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Risk and IT factors that Contribute to Competitive Advantage and Corporate Performance

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ABSTRACT

Existing research has established determinants of an IT-enabled strategy for competitive advantage which include IT Leadership, IT Skill, and IT Infrastructure (Sambamurthy 2000; Dehning and Stratopoulos 2003). Although research is emerging to demonstrate risk's impact on competitive advantage, it still remains focused on mitigation and avoidance as its contribution (McGaughey et al. 1994).

This study leverages and expands existing research in the area in three ways: first, it establishes higher-level constructs defined as Technical Leadership, Technical Skill, and Technical Infrastructure. Doing so affords us to have a more robust framework to accommodate additional technical capabilities and assets a firm possesses such as risk. Second, unique information to explain the individual impact of IT-centric and Risk-centric determinants on competitive advantage are uncovered. Third, the combined impact of risk determinants and IT determinants are analyzed and contrasted by creating interaction indices for both.

Keywords

Risk Management, Business Intelligence, Competitive Advantage, IT Strategy.

INTRODUCTION

There has been considerable research to identify and quantify those IT-centric factors that significantly contribute to an IT-enabled business strategy (Bhatt and Grover 2005; Dehning and Stratopoulos 2003; Santhanam and Hartoro 2003; Wixom and Watson 2001). Conversely risk management, although well-known and studied throughout the academic community, is an area that often focuses on risk mitigation and avoidance (Caldwell and Mogull 2006; McGaughey et al., 1994). This seems to be changing as leading researchers differentiate firm competitiveness using innovation and risk taking factors (Porter 1998; Nemetz and Fry 1988). Some private sector research is now focusing on the competitive advantages of risk (<http://www.pwc.co.uk/eng/issues/risk_management_compliance_competitive_advantage.html>) and opportunities gained by effectively identifying, quantifying, and managing risk.

Considerable differences exist in the levels of interest to identify significant determinants of competitive advantage and corporate performance, both in the private sector and academia. Although IT is aggressively studied in the academic community, this group has contributed little to risk with regard to competitive advantage. In the same vein, while the private sector has published some studies and articles supporting the notion of leveraging risk for competitive advantage, those efforts often lack robust design and statistical rigor that readers can apply and infer findings.

This study is designed to leverage and extend previous work on IT-centric determinants and their contribution to IT-enabled business strategy in three ways: first, by defining higher-level constructs that reflect the categories of IT-centric factors such as Technical Leadership, Technical Skill, and Technical Infrastructure (Piccoli 2005). The term Technical is defined in this study includes such areas as geospatial analysis, telecommunication, and robotics. While this study is focused only on Risk and IT, the purposed framework is designed to be more encompassing for future studies.

Second, the research attempts to answer the following question: Do risk factors in IT-enabled business strategies contribute to the competitive advantage of a company? To that end, this study extends the framework defined by Dehning and Stratopoulos (2003) by adding risk factors consistent with the IT determinants, including Risk Management, Risk Skills, and Risk Infrastructure. The study investigates the relationship, if any, between an organization's competitive advantage and its investment in IT and risk capabilities and assets as well as examines the interrelationship and potential correlation between IT and risk factors (refer to Figure 1 for more information).

Finally, this research takes the two sets of factors: IT and risk, and creates interaction indices for each. These indices reflect the combined strength of respective individual determinants. The study, therefore, can compare and contrast the first-order effects of individual regressors versus the interaction effect of the indices, providing unique insight and fodder for future research.

LITERATURE REVIEW

There are three dimensions that framed this literature review. First was to gather current research studies conducted in this area. To that end, only relevant literature published in the year 2000 or later was included. While this focused the research for IT, the constraint was relaxed for risk, where finding the relevant content was more of a challenge. The second dimension was a constraint on the topic: IT-dependent strategies for competitive advantage. And the third dimension was a constraint on the risk management and resources used for competitive advantage.

IT Literature

Specific to IT-centric studies, the literature covered a broad range of methodologies, including archival (Bharadwaj 2000; Dehning and Stratopoulos 2003) theoretical (Weilli et al. 2002; Sambamurthy et al. 2003), survey (Wade 2001; Wixom and Watson 2001) and literature review (Piccoli and Ives 2005). Many of these studies offered theories and frameworks to quantify the impact IT-centric determinants had on a successful business strategy, all with varying degrees of outcomes.

Table 1. IT Literature Review

| IT Citations | Technical Infrastructure | Technical Skills | Technical Management |
|-------------------------------|--------------------------|------------------|----------------------|
| Bharadwaj 2000 | X | X | X |
| Duliba et al. 2001 | | | X |
| Feeny 2001 | X | | |
| Wixom and Watson 2001 | X | | X |
| Wade 2001 | X | X | X |
| Ross and Beath 2002 | X | X | X |
| Weilli et al. 2002 | X | X | X |
| Sambamurthy et al. 2003 | X | X | X |
| Santhanam and Hartono 2003 | | X | X |
| Dehning and Stratopoulos 2003 | X | X | X |
| Bhatt and Grover 2005 | X | X | X |
| Oh and Pinsonneault 2007 | X | X | X |

Nevertheless, for this study, there are 12 papers in particular whose focus is specific to three IT determinants of an IT-enabled business strategy. Although specific terminology may vary, the determinants can be accurately reflected in terms of Technical Leadership, Technical Skill, and Technical Infrastructure or Assets. Table 1 summarizes the papers and the determinants they address. While the IT factors may be similar for competitive advantage, they often differ greatly within competing firms (Bhatt and Grover 2005). The key to competitive advantage for IT-dependent strategies is the method in which IT resources are leveraged (Porter 1979, 1980; Sambamurthy 2000).

There are three IT-centric factors of interest for this study: IT Leadership, IT Skill, and IT Infrastructure. Each individually covered below.

IT Leadership. This determinant is commonly used for explaining competitive advantage in an IT-enabled strategy. Research has shown that good leadership and management is required to identify the direction of the IT architecture, effectively guide and manage the IT organization, and orchestrate the implementations while simultaneously managing costs (Bharadwaj 2000). This leadership skill is developed over time by internal learning of what works and what does not as well as developing the necessary interrelationships among individuals within the organization to ensure coordination and communication (Bhatt and Grover 2005).

IT Skill. IT Skill has been proven to be an important proxy for corporate performance and sustainable competitive advantage. Creating a resource pool of educated, well-trained individuals to innovate, implement, and maintain a successful IT environment is not a trivial task, nor is it done quickly. IT Skill is not an individual responsibility but a team effort (Dehning and Stratopoulos 2003). Many studies hypothesize that organizational learning is related to successful implementation which is difficult for competitors to emulate and, therefore, translates into a competitive advantage (Bhatt and Grover 2005). Research conducted outside the IT area has similar findings concerning the value of training and education as a means of developing skilled resources for competitive advantage (Johannessen and Olsen 2003).

IT Infrastructure. This factor includes all the physical resources necessary to execute an IT-enabled strategy (Weill and Broadbent 2000); hardware, software, and networks are just a few examples. It takes considerable time for companies to invest and implement an effective IT infrastructure (Bharadwaj 2000) which makes infrastructure a factor for competitive advantage simply because it could take years to duplicate (Weill and Broadbent 2000). Others argue that IT Infrastructure, while important, is not a factor for competitive advantage due to open architectures and enterprise applications that can be purchased (Bhatt and Grover 2005). For our purposes, we will hypothesize that IT Infrastructure will have a significant impact on competitive advantage.

Risk Literature

While there is considerable academic research in the area of IT-enabled strategies for competitive advantage and corporate performance, there is sparse formal academic research dedicated to corporate strategies leveraging risk management for competitive advantage. That doesn't necessarily mean that risk is not considered a means to competitive advantage. The private sector seems to be providing thought leadership for this topic.

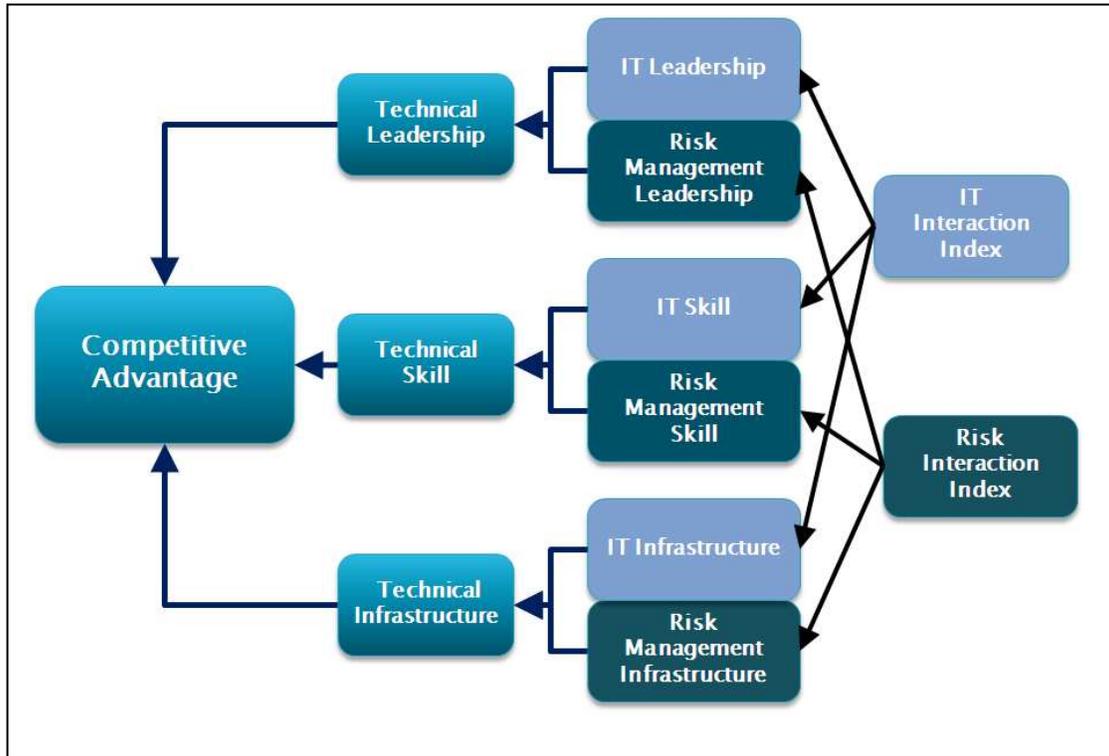
Assuming too little risk or only focusing on mitigation and avoidance leads to companies missing opportunities. This finding was based on a survey conducted and published by PricewaterhouseCoopers and is indicative of the current trend in thinking how to best leverage risk management in the organization. The practice not only exposes risk metrics to user communities for decision support but also provides the basis for establishing a risk culture for competitive advantage. This is supported by findings from a risk survey by the Economist Intelligence Unit that found 97% of executives and risk professionals concurred that effective risk management is a factor to competitive advantage and corporate performance (Insurance Journal, 2007).

Moreover, research is suggesting that there exists a relationship between risk management and IT. As risks are identified and metadata is established regarding their management, metrics will be monitored, maintained, and published through IT applications to improve corporate performance. Risk metrics are envisioned to be an integral part of Business Intelligence, decision support systems, and performance management applications (Caldwell and Mogull 2006).

MODELS

This study proposes a framework for explaining the factors that contribute to competitive advantage and corporate performance. Skilled resources and capabilities contribute to the overall performance of an organization (Sambamurthy 2000). Figure 1 identifies the core elements of the framework. The following sections describe each element and its role.

Figure 1. Determinants Model



Dependent Variable

Competitive Advantage afforded by technology has been well researched for years. That research concludes that technology contributes to corporate performance and competitive advantage through, for example, product or service innovation, corporate differentiation, process efficiency, cost reduction, and quality improvement (Porter 1998) but technology infrastructure, such as applications and computer systems, is not sufficient. Instead, the technology must be coupled with skill and management to best leverage the technology implemented.

Measuring Competitive Advantage will be done in one of two ways. Our preference is to leverage an index that rates competitive advantage of corporations. The alternative would be using a survey respondent’s perspective as a subjective measure.

Constructs

Previous research provides the foundation for utilizing IT Leadership, IT Skill, and IT Infrastructure as indicators of competitive advantage and corporate performance (Bharadwaj 2000; Wade 2001; Ross and Beath 2002; Weilli et al. 2002; Sambamurthy et al. 2003; Santhanam and Hartono 2003; Dehning and Stratopoulos 2003; Bhatt and Grover 2005; Piccoli and Ives 2005). This study generalizes these indicators and applies them to technology as a whole. To that end, there are three constructs used in the present research framework, including Technical Leadership, Technical Skill, and Technical Infrastructure.

Independent Variables

There are six independent variables examined in this study as follows.

IT Leadership

Previous research has identified that the leadership (Piccoli and Ives 2005; Oh and Pinsonneault 2007) and management (Dehning and Stratopoulos 2003) of IT as critical to the success of an IT-enabled business strategy. The IT organization must foster its management skill over time in order to manage the technical environment, conceive innovative techniques and approaches, and effectively scope inherent risks (Bharadwaj 2000) associated with infrastructure investments and technology trends. An IT proxy example for measuring IT Leadership capability will be the leadership of the IT organization.

Risk Management (RM) Leadership

A risk proxy example is similar to IT Leadership in that the organizational role the leader of risk plays in the organization is indicative of the managerial capability and skill. Therefore, RM Leadership examines a similar level of roles and related responsibilities as outlined above.

IT Skill

The technical skill of IT refers to the expertise required to evaluate, select, implement, build, and support the use of the IT environment, from technical infrastructure such as hardware, operating systems, and networks to the user facing applications. The technical skill of IT is critical to the performance of IT and its ability to contribute to competitive advantage (Dehning and Stratopoulos 2003; Bharadwaj 2000).

Past research associates skill with the capability of the individuals responsible for the planning, execution, and support of the IT environment. Consequently, the better trained and educated these individuals, the increased possibility for better performance and results (Johannessen and Olsen 2003). Education and training, therefore, is the proxy for IT Skill. Specifically, what is the level of investment a corporation makes in training its IT personnel as a percentage of overall revenue per year?

Risk Management Skill

Similar to IT, RM Skill measures a similar proxy. In terms of annual revenue, for example, what percent is dedicated to risk education and training?

IT Infrastructure

IT infrastructure is considered difficult to imitate; consequently, a barrier to competitors (Oh and Pinsonneault 2007) and a source of competitive advantage. All hardware and software implemented in an environment to establish the platforms from which information is gathered, synthesized, and delivered to user communities to support operational and strategic decision-making is considered under this construct.

A measure of the IT infrastructure is how much the corporation spends annually on the IT budget for purchasing and implementing applications, expanding services, and shoring up their platforms. Percent of annual revenue is a proxy example to measure the level of annual expenditures on IT infrastructure.

Risk Management Infrastructure

RM Infrastructure follows a similar proxy as IT. This measure is a percent of annual revenue dedicated to risk software, hardware, and services.

HYPOTHESES

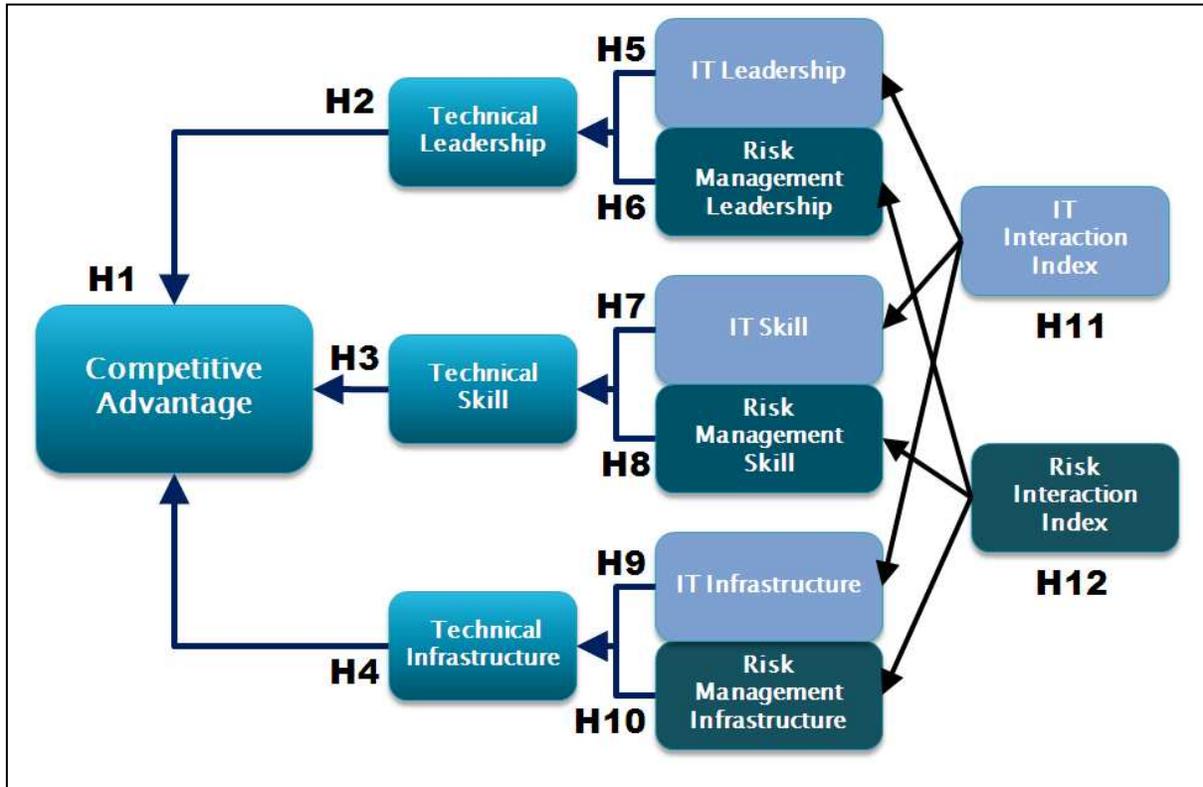
There are 12 individual hypotheses identified and tested in this study, covering four distinct areas: Dependent Variable, Technical Constructs, Independent Variables, and Interaction Indices (refer to Figure 2 for more information).

Dependent Variable

Hypothesis 1 -- Competitive Advantage is positively impacted by the three Technical constructs: Technical Leadership, Technical Skill, and Technical Infrastructure.

This hypothesis is consistent with existing research that attempts to demonstrate a positive relationship between an organization's ability to establish successful IT management, develop a capable, experienced technical team (Bharadwaj 2000), and implement the necessary infrastructure to support the organization's strategic objectives, all contributing to an environment that is difficult to emulate by competitors (Porter, 1979, 1980; Sambamurthy 2000).

Figure 2. Hypotheses



Technical Constructs

There are three technical constructs in the framework where hypotheses are established to confirm or refute that the competitive advantage of an organization is impacted by Technical Leadership, Technical Skill, and Technical Infrastructure. It is theorized that competitive advantage, or the establishment of processes which are difficult to imitate, is achieved by the contribution of specific technical resources and capabilities (Porter, 1979, 1980; Sambamurthy 2000). Based on these theories and related hypotheses, the following hypotheses are established for this study.

H2 – Companies with superior Technical Leadership will experience competitive advantage and increased performance.

The ability of managing and leading technical resource teams seems to be a factor for competitive advantage (Dehning and Stratopoulos 2003).

H3 – Companies with superior Technical Skill and capability will experience competitive advantage and increased performance.

Research has shown that successful technical areas such as IT are dependent on the training and skill of a team of individuals (Bharadwaj 2000) that is fostered over time and difficult to emulate by competitors.

H4 – Companies with superior Technical Infrastructure will experience competitive advantage and increased performance.

IT infrastructure has been associated with the ability to deliver, maintain and support the services dictated by an organization (Weill and Broadbent 2000). This hypothesis has been generalized to encompass more than just IT but any technology based infrastructure necessary to deliver and support required services of an organization.

Independent Variables

Those theories and previous research that support this paper's hypotheses for the three construct variables above, serve as the basis for establishing the following six hypotheses. Much of the existing research cited in this paper specifically posits that IT-centric factors such as IT Leadership, IT Skill, and IT Infrastructure contribute to competitive advantage as mentioned in the Construct Variable section. Thus, the following three hypotheses are offered:

H5 – Companies with superior IT Leadership will be significant for Technical Leadership.

H7 – Companies with superior IT Skill will be significant for Technical Skill.

H9 – Companies with superior IT Infrastructure will be significant for Technical Infrastructure.

It is the view of these authors that the existing theories regarding the contribution of IT technology for competitive advantage were too narrow in their definition of technology. There is little or no mention of technologies such as cellular, satellite, and geospatial, all potentially critical for many organizations. Therefore, this paper posits that other technologically based practices, for example, Risk Management, will contribute to competitive advantage for similar reasons as theorized for IT. To that end, the following three hypotheses are made.

H6 – Companies with superior RM Leadership will be significant for Technical Leadership.

H8 – Companies with superior RM Skill will be significant for Technical Skill.

H10 – Companies with superior RM Infrastructure will be significant to Technical Infrastructure.

Interaction Indices

Fundamental to this research is the theory that Risk will have a significant impact on competitive advantage. Although independent variables are hypothesized for individual Risk and IT factors, a set of hypotheses are offered for the interaction indices as follows:

H11 – IT Interaction Index will have a significant impact on competitive advantage

H12 – Risk Interaction Index will have a lower impact on competitive advantage than the IT Index

PHASE ONE STUDY DESIGN: SURVEY

We envision two phases to this research. Phase One is a pilot survey study and Phase Two is a longitudinal three-year archival study. The pilot survey will collect primary data used for the following purposes:

- Tuning the framework.
- Establishing a foundation for statistical analysis.
- Finding initial evidence to support or refute hypotheses.
- Exposing potential for further research, more specifically conducting an archival study from which to compare against survey results.

The survey will be submitted to over 100,000 potential respondents. All being a global community of corporations, non-profit organizations, and individuals involved in designing, implementing, and supporting decision support systems.

The following statistical analysis is based on our ability to leverage an index measuring Competitive Advantage. If subject measurement is required, then a logistic regression model will be used.

OLS Regression Analysis: Independent Variables

Descriptive statistics will be calculated and published for initial examination of the data distribution, including \bar{X} , s^2 , s , skewness, kurtosis, and relative percentage of responses.

The primary analytic function of this study will be an Ordinary Least Squares (OLS) regression model. The purpose of this model is not to predict the response variable. Instead, the OLS model is employed to explain the level of variance the independent variables have on competitive advantage. The function follows:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + e_i$$

Where Y_i is the dependent variable, β_i is the intercept, e_i is the error. All coefficients (slope) for each independent variable are identified, including 4 control variables and 6 independent variables, and 2 interaction indices as follows:

- $\beta_1 X_1$ - Perceived Effectiveness of IT Control Variable
- $\beta_2 X_2$ - Perceived Effectiveness of RM Control Variable
- $\beta_3 X_3$ - Percentage of Annual Revenue Growth Control Variable
- $\beta_4 X_4$ - Percentage of Customer Retention Control Variable
- $\beta_5 X_5$ - IT Leadership Independent Variable
- $\beta_6 X_6$ - RM Leadership Independent Variable
- $\beta_7 X_7$ - IT Skill Independent Variable
- $\beta_8 X_8$ - RM Skill Independent Variable
- $\beta_9 X_9$ - IT Infrastructure Independent Variable
- $\beta_{10} X_{10}$ - RM Infrastructure Independent Variable
- $\beta_{11} X_{11}$ - IT Interaction Index
- $\beta_{12} X_{12}$ - RM Interaction Index

The model results will be examined at significance levels of 0.10, 0.05, and 0.01.

Statistics from the OLS model will include the following:

- β of each independent variable to determine if there exists a relationship and whether that relationship is positive or inverse.
- t - Test conducted for each independent variable to determine if the significance of the variable with regard to the response variable.
- F - Test to reject or not reject the null hypothesis of the overall model and the significance of R^2 .
- Adjusted R^2 to determine how much of the response variance is explained by the variables themselves. The Adjusted R^2 is included to mitigate the influence that independent variables will have on the R^2 result.

OLS Regression Analysis: Indices

A second series of variables will be examined using an OLS model separate from the regression conducted above. This test will use only two interaction (moderation) indices (Chan et al. 1997) combining IT-centric and Risk-centric independent variables as follows:

- $\beta_{11} X_{11}$ - IT Interaction Index represents the product of IT Leadership x IT Skill x IT Infrastructure
- $\beta_{12} X_{12}$ - RM Interaction Index represents the product of RM Leadership x RM Skill x RM Infrastructure

The objective of this second regression test is designed to evaluate the interaction between indices of IT and Risk in an effort to see if each index is more significant than the individual results in the first regression test.

Additional Regression Analysis

In an effort to measure constructs such as IT Leadership and RM Infrastructure, one of three approaches will be employed, including Hierarchical Regression Analysis, Step-wise Regression, or creation of Interaction Indices.

FUTURE RESEARCH

The primary data gathered from the survey will serve to refine the proposed model. The updated version will be the basis for a three-year, longitudinal, archival study. Secondary data will be gathered over a three-year time span in order to address technology lag (Oh and Pinsonneault 2007) often associated with technology-dependent strategies. The archival study and its statistical results will be compared and contrasted with the survey pilot. Together, both studies will provide substantial evidence to make inferences, conclusions, and explanations regarding the significance and impact of the independent variables on corporate competitive advantage and performance. Meta Analysis will be conducted, taking the outcomes from both studies and comparing effect sizes and results.

Aside from the data and statistical findings, the framework will provide a template for explaining the impact of technical leadership, skills, and infrastructure on successful competitive advantage. Evaluating the impact data warehousing or business intelligence has, for example, on corporate performance.

Other important research should extend the factors themselves. Do leadership, skill, and infrastructure sufficiently explain competitive advantage? Or, are there more significant factors such as information repositories? While some technology assets can be purchased, such as risk management software or ERP applications, other assets must be built by the organization itself. These assets are prerequisite to many technology-dependent corporate strategies. The data warehouse and other information repositories, such as master data management for customers, products, policies, and accounts, are examples of critical information repositories and potentially the basis for corporate advantage and further research (Sambamurthy et al. 2003; Wade 2001).

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