us understand the way businesses are conducted, and identify specific needs and goals. It would further the knowledge base of understanding immigrants and applying it towards identifying their needs as well as ethnicity in a sociological perspective.*

Country of origin, languages spoken

Business

Educational back ground

*Some schooling*      *Undergraduate*      *Graduate*

Business courses

Professional certification

What motivated you to identify this business?

Were there others who did this business to guide you in your immediate circle?

What are some issues you find?

*Regulatory*  
*Operational*  
*Marketing*  
*Other*

What is your annual income range?

*Less than \$25000*  
*Less than \$50000*  
*Less than \$100000*  
*Less than \$ 200000*  
*Less than \$500000*  
*Less than a million*  
*Less than 1.5 millions*  
*More than 1.5 millions*

What is the nature of your business?

What is something that you wish to be improved?

What is something you can advise?

# HOW SHOULD THE GOVERNMENT MANAGE PUBLIC DEBT? A CASE OF AN EMERGING COUNTRY

**Rika Nakagawa**  
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## ABSTRACT

*The purpose of this paper is twofold: to review guidelines for public debt management published by IMF and the World Bank, and to analyze the system of public debt management in Malaysia, an emerging country, from a viewpoint of the guidelines. In the past, some developing countries were in default on loans due to failures of government debt management. One of the common features in these countries was that they financed their fiscal deficit with foreign borrowing. This means that those governments always face an exchange rate risk. Despite the risk, these governments are poor in risk management skills. These cases raised an important question: how should developing countries manage the public debt? IMF and the World Bank were requested to provide technical assistance in debt management for developing countries, and in 2001 they published **Guidelines for Public Debt Management**. The guidelines emphasize two factors: to address themselves to risk management and to develop the government bond market.*

*Malaysia, a middle income country, has succeeded in economic development without depending on foreign borrowing. One reason is that the Ministry of Finance set clear strategies for public debt management. As the top priority, they raised money from the domestic market in order to avoid the exchange risk. The country has promoted the government bond market so that the government can finance their fiscal deficit with domestic private savings. In addition to this, the government has encouraged the Employee's Provident Fund, a government-linked pension fund, and private banks, to expand the bond market. This well-developed bond market enables the Malaysian government to access domestic savings and manage public debt with less exchange rate risk.*

*As the Malaysian case shows, a key for developing countries to manage debt risks is development of the financial system, including the banking sector and the bond market. With a view to practical market development, this paper draws three policy implications. First, the governments of developing countries need to promote the financial sector because financial institutions act as intermediaries between lenders and borrowers. Secondly, the government needs to encourage private banks and government-linked institutional investors to support the bond market. Finally, the government needs to establish strategies of public debt management.*

**Keywords:** *Public Debt Management, IMF, World Bank, Employee's Provident Fund, Malaysia*

## **NEW GLOBAL CHALLENGER: UNDERSTANDING THE POTENTIAL OF COMPANIES FROM HIGH-GROWTH EMERGING MARKETS**

***Emin Civi***

*University of New Brunswick, Canada*

### **ABSTRACT**

*This study focuses on how new companies/entrepreneurs from emerging economies capitalize on opportunities in world markets. Industrialization, modernization, urbanization, and privatization have led to rapid economic development and transformation in EMs. These changes helped new entrepreneurs to adapt at managing broad range of risks comfortably. They have also mastered at improvisation, are very quick of problem solving to fit local and international context. New type of entrepreneurs have been searching new opportunities in the world market and adapting their strategies very rapidly. They are not following traditional internalization pattern, instead they are skipping many steps and becoming new challenger in global arena.*

## **ECONOMIC IMPACTS OF BIOENERGY POLICY**

**Naveen C. Adusumilli<sup>1</sup>, Ronald D. Lacewell<sup>2</sup>, C. Robert Taylor<sup>3</sup> and M. Edward Rister<sup>4</sup>**  
*Texas A&M University<sup>1,2,4</sup>, USA and Auburn University<sup>3</sup>, USA*

### **FRAMEWORK**

*Recent extended periods of high fuel prices and controversy over oil imports from unstable and unfriendly nations to the United States have propelled lawmakers to pursue a major national initiative that promotes the production of domestic energy through renewable sources. This initiative primarily focuses on the production of ethanol and biodiesel, with recent research extending to include cellulosic fuels. These biofuels are considered complementary with food production by many; however large-scale production often interferes with the traditional food, fiber and U.S. natural resource system. While the U.S. biofuel industry is growing rapidly, it has failed to address the interaction and synergism among food, fiber, and resource sectors.*

*This research is an overview of selected issues and implications of the U.S. bioenergy policy that is designed to result in the production of 36 billion gallons of biofuels by 2022. The present legislated policies have economic, energy, and environmental consequences, including impacts to food and crop prices, cropland requirements, irrigation water demand, and total fertilizer use. For example, there are studies that indicate that biofuels policy encourages a potential increase in primary plant nutrients consumption and their price levels, substantial increase in water use both for production of feedstock and conversion into fuel, and expanded cultivation on highly sensitive lands to supplement increased acreage requirements. These studies propose that policies have to extend beyond quotas and volumetric mandates in ways that protect sensitive resources. In addition, some of the projected aggregate economic consequences and unintended outcomes of these renewable energy policies are addressed, including implications for food, fiber, and forestry production and resulting prices.*

**Keywords:** Biofuels, Renewable, BioEnergy Policy, Sustainable

# IMPLEMENTING COOPERATIVE LEARNING IN AN EFL READING CLASS

**Gordon Myskow, Paul Underwood and Takahiko Hattori**  
Otsuma Women's University, Japan

## ABSTRACT

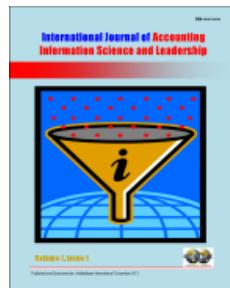
*The use of cooperative Learning (CL) in L2 classrooms is often discussed in the context of oral communication. A class that focuses on the seemingly solitary act of reading might appear to be an unlikely place to implement CL activities. This article however shows how CL can be employed throughout the reading process to not only improve comprehension of target texts, but to promote the use of higher-order critical thinking skills, including synthesis, analysis and evaluation. The authors describe specific ways that they have employed Spencer Kagan's structural cooperative learning model in their EFL secondary school reading classes in Japan to achieve a variety of reading objectives.*

**Keywords:** Cooperative Learning, Group Work, Teaching English

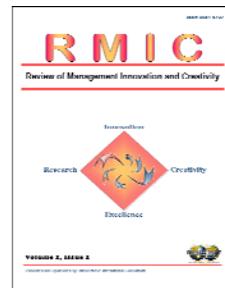
For information about Intellectbase International Consortium and associated journals of the conference, please visit [www.intellectbase.org](http://www.intellectbase.org)



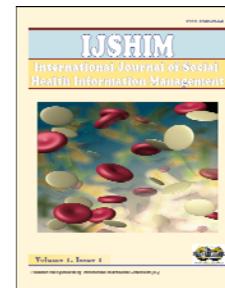
**JAGR-Journal of Applied Global Research**



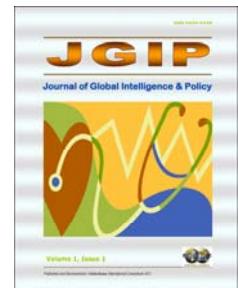
**IIAISL-International Journal of Accounting Information Science and Leadership**



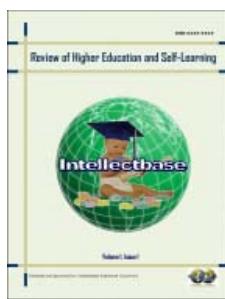
**RMIC-Review of Management Innovation and Creativity**



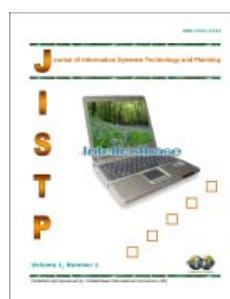
**IJSIM-International Journal of Social Health Information Systems Management**



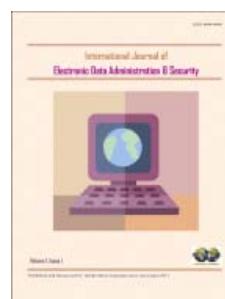
**JGIP-Journal of Global Intelligence and Policy**



**RHESL-Review of Higher Education and Self-Learning**



**JISTP-Journal of Information Systems Technology and Planning**



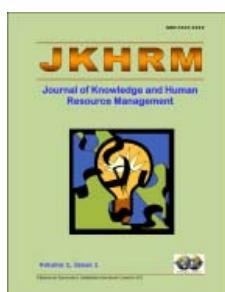
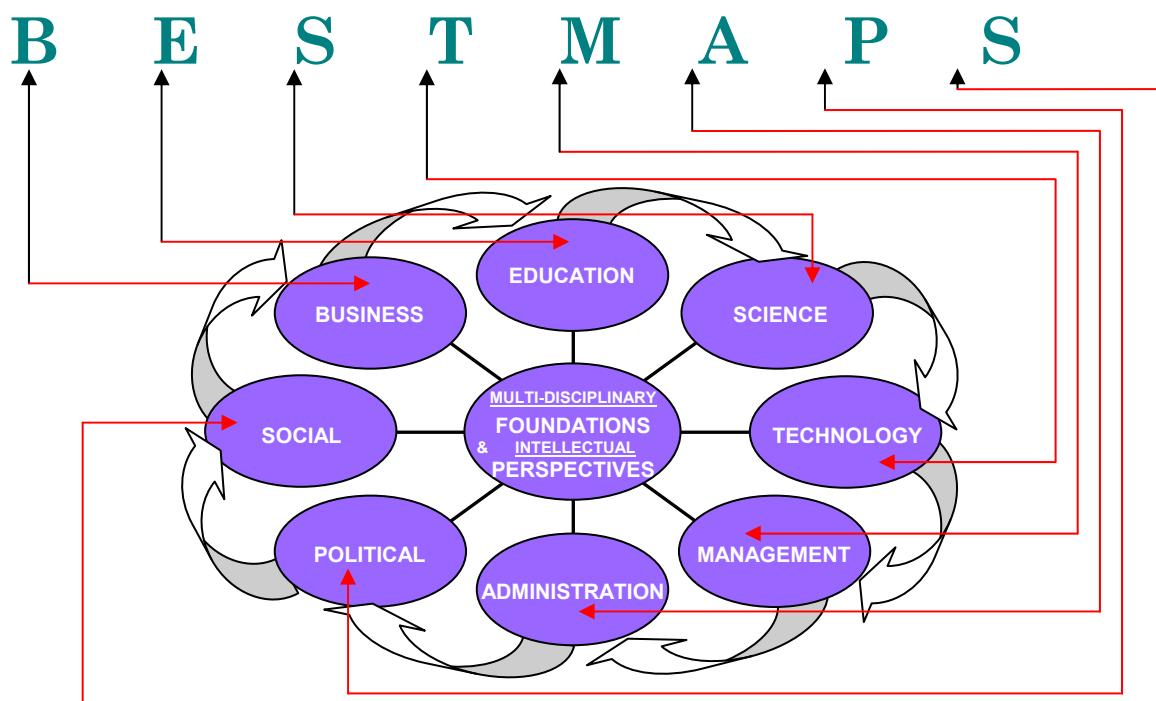
**IUEDAS-International Journal of Electronic Data Administration and Security**



**JIBMR-Journal of International Business Management & Research**



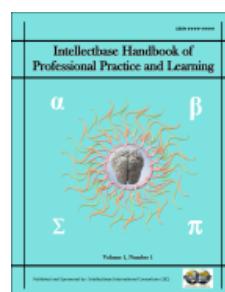
**JOIM-Journal of Organizational Information Management**



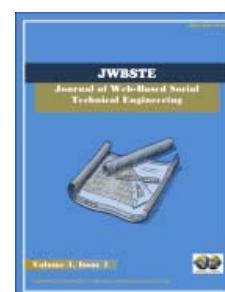
**JKHRM-Journal of Knowledge and Human Resource Management**



**JGISM-Journal of Global Health Information Systems in Medicine**



**IHPPL-Intellectbase Handbook of Professional Practice and Learning**



**JWBSTE-Journal of Web-Based Socio-Technical Engineering**

