THE PRACTICE OF RISK MANAGEMENT IN OUTSOURCING AND ITS IMPACTS: AN EMPIRICAL INVESTIGATION

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A DISSERTATION

Submitted to
Michigan State University
In partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Operations and Sourcing Management

2011

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ABSTRACT

PRACTICE OF RISK MANAGEMENT IN OUTSOUCING AND ITS IMPACTS: AN EMPIRICAL INVESTIGATION

By

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The outsourcing literature has a great deal of work describing how to practice risk management. Further, it details the benefits of specific risk management practices. It is surprising then that risk management in outsourcing arrangements is often avoided or treated as an administrative hurdle. Outsourcing arrangements face serious risk such as the possibility of opportunism by the supplier and the loss of valuable skills within the firm. Outsourcing complicates risk management for a firm as the company loses control over what may be vital processes. Given the risks outsourcing arrangements introduce, it is important to understand why risk management techniques may not be used in these sensitive situations.

To examine the antecedents to the use of risk management, the theory of planned behavior is adapted to an outsourcing manager who is responsible for an outsourcing arrangement. The antecedents identified are the manager's perceived ability to react to problems, the process-focused risk management policies of the firm, and ambiguity surrounding the outsourcing arrangement. Each of these were found to be related to the use of risk management. Additionally, the study found that risk management effectiveness is related to ambiguity surrounding the outsourcing arrangement, the use of risk management, and resource slack available to the outsourcing arrangement. The final relationship found was between risk management effectiveness and supplier performance.

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These findings add to the literature on supply chain risk management, first by explaining why risk management practices may not be practiced in a variety of situations and second by demonstrating that when outsourcing managers apply risk management practices, they are effective and improve supplier performance. While prior research had documented the costs of mismanaged risk, this is the first large-scale study to find the benefits of proactive risk management in outsourcing to supplier performance.

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CHAPTER 1

INTRODUCTION

This dissertation investigates a paradox with respect to risk management practices: even though the prevailing view among both academics and practitioners is that risk management practices are beneficial, their use is far from widespread. Outsourcing arrangements provide a context of contemporary interest in which to study the practice of risk management. As noted by Shi (2007), "Although academics have long warned about those more strategic risks, why outsourcing managers, particularly those from the client companies, pay less attention to them or are less active in managing them is not well understood."

Risk management practices have long been exalted in the academic and practitioner literatures (Aubert, Patry, Rivard, and Smith, 2001; Raz, Shenhar, and Dvir, 2002; Zwikael and Sadeh, 2007; Shi, 2007). The claimed benefits have gone beyond the simple reduction of risk to extend to performance improvements throughout the enterprise (Sheffi, 2005).

Despite the purported benefits of managing risks, risk management is not practiced in a number of important business contexts including outsourcing. Lonsdale (1999) notes, for example, that firms have made outsourcing decisions without regard to certain important risks. Prior researchers have claimed that many of the firms that outsource functions do not appreciate the risks they face (Lonsdale and Cox, 2000). Scholars have suggested that risk management may be viewed as an administrative hassle, that it may require skills project participants lack, and that the information required to perform risk management effectively may be lacking (Kliem, 1999). These disparate reasons, however, have not been assembled into a theory to explain why risk management practices get adopted in some instances and not in others.

Outsourcing arrangements provide a context of contemporary interest in which to study the

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practice of risk management. Outsourcing in this study refers to a strategic supplier relationship. It involves the procurement of intermediate inputs (Feenstra and Hanson, 1996), business process outsourcing (Aron, Bandyopadhyay, Jayanty, and Pathak 2008), and innovation outsourcing (Quinn, 2000). An outsourcing arrangement is a case of the focal firm acquiring an intermediate product or service from a supplier. In a discussion of the invisible costs of outsourcing (Stringfellow, Teagarden, and Nie, 2008) note that "while offshoring services and knowledge can help a company gain a competitive advantage by providing access to low production costs (cheap labor, tariff reduction, tax breaks and other economic incentives offered by the foreign government), access to knowledge and skills, and constant service coverage, service offshoring is not without its challenges." Outsourcing arrangements have attendant risks that must be managed (Zsidisin, Melnyk, and Ragatz, 2005). The fact that one half of outsourcing arrangements entered into end in termination speaks to the risks these ventures face (Weidenbaum, 2005) and thus makes outsourcing arrangements situations in which risk management practices are likely to be beneficial.

Two research questions are addressed by this research. First, what are the factors that influence the use of risk management in outsourcing arrangements? This specifically concerns the proactive management of foreseeable risks. By addressing this question, a theoretical explanation for the lack of use of risk management practices will be provided. While prior scholars have acknowledged the existence of the paradox, a systematic, theoretical examination of the reasons for the paradox has not been conducted. This dissertation aims to fill this gap in understanding. This gap is important in view of the large amount of literature support for the benefits of risk management practices in outsourcing arrangements.

The second research question asks what are the benefits to be derived from the use of risk

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management. This theoretical relationship has strong literature support, but tests conducted thus far are anecdotal (e.g. Aubert, Patry, Rivard, and Smith 2001). A more rigorous investigation of this relationship would build on these prior studies by providing more confidence in the results. Additionally, identifying the benefits of practicing risk management can help firms determine whether it is worth encouraging the practice of risk management.

To address the antecedents of risk management, a modified version of the theory of planned behavior is used (Ajzen 1985). Hypotheses are developed that propose that the perceived ability to react to problems (representing attitudes toward the behavior of risk management), process-focused risk management policies (representing subjective norms acting on the managers), and ambiguity surrounding the outsourcing arrangement (representing perceived behavioral control over the behavior) affect risk management.

To address the benefits of risk management, hypotheses are proposed that suggest ambiguity surrounding the outsourcing arrangement, the use of risk management, and resource slack each affect risk management effectiveness. Additionally, risk management effectiveness is hypothesized to affect supplier performance.

The full model is tested using data collected from a large-scale sample web survey. The estimation is performed using structural equation modeling. After the sign and statistical significance of the hypotheses is determined, a discussion of the results is presented that covers the implications for research and for managers. Finally, limitations of the research are covered along with a discussion of areas for future research.

STUDY SCOPE

This research focuses specifically on proactive risk management practices, which are aimed at identifying risks and then addressing these identified risks. The study thus concentrates on

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foreseeable risks rather than unforeseeable ones.

The context in which risk management practices are examined are outsourcing arrangements. Outsourcing arrangements are defined to be relationships with the most important supplier of a product that has the potential for disrupting operations in important ways such as the stoppage of production or quality problems. Outsourcing arrangements are thus purchases of strategic importance to the firm rather than ordinary purchases of non-critical items.

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CHAPTER 2

THEORETICAL DEVELOPMENT

AN OVERVIEW OF RESEARCH STREAMS ON RISK MANAGEMENT

This section develops the theoretical base for the study through a critical review of the literature. First, the literature on risk is reviewed and critiqued. The concept of supply chain risk is then developed, and a definition of supply chain risk informed by managerial perceptions of risk is provided. Then, a review of the risk management literature is used to identify the independent steps of the proactive risk management process of interest to this study. Finally, this section will examine the theory of reasoned action and the theory of planned behavior to review the theoretical basis for studying the antecedents of risk management. The relevant constructs that correspond to components of the theory of planned behavior are also identified and defined.

Mathematically-Derived Concepts of Risk

Much of the traditional conceptions of risk have made use of mathematical formulations. Economic portrayals of risk have relied on expected value theory (Mitchell 1995). According to this definition, risk is characterized by a probability distribution of various outcomes. When confronted with the choice between two situations with equal expected values, a risk-averse agent would always choose the situation that offers a certain outcome over the situation that offers a diversity of outcomes above and below the expected value. A risk-seeking agent would have the reverse set preferences, and a risk-neutral agent would be indifferent to both situations since the expected values are the same. The behaviors of each of these types of agents have been studied. Among risk-averse agents, there are certain situations in which a situation with a lower expected value would be preferred to a situation with a higher expected value. However, these agents may also choose risky situations when provided with a sufficient rise in expected value to

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do so. The degree of risk-aversion of the agent determines what requirements need to be met for a risky situation to be chosen.

This definition of risk beginning in economics has also been adapted in part by the business literature with some modification, and in the supply chain management literature specifically (e.g. Cousins, Lamming, and Bowen 2004). Rather than a probability distribution, risk is seen as a probability of a negative outcome (relative to some reference outcome) multiplied by the magnitude of the outcome. This assumes that the magnitude of the outcome can be suitably quantified.

Such a definition of risk is not without issue, as explained by Kaplan and Garrick (1981). They note that real-world conceptions of risk are unlikely to be so quantified into a single, calculable number through multiplication. The authors define the risk of a situation as a set of outcomes, each with its own probability. This set can be plotted as a two-dimensional curve with outcomes on the vertical axis and probabilities on the horizontal axis. Reducing this curve, with its informational richness, to a single numerical quantity and calling this the risk simplifies the situation too much according to Kaplan and Garrick (1981). This is supported by the findings of March and Shapira (1987) who find that the few managers who believe that such a calculation should be made bother to attempt the calculation in practice.

Other mathematical definitions of risk have been offered within the business literature with much development occurring within the finance literature. These definitions have adopted risk to mean the mathematical variance of possible outcomes (Pratt 1964; Arrow 1971). For example, risk has played a prominent role within finance in the development of modern portfolio theory (Markowitz 1952; 1959; Sharpe 1964). Markowitz (1959) defines risk to be the variance of return and prescribes a method for reducing this variance by investing in assets that are not

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perfectly correlated with one another. The method of risk management is thus diversification among various assets. By choosing a sufficient number of assets and dedicating no more than a small amount of the total portfolio to be invested to any particular asset, risk is thus claimed to be minimized.

Notable in this approach to defining risk is that the potential for positive developments contribute to the total amount of risk. This is contrary to most traditional, asymmetric notions of risk, wherein only negative surprises are truly considered risks. Considering positive developments as risky leads to some counterintuitive situations, a point noted by Markowitz (1952). For example, an individual finding a stack of unclaimed lottery tickets would instantly see the riskiness associated with his net worth increase (Besanko and Braeutigam 2010) despite the lack of a negative outcome associated with the tickets. Kaplan and Garrick (1981) similarly consider an heir whose benefactor has died. The benefactor's assets have yet to be assessed but are believed to be $1 or $2 million. The authors note that while the heir faces considerable uncertainty, the heir would be unlikely to refer to the situation as one containing risk. Thus, managers who wish to reduce both upside and downside risk would be advised to avoid similar examples of positive-outcome risk that could occur in a corporate context even though a typical manager's true preferences are asymmetric with respect to each type of risk.

Another important aspect to this definition of risk is the choice of the mathematically precise notion of variance. Other possibilities, such as the probability that a particular outcome will occur are excluded. By using a definition based on variance, the extents of deviations matter in a non-linear way out of necessity. Also, any deviations from the average result contribute to measured risk even if they fall within an acceptable level for the manager. Indeed the choice of using standard deviations to measure risk was not based on it's managerial significance, but on

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the ability of such a measure of risk to be analyzed in depth by analytic methods by financial researchers who assumed a Gaussian distribution of returns (Taleb 2007).

Such approaches to risk management in managing financial risk have not always been well-implemented or well-received. The hedge fund Long Term Capital Management included two Nobel Prize winners who after amassing large amounts of capital proceeded to lose more than $4 billion over the course of a few months following the Russian financial crisis in 1998 (Lowenstein 2000). The fund required the intervention of the Federal Reserve to exit its investments. The overuse and misuse of such sophisticated analytical methods has also been blamed for the 2008 global financial crisis (Patterson 2011) and financial crises in general (Cooper 2008). In fact, some hedge fund managers have made vast sums of money by exploiting the flaws in such analyses (Lewis 2010). In commenting on the 2008 financial crisis, Lewis (2010) explains that the assumption of uncorrelated housing prices nationwide allowed diversified combinations of individually low-quality mortgages to be sold as high quality as a result of their prioritizing orders of payment and diversification among several mortgages. By making contrary investments, several managers were able to profit from the crisis (Lewis 2010; Zuckerman 2009).

Other definitions of risk and approaches to risk management have been proposed within the field of finance. For example, Harlow (1991) presents a method for allocating assets that considers only downside risk. Harlow (1991) notes that such a measurement is more consistent with investor definitions of risk and also provides results that are at least as efficient as those that attempt to limit both downside and upside risk. Harlow's (1991) results expose some of the issues in more traditional approaches by recommending portfolios that offer greater downside protection for investors while offering equal or greater returns.

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Some definitions of risk in a supply-chain-management context resemble those used in the finance literature. For example, Talluri, Narasimhan, and Nair (2006: 213) argue that "with the amount of historical supplier data that is available with buying firms, they should evaluate objective measures proactively by examining the underlying characteristics of the data." They follow by producing a chance-constrained data-envelopment-analysis approach for suppliers whose performance varies. A standard deviation is used in the model to represent risk, and the performance variables of suppliers are assumed to be normally distributed.

Though these risk assumptions may be valid with respect to the variables studied by Talluri, Narasimhan, and Nair (2006) and appropriate for the purpose of supplier selection, the effects of these risks on the buying firm may not correspond to the distributions assumed. For example, even if delivery time is normally distributed, an early delivery may not produce any realizable benefit for the firm receiving the product. Furthermore, the magnitude of a late delivery may not matter; if a delivery is sufficiently late that a firm needs to locate an alternate source for a product, then representing the magnitude of how late the product is in the supplier's performance variables may not be appropriate. Risk management is likely to be performed with respect to the perceived potential losses to the firm rather than according to the distribution of performance outcomes of the supplier. Though supplier performance certainly directly affects potential losses to the firm, the perception of the latter should be the focus of a study of the type of risk managers are likely to seek to address through risk management techniques.

Managerial Perceptions of Risk

March and Shapira (1987) expand on the difficulties of traditional notions of risk that have been used within academia: "we have examined how executives define and react to risk, rather than how they ought to do so. We conclude not only that managers fail to follow the canons of

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decision theory, but also that the ways they think about risk are not easily fit into classical theoretical conceptions of risk" (March and Shapira 1987: 1414). Particularly striking evidence is provided by the findings of MacCrimmon and Wehrung (1986) who found that when executives were tasked with ordering a list of investment alternatives, expected value theory was followed only 11% of the time. March and Shapira's (1987) review found that the majority of managers thought risk could not be quantified at all in such a way that risks could be compared directly to one another, with one vice president of finance saying "No one is interested in getting quantified measures" and another manager saying "you don't quantify the risk, but you have to feel it." Needless, to say, models of "felt" risk would be difficult to construct, so traditional, quantified definitions of risk remain prominent in the literature, with March and Shapira's (1987) work often cited in support (Zsidisin 2003).

These concerns regarding many definitions of risk used today are an issue for the present study, which plans on using managerial responses. Though a definition of risk can be provided to managers, it is likely that a manager's existing notions of risk will inform responses if the definition provided differs widely from those preexisting notions. To address this issue, reviews of traditional views of risk management have been provided by Kaplan and Garrick (1981), and further work to provide grounded notions of supply risk have been performed by Zsidisin (2003).

In reviewing traditional notions of risk, Kaplan and Garrick (1981) offer that risk includes both the notions of uncertainty as well as damage. It is not sufficient for there to be a wide distribution of outcomes (which would be uncertainty). Only those outcomes need to be perceived as harms contribute to the presence of risk. The potential for positive outcomes do not contribute to risk. Further noted is the distinction between risk and hazards. A hazard refers to a source of damage. However, a prominent hazard and potentially lethal hazard (e.g., a nuclear

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power plant) can nevertheless be accompanied by a small risk with the use of prominent safeguards. Kaplan and Garrick (1981) note that a hazard can never be associated with a risk of zero, but when safeguards overwhelm the hazard, the risk will be small.

Kaplan and Garrick (1991) also note an important epistemological point about risk: risk is inherently perceptual. The perceptual nature of risk stems from the contribution of uncertainty to risk. Uncertainty (outside of contrived games or quantum events) stems from a lack of knowledge by the party assessing a situation. Thus, a reference to "perceived risk" contains a redundancy. All risks outside of the above exceptions are perceived. Typically, when a reference to perceived risk is made, it is to compare it to some other expert party's perceived risk, which is referred to as "absolute risk" even though the expert party's assessment is also a perception, however well-informed it may be. Expert parties often base their assessments on the past frequency and damage resulting from multiple trials. The problem of induction (Hume 1741), however, means that even such expert judgments do not represent absolute knowledge of risks even though they are likely to be more accurate appraisals than those offered by a general audience.

Supplier Risk

Formal, empirically-derived definitions of what constitutes risk in a supply chain management context have been developed more recently (Zsidisin 2003). Zsidisin (2003) took a grounded theory approach to produce a definition of supply risk based on case study interviews with firms in the aerospace and electronics industry. He determines that supplier failures are a source of supply risk as suppliers may be unable to meet their obligations to the firms studied. Also, market failures can be a source of supply risk as they may be a sole supplier of a needed product or the market may not have the capacity to serve the focal firm's needs. In addition to these

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sources of supply risk, respondents also identified outcomes, namely a disruption to the firm's ability to meet customer requirements, which was universally identified as a serious issue, and issues with supply that posed a threat to customer life and safety, which was restricted to the aerospace industry firms.

Zsidisin's (2003) definition has a number of strengths. It is a recent, grounded definition within the supply chain management literature that is based on managerial views of risk. A few issues, however, prevent its verbatim adoption for this study. First, it may not be a suitably inclusive definition of risk. As the study is based on a limited number of case interviews in selected industries, it is reasonable to believe that a larger sample might identify additional sources of supply risk. For example, regulatory issues are not identified as a source of risk, but they might be had a more politically vulnerable industry been included in the sample or had more firms with different experiences from the same industry been interviewed. A review of Zsidisin's (2003) table of reported risks from each firm also confirms that there are relatively few overlapping definitions of risk between firms. It is likely then, that the idiosyncrasies of each firms' perceptions of risk may prevent an enumerated list of cross-industry supply risks from being formed.

Table 1 provides examples of risk in the operations and supply chain management literature. In keeping with the modern empirical literature on supplier risk, this study defines supplier risk as potential supplier-associated problems as perceived by a manager that may negatively affect the company's operations. Peculiar to this definition is the fact that risks are perceptual. This is based on Kaplan and Garrick's (1981) observation that situations do not really have a "true" risk level that can be compared with a manager's estimation of what the risk is. All "true" risk levels are based on the perceptions of some other party, so risks are necessarily

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observer-dependent. As an example, a if a manager identifies power outages as a risk, then it qualifies as a risk even if a detailed analysis would show that there is no threat from power outages. All risks fundamentally arise from a lack of knowledge about the future, whether based experience or on ignorance (Kaplan and Garrick 1981).

The definition of supplier risk is non-specific as to the type or source of uncertainty beyond being associated with the supplier. Uncertainty can result from internal or external sources. Both uncontrollable and controllable events are considered risks as long as they include elements of uncertainty (i.e., they are not fully controlled). Further, risks can apply to different sources of the project. They may be technical, budgetary, or schedule-related (Shtub, Bard, and Globerson 2005).

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Table 1: Definitions of types of risk in the operations management literature

Reference	Attributes of risk	Definition
Zsidisin (2003)	Supply risk arises from supplier failures and market failures. Supply risk associated with inability to meet customer requirements or threats to customer life and safety.	"Supply risk is defined as the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety."
Talluri, Narasimhan, Nair (2006)	Symmetric with respect to losses and gains Non-linear effect of deviations from mean outcomes Unbounded negative or positive possibilities Risks are independent of one another	Gaussian distribution of possible performance variable attributes
Cousins, Lamming, and Bowen (2004)	Types of loss can be financial, performance-based (e.g. inferior product), physical (e.g. destruction of capital or environment), social (e.g. reputation), psychological (e.g. morale), or time-based	Product of the probability of an event and its consequences
Knemeyer, Zinn, and Eroglu (2009)	Disruptions outside the firm that can still exert a business impact on the firm.	Supply chain risk is the probability of an event multiplied by the business impact
Gray, Roth, and Leiblein (2011)	Asymmetric with respect to losses and gains Can be tied to a specific cause (e.g. poor manufacturing practices)	"Quality risk is the propensity of a manufacturing establishment to fail to comply with good manufacturing practices, which from theory increases the likelihood of outgoing product quality defects."
Zwikael and Sadeh (2007)	Risk is perceptual Risk can be felt at the beginning of a project without formal assessment	Uncertainty of a managed project that can be suitably captured by a 1-10, low-to-high risk scale

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Risk Surrounding an Outsourcing Arrangement

Risk in an outsourcing arrangement is of a different nature than the more general concept of supplier risk. Outsourcing arrangements are more likely to involve the transfer of organizationally valuable knowledge and be complicated by relational issues. Thus, outsourcing is a context in which the risks are simultaneously greater and more difficult to properly define in any given outsourcing arrangement.

Outsourcing risks can be organized into a typology that includes budgetary risk, scheduling risk, relational risk, technological risk, performance risk, personnel risk, and dependency risk. To explicate the typology, budgetary risk refers to uncertainty that exists with the cost projections for an outsourcing arrangement. Arrow (1962) notes that suppliers may be unable or unwilling to bear the full risk of cost-overruns. In these situations, cost-plus contracts are typically used, which transfers a portion of the risk to the buyer. Scheduling risk refers to the uncertainty associated with the ability of the supplier or the buyer to meet deadlines assumed by the formal or informal terms of the outsourcing deal. An example of this was provided by Sanders and Cameron (2011) who described the ongoing issues Boeing has had with late deliveries from suppliers for critical components of the 787 aircraft. Relational risk refers to the possibility that the character of the relationship may shift to the detriment of the buyer. For example, Zhang, Henke, and Griffith (2009) present relational stress as capable of having potentially negative consequences for both parties in a buyer-supplier relationship. Technological risk refers to uncertainty regarding whether the outsourcing arrangement will be negatively effected by outside technological developments. Handfield, Ragatz, Peterson, and Monczka (1999) identify technological risk as an important factor in supplier selection. Specifically, they recommend that managers ask whether the technology is critical and act

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accordingly. Additionally, they cite the rate of technological change required design expertise of the supplier with respect to technology as important. Performance risk refers to uncertainty regarding whether the supplier will be able to deliver according to the expectations the buyer has set. This problem can arise due to non-cooperative incidents in which the supplier has misrepresented its capabilities or from genuine issues the supplier that are not the result of deception (Zhang, 2006). Additionally, Nidumolu (1995) identifies performance risk as the difficulty in determining performance outcomes in the late stages of a product. Personnel risk refers to the uncertainty that individuals at the buyer or supplier will act in a way that compromises the position of the organization. This can result from the loss of knowledge from personnel who are transferred to the supplier organization, lowered morale, and from losing control of information that was previously held confidential within the organization (Shi, 2007). Dependency risk refers to the possibility that the buyer may become beholden to the supplier over time as important parts of the value creation process are transferred to the buyer. Over time, this can result in crisis for the buyer as described by Fine (1998).

While each of these risks can be present in any supplier relationship, outsourcing is likely to affect the make-up of these risks. Budgetary risks, scheduling risks, performance risks, and technological risks are common to relationships with all suppliers. The increased interaction and transfer of value-added processes to suppliers associated with outsourcing, however, would tend to increase relational risks, personnel risks, and dependency risks relative to simpler purchases of commodity products. The fact that outsourcing requires high levels of interaction with the supplier and is associated with the transfer of a value chain process means that there may be extra strains on the relationship and the personnel involved. Additionally, a careless choice of outsourcing an important part of the value chain without considering the strategic impacts on the

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organization can create dependency risks even for a project that is justified on the basis of short-term cost considerations.

A strategic outsourcing arrangement is likely to have several of these risk elements. When a buyer chooses to outsource a strategically important process to a supplier, this comes with several short- and long-term risks (Shi 2007). In these situations where multiple competing risks with different time frames compete for attention, proactive risk management practices are most likely to have some benefit to the firm. Though the risks most likely to be associated with outsourcing (relational, personnel, and dependency risks) are most likely to be difficult to manage, a structured risk management approach may help to identify, assess, mitigate, and produce response plans for these risks.

Risk Management

Much of the research on risk management is normative or descriptive work on companies already performing risk management. For example, Sheffi (2005) and Sheffi and Rice (2005) provide a normative framework for managers seeking to classify risks and guidance as to how an organization can construct itself to respond to risks. Benaroch (2001) builds on concepts of risk in the finance literature to recommend the creation of operating options to maximize the value of a firm's investments. Kliem (2004) also adopts a normative stance in developing a framework of outsourcing risks and recommending a managerial process to match risks and control measures. Knemeyer, Zinn, and Eroglu (2009) provide a sophisticated, quantitative method for managers to implement to plan for catastrophic risks. Descriptive work includes research such as Aubert et al's (2001) examination of outsourcing risk management practices at British Petroleum. Descriptive studies have also been performed by Zsidisin, Panelli, and Upton (2000), who performed detailed case studies of risk management in firms and determined that individuals

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within organizations believe supply risk management efforts within their organizations were insufficient..

Though there are many steps and sub-steps of the risk management process, and the definitions can vary in important ways, most proactive risk management process frameworks have common elements, which repeat across the literature: (1) one or more risks must be identified, (2) the probability and consequences of the risks should be assessed in some manner, (3) some attempts at mitigating the risk should be considered and implemented, and (4) some measures should be taken proactively to ensure that risks can be dealt with once they are realized.

"Risk assessment means evaluating the likelihoods and consequences of prospective risks, either by the use of frequency data or on the basis of expert judgments, scenarios and subjective probabilities" (Cohen and Kunreuther 2007: 526). This definition is based on literature in the risk assessment area (Haimes 1998). Of note is the fact that this definition is goal-focused. The assessment of risk can be performed using a variety of different methods. The validity of the method or the accuracy of the ultimate results are immaterial to the fact that the task being performed is risk assessment. Intent thus forms an important role in risk assessment. The managerial intent to evaluate probabilities and impacts of prospective risks is necessary for the behaviors performed to constitute risk assessment. Thus, any definition of risk assessment or attempt to measure the construct ought to not make exclusive reference to specific methods of ascertaining probabilities of consequences. Instead, the manager's intent to ascertain these is key to the definition.

Cohen and Kunreuther (2007: 527) refer to risk management as "developing strategies for reducing the probabilities of negative events and/or their consequences should they occur." As

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examples, of risk management strategies, they cite risk avoidance, risk mitigation, and funding for recovery.

In an article regarding planning for catastrophic risks, Knemeyer, Zinn, and Eroglu (2009) note that for firms to achieve resiliency, they need "to establish a proactive process to identify possible sources of catastrophic risk, measure potential effects on one's supply chain and then select appropriate countermeasures that may prevent or mitigate the effects." This includes risk identification, assessment (through the measuring of effects), and the risk avoidance and risk mitigation through the deployment of countermeasures. Knemeyer, Zinn, and Eroglu's (2009) also makes reference to contingency planning, which prescribes what a firm will do should when a risk is realized and a response is needed to address the issue.

The proactive planning process detailed by Knemeyer, Zinn, and Eroglu (2009) consists of a risk identification step (which is location- and threat-specific), a risk assessment step, a risk avoidance and mitigation step that includes the evaluation of countermeasures, and a final step that includes the selection of countermeasures. Of note is that some of the countermeasures suggested by Knemeyer, Zinn, and Eroglu (2009) could be considered response planning rather than purely proactive countermeasures that avoid or mitigate risk. For example, the authors refer to the possibility of establishing relationships with third parties in an attempt to increase flexibility should a problem occur. While this is a prior action, it is a prior planning action that identifies a method to be pursued should a risk be realized and the firm need a method to recover.

The definition for risk management used by this study is based in part on the process suggested by Knemeyer, Zinn, and Eroglu (2009). As their process is a normative process suggested for use by managers, the specific details of each step of the normative process are not

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included as part of the definition. For example, the authors suggest the use of large-scale catastrophe simulation modeling to assist in risk assessment. Regardless of the virtues of this technique, it is not a necessary component of the behavior labeled risk assessment (which is merely the execution of a managerial intent to determine the probabilities and consequences of a particular risk).

In keeping with Knemeyer, Zinn, and Eroglu (2009), risk identification is defined as the first step of the risk management process. Risk identification is defined as a proactive attempt by a manager to determine what risks are associated with a particular supplier. Of note is that this definition does not refer to the specific nature of the technique used. The manager might use brainstorming techniques, the experience of others in the firm, the business literature, industry reports, or any number of other sources.

Risk analysis is the second step of the risk management process and consists of a proactive attempt by a manager to determine the likelihood and consequences of known risks associated with a particular supplier. Note that risk identification does not imply that a risk analysis has been performed. While risk identification only requires a list to be produced, the likelihood and consequences of risk may not be obvious to the manager. Sheffi (2005), in fact, notes that risks are seldom analyzed by many firms, let alone plotted on a two-by-two matrix to indicate the likelihood and consequences of risk (Sheffi and Rice 2005). Similarly, though a risk analysis implies that there is at least one known risk, its performance does not indicate the extent to which a thorough risk identification has been performed. A manager could perform a thorough analysis of obvious risks without having dedicated any time or effort to exposing non-obvious risks.

The third step of the risk management process is defined to be risk mitigation, which consists of a proactive attempt by a manager to avoid, reduce the probability of, or reduce the

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consequences of known risks associated with a particular supplier. Of note is that risk mitigation subsumes risk avoidance. Kaplan and Garrick (1981) note that risk can never be fully avoided. Additionally, the managerial process of selecting countermeasures is not separated into separate steps, one of which considers countermeasures that avoid risk and the other considering countermeasures that only mitigate risk. Rather, countermeasures are considered together and selected based on their merits and costs of implementation (Benaroch, Lichtenstein, and Robinson 2006). Thus, risk avoidance and risk mitigation do not consist of separate risk management strategies either conceptually or in practice.

The fourth step of the risk management process is risk response planning. A risk response plan consists of a proactive attempt to formulate the steps to be executed if a risk associated with a particular supplier is realized. A risk response plan may consist of real options that are executed upon a failure (Benaroch, Lichtenstein, and Robinson 2006), taking advantage of organizational flexibility (Sheffi 2005), or making use of prior measures that were put in place (Knemeyer, Zinn, and Eroglu 2009).

Other steps including the ongoing monitoring and reassessment of risks are included in certain risk management frameworks. However, they are excluded from the present study since they are more often described in normative frameworks but do not appear in empirical practice. As this study is concerned with the behavior of risk management as it is practiced, this omission by managers is less of a concern than representing all possible components of a risk management process.

Common to these components of the risk management process is that each may be performed without a thorough execution of the other steps. For example, a risk response plan does not require that a thorough or rigorous risk identification technique to have been executed

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or for risks to have been assessed. Its only requirement is that there be at least one known risk for which it is required to produce a plan. Risk mitigation is similarly independent of any other steps. Risk mitigation does not imply that a response plan has been formulated or that the risks have been identified or assessed.

Also common to each of the steps of the risk management process is the fact that all steps reflect a managerial intent to achieve a certain result. They do not require that the method or technique used be accurate. A thorough identification of risks can be performed using state-of-the-art methods and still fail to identify some risk that had escaped detection (Kaplan and Garrick, 1981). Since a complete enumeration of all possible risks associated with a course of action can never be achieved (Kaplan and Garrick, 1981), any useful definition of risk identification, must necessarily reflect an attempt, and this attribute is extended to each of the other risk management process steps.

As this study examines risk associated with a particular supplier and the proactive risk management process, the definitions are restricted to the identification, assessment, and mitigation of and planning for risks associated with a supplier prior to the realization of any risk that creates a problem. Outside the scope of the study are aspects of risk management that are not proactive, including ongoing monitoring of risk throughout the project, ongoing modifications to risk identification, assessment, mitigation, and response planning results, and the execution of the risk response plan. Also, reflections on the success of the risk management techniques adopted and evaluation of the strategies used for refinement is not included as part of the study. Though these are important aspects of a holistic approach to risk management (PMI Standards Committee, 2004), they are outside the scope of this study. Since they occur at different times within the project and may be suitable only to specific to certain types of projects, they are better

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left for other separate investigations of risk management issues.

Of note regarding the research on risk management is the general lack of research into the antecedents to risk management. While there is considerable interest in how risk management should be performed, and the lack of risk management has been well documented, the reasons for its nonperformance by management have not been investigated. To address this gap, a behavioral theory of action is required.

THEORY OF REASONED ACTION

The theory of reasoned action (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980) sought to better explain the connection between attitudes held by an individual and action. One of its contributions was to separate behavioral intentions from the actual performance of a behavior to allow for factors that may inhibit a person's intentions from being carried out in action. See Figure 1 for a graphical representation of the theory.

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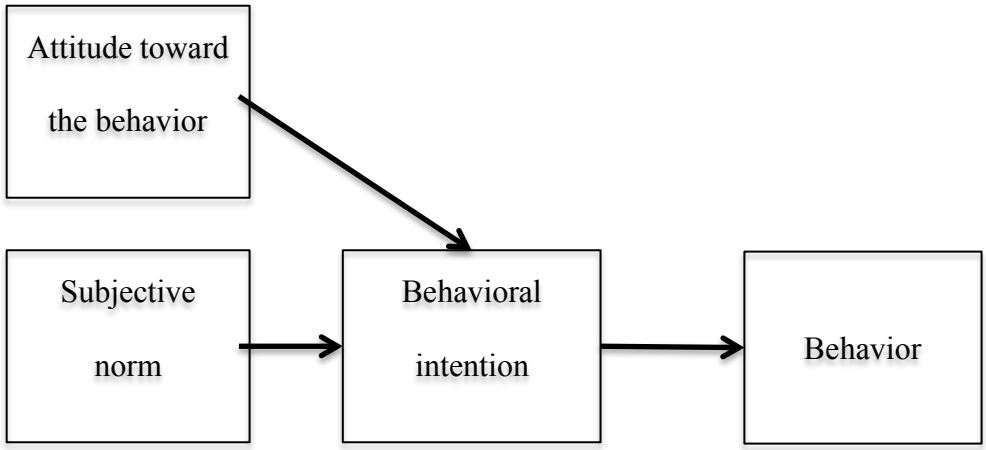
Figure 1: Theory of reasoned action (Fishbein and Ajzen 1975)



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The theory posits three constructs: behavioral intentions, attitudes, and subjective norms. An intention to commit a behavior is dependent both on the relevant attitudes held by the person. For example, a person who has developed the attitude that the cigarettes are disgusting may be more likely to form the intention to quit smoking.

Subjective norms refer to the expectations that others have that the person commit the action. While managerial pressure is likely to be the strongest subjective norm in a business setting, the expectations of peers as well as subordinates constitute an influence that falls under the subjective norm construct. Since multiple sources may influence an individual, a person may experience subjective norms from one group that are in conflict with the subjective norms exerted by another group. An example might be a plant manager who is incentivized by senior management to increase output, but manages workers who seek to avoid overtime. In such a situation, a comprehensive measurement of subjective norms would be needed to determine the net effect on the plant manager's behavioral intentions.

The purpose of separating individual attitudes from subjective norms is to enable measurement of a person's independent, voluntary desire to perform an action, which is formed by attitudes, and the external pressures on the person to perform the action. In this way, the theory examines intrinsic motivations by way of attitudes and extrinsic motivations by way of subjective norms imposed by others.

The theory of reasoned action also claims that a person who has formed a behavioral intention to perform an action is likely to commit the behavior. Though this relationship is seemingly obvious, it does not hold in a number of practical situations. For example, people might intend to wake up at a certain time but instead find themselves pressing the snooze bar in the morning. They might intend on quitting smoking forever, but find themselves unable to quit.

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This can occur in business situations as well. Best practices are often compiled by managers with well-formed intentions but poorly implemented in practice despite those intentions. Circumstances may intervene, and steps that are known to be of long-term benefit may be skipped to address ad hoc issues. The intention to perform the step cannot compete with the urgency of the situation management may find themselves in.

The theory of reasoned action is a very general theory intended to a wide variety of human behaviors (Fishbein and Ajzen 1975), both unplanned activities and those planned in advance. This allows a very general theory that can be applied to a number of specific situations. The technology acceptance model, for example was an adaptation of the theory of reasoned action (Davis 1986; Davis, Bagozzi, and Warshaw 1989). The model has been widely tested within information-technology-management research (e.g. Matthieson 1991; Szajna 1996; Venkatesh and Davis 2000). (See Legris, Ingham, and Collerette (2003) for a detailed review of research on the technology acceptance model.)

Other applications of the theory of reasoned action have fared less well. Wicker (1969) called for the abandonment of the attitude construct based on weak empirical support. Similarly, Mischel (1968) concludes from the weak relationships between traits of the individual and situational behaviors. The omission of immediate, specific, situational factors inhibited the theory of reasoned action and necessitated the development of the theory of planned behavior (Ajzen 1985; 1991).

THEORY OF PLANNED BEHAVIOR

Ajzen (1985; 1991) extended the theory of reasoned action to form the theory of planned behavior. See **Figure 2** for a graphical representation of the theory.

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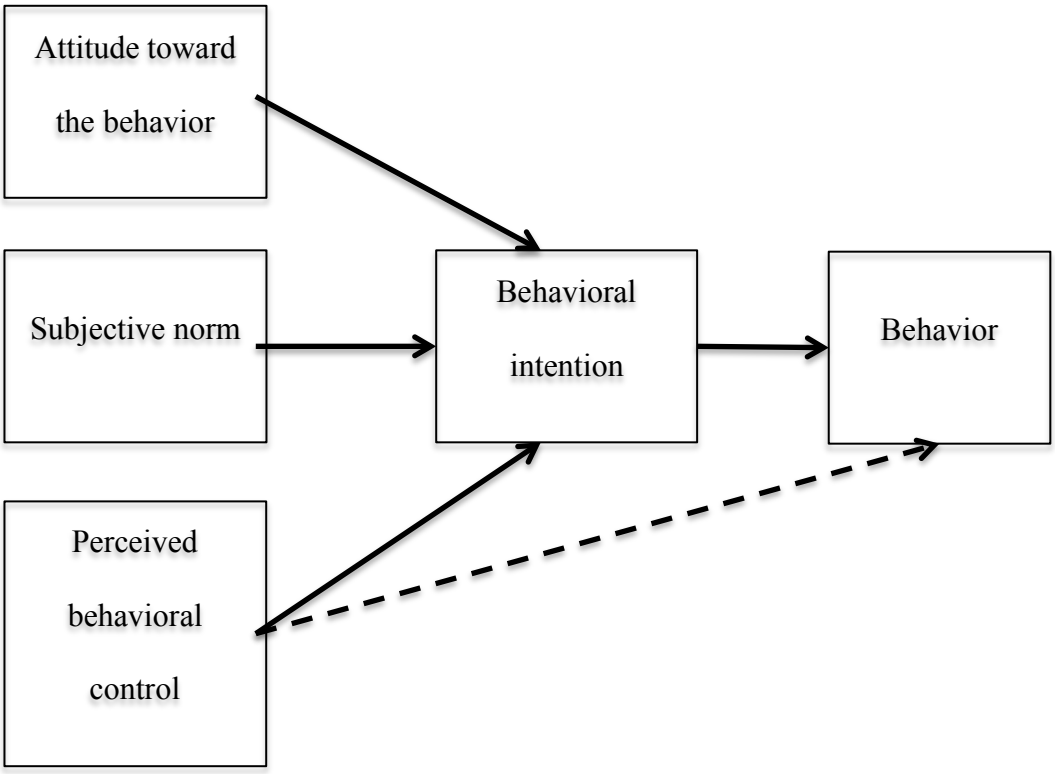
Figure 2: Theory of planned behavior (Ajzen 1991)



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Intentions still are central to the theory of planned behavior. Intentions to perform the behavior are still hypothesized to affect the performance of the behavior.

The first determinant of intentions is the attitudes toward the specific behavior. This refers to the "degree to which a person has a favorable on unfavorable evaluation or appraisal of the behavior in question." (Ajzen 1991, p. 188) This "salient information, or beliefs, relevant to any given behavior" is to be contrasted with general beliefs that may or may not apply to a given situation but instead form traits of the individual. The second determinant of intentions are subjective norms, which represent the social pressure to perform (or avoid) the action or behavior. This construct was also part of the theory of reasoned action. The third determinant of intention is perceived behavioral control. Perceived behavioral control reflects the actual ability of the actor to perform the behavior regardless of the actual intention to perform the behavior.

The justification for perceived behavioral control stems from the generality of self-efficacy theory (Bandura 1980). Self-efficacy measures the extent to which actors believe that they can competently execute the behavior. Bandura et al (1980) determined that a wide section of literature showed that self-efficacy is an important determinant of actual behavior. On these grounds, perceived behavioral control is claimed to influence behavior.

Bandura's (1980) concept of self-efficacy, which forms the theoretical basis for perceived behavioral control is to be kept distinct from Rotter's (1966) concept of locus of control. Self-efficacy is specific to the behavior being performed, while locus of control refers to a trait characterizing the general ability of the individual. Locus of control remains stable for an individual across situations, but the individual and the particular situation being faced jointly determine the individual's perceived behavioral control. It is not a generalized trait of the individual independent of context (Ajzen 1991).

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Perceived behavioral control may directly affect the behavior rather than being fully mediated by intentions. For example, weight loss studies performed by Netemeyer, Burton, and Johnston (1990) and Schifter and Ajzen (1985) found that perceived behavioral control actually had a stronger direct effect on than intentions. Ajzen (1991) notes that studies of job search behavior, video game playing, problem drinking, leisure activity behavior, and cognitive task performance found direct effects between perceived behavioral control variables and the focal behavior that were not fully mediated by intentions. Though actual behavioral control would arguably be a better measure, perceived behavioral control has shown itself to be a well-supported proxy (Ajzen 1991).

Madden, Ellen, and Ajzen (1992) confirmed the utility of the theory of planned behavior relative to the theory of reasoned action. They examined ten behaviors and determined that the theory of planned behavior's inclusion of perceived behavioral control greatly improved the predictions of intentions and behaviors. In particular, behaviors that were likely to be difficult to perform were more likely to be improved. This implies that for complex behaviors that involve judgment and uncertainty, the theory of planned behavior is more likely to be suitable than the theory of reasoned action.

Applications of the Theory of Planned Behavior

The theory of planned behavior has been applied to a wide variety of actions, lending credence to its power. One application Ajzen and Driver (1992) examined five leisure activities. The study confirmed that all path relationships in the theory of planned behavior relating to attitudes, subjective norms, and perceived behavioral control predict intentions and behavior as predicted by the theory of planned behavior.

An early application of the theory of planned behavior had some success. Schifter and

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Ajzen (1985) examined weight loss among women. Attitudes, subjective norms, and perceived behavioral control did predict intentions to lose weight. Perceived control and intentions were moderately successful in predicting the actual amount of weight lost over six weeks. Notable is that these antecedents were specific to the weight loss action. Other, more general, factors such as health locus of control, perceived competence, and action control are more general trait variables of the individual respondent and were found to be unrelated to the amount of weight lost. This lends credence to the value of the theories inclusion of constructs that relate specifically to the action performed and the omission of general trait variables that may affect behavior only under certain circumstances in which those traits are salient to the individual.

The theory of planned behavior has also been applied to behaviors relevant to business. Sparks and Shepherd (1992), for example, examined consumer decisions to buy organically grown vegetables. This study produced strong support for the theory of planned behavior. However, it also identified self-identity (specifically a green identity) as a factor that influenced intentions. This study examined only intentions, however, and not behavior.

Pavlou and Fygenson (2006) extend the theory of planned behavior to the adoption of e-commerce platforms by end users. The two behavioral actions they attempt to predict are gathering product information and buying a product on the web. They validate the influence of attitudes, subjective norms, and perceived behavioral control on adoption behaviors through intentions. Though their model examines perceived behavioral control as a second-order factor composed of controllability and self-efficacy, the results indicate the usefulness of the theory of planned behavior in predicting contemporary behaviors relevant to business applications. Other studies of adoption by end-users of products include George (2004); Hansen, Jensen, and Solgaard (2004); and Hsu, Yen, Chiu, and Chang (2006).

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Additionally, the theory of planned behavior has been applied to managerial behaviors. For example, Cordano and Frieze (2000) performed an empirical test of the preferences of environmental managers. The findings indicated that pollution prevention attitudes, subjective norms surrounding environmental regulation, and perceived behavioral control affected behavioral preferences. Lynne, Casey, Hodges, and Rahmani (1995) performed another study that found the importance of managerial attitudes on the adoption of conservation technology.

The theory of planned behavior has also been extended to study technology adoption in the workplace. Morris, Venkatesh, and Ackerman (2005), for example, extended the theory to examine the roles of gender and age in adoption behaviors.

ANTECEDENTS OF THE USE OF RISK MANAGEMENT

To extend the theory of planned behavior to the context of risk management adoption requires the identification of constructs relevant to the risk management context that correspond to concepts within the theory of planned behavior.

Prior to identifying these constructs, the role of intentions within the theory of planned behavior needs to be considered. Intentions either fully or partially mediate the relationships between each of the antecedents (attitudes toward the behavior, subjective norms, and perceived behavioral control) and the behavior. The theory thus claims that each antecedent exerts a positive effect on the behavior. That this occurs through intentions illuminates the psychological mechanism by which this positive relationship occurs is only one claim of the theory. This study will instead focus on the contribution of the theory of planned behavior in the identification of attitudes toward the behavior, subjective norms, and perceived behavioral control as ultimate antecedents to behavior.

To simplify the theory for the purposes of this study, intentions are treated as a black box,

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and the modified theory is illustrated in Figure 3. The main reason for the simplification is that including intentions would not help address the research question of identifying the ultimate antecedents of behavior. While intentions are likely a proximate antecedent, it would not be illuminative to the present study. A second reason is however important the role of intentions is psychologically, the managerial relevance is realized by identifying antecedents that can be controlled or readily influenced by firms. Intentionality by itself does not fit in either of these categories whereas the antecedents in the theory of planned behavior do.

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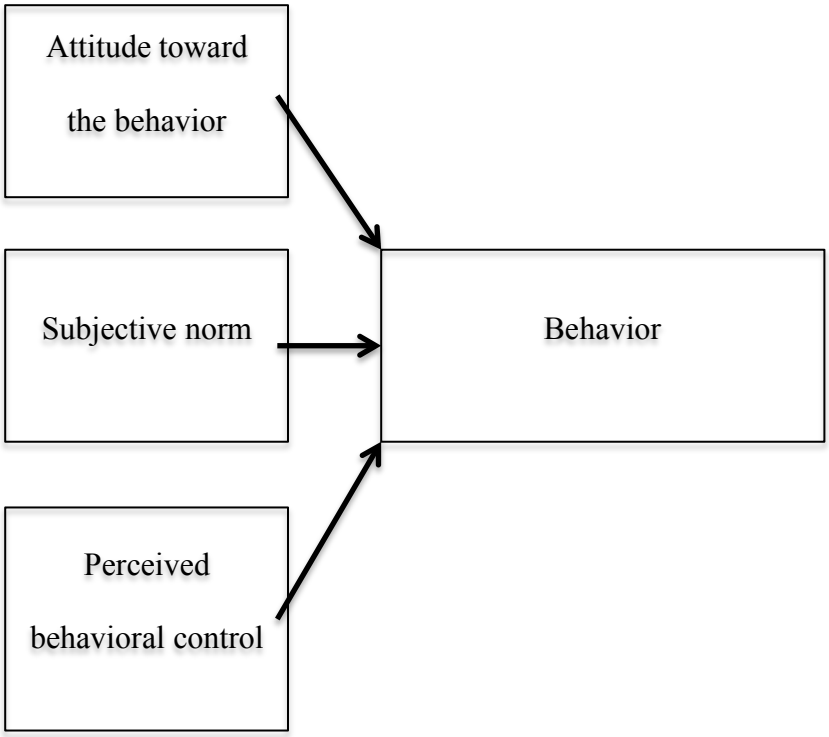
Figure 3: A modified version of the theory of planned behavior



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The modified theory preserves the theory of planned behavior's ability to identify the antecedents of the behavior while eliminating the need to measure what intentions were formed to produce the behavior. The remaining constructs can then adapted to the risk management context as per Table 2. These adaptations are described in the hypotheses section.

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Table 2: Application of the theory of planned behavior to the use of risk management

Theory of Planned Behavior	Research Model for the Use of Risk Management Practices
Attitude toward behavior	Perceived ability to react to problems: This is an attitude that reflects a manager's concept of how useful it is to proactively managing risks that can be easily addressed after they become problems.
Subjective norm	Process-focused risk management policies – These policies are a subjective norm formed by authority figures within the organization rather than by peers within the organization or peer firms in the industry. These policies create extrinsic incentives for the individual.
Perceived behavioral control	Ambiguity surrounding the outsourcing arrangement – An ambiguous situation is one in which proactive management (including proactive risk management) is difficult. This undermines the manager's confidence that proactive risk management can be executed well.
Actual behavior	Use of risk management – The components of proactive risk management are the focal behavior influenced by the above antecedents.

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CHAPTER 3

HYPOTHESIS DEVELOPMENT

The hypotheses to be tested are depicted in Figure 4. The first three hypotheses derive from the theory of planned behavior and the risk management and associated literatures. The remaining hypotheses are based on the risk management and associated literatures.

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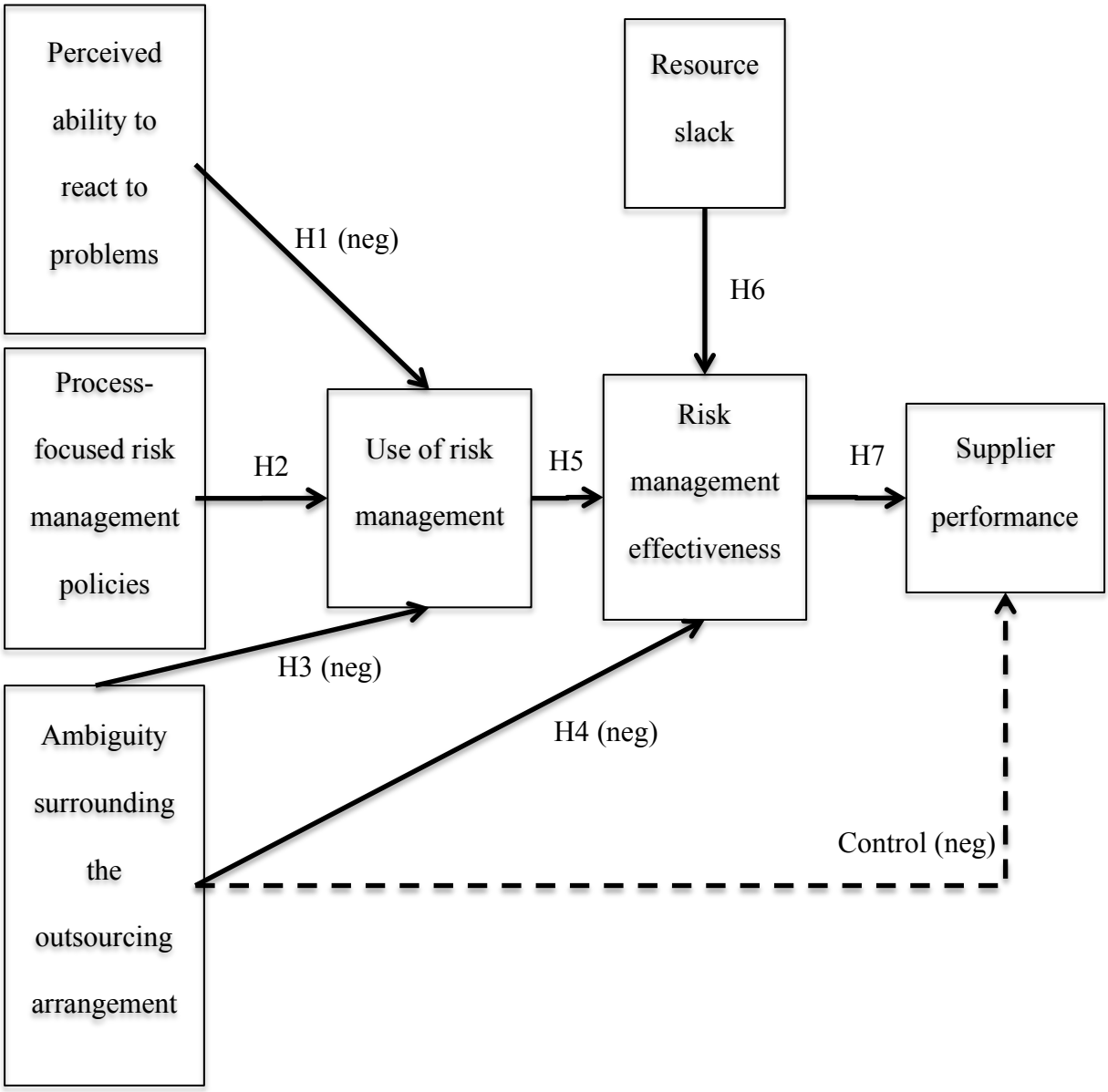
Figure 4: Conceptual model



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ANTECEDENTS OF THE USE OF RISK MANAGEMENT

Perceived ability to react to problems

The first construct to be adapted from the theory of planned behavior concerns attitudes toward the use of risk management. It is unlikely that managers will view all outsourcing activities as worthy of a complete, thorough application of all risk management practices. For example, Raz and Michael (2001) met managers who "claimed risk management was an unnecessary activity, and that the resources it required could be put to better use elsewhere." The authors note that their examination was of "Israeli culture, which places a high value on personal initiative, improvisation and on-the-spot problem-solving, while giving less emphasis to disciplined work processes." Another example is that, despite their demonstrated effectiveness in reducing complication and mortality rates in multiple contexts, checklist adoption in hospitals remains relatively low (Conley, Singer, Edmondson, Berry, and Gawande, 2010). In these cases, the perceived usefulness of checklists recommended for use by doctors lags behind the actual usefulness of the checklists documented in the medical research literature.

An important determinant of these attitudes toward the use of risk management is the manager's determination of how well the organization will be able to respond to an issue should one arise. If managers perceive remedial actions as straightforward and easily adopted at low cost, then proactively preventing problems is perceived as less important. Sheffi (2005) in describing a resilient enterprise argues that such an organization should have the full flexibility to respond to any issues that may arise without disruption. Such an enterprise would be impervious to risk, not by isolating itself from it through buffers, but by having low-cost responses to any externally created situations. While few, if any, managers have the luxury to operate within such an idealistic situation, there are certain situations that lend themselves easily

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to adaptation. For example, procuring commodity products produced by multiple suppliers who have multiple delivery channels available at stable prices will be less likely to benefit from risk management than the procurement of a heavily engineered product produced by a single, overseas supplier with unique competencies that cannot be duplicated by competitors (Kraljic 1983).

This existing literature suggests that attitudes toward the use of risk management are thus represented by the ability to react to problems, i.e. the ability to respond to issues post-hoc at a reasonable cost. This expectation of the manager's to be able to react to problems that may arise is important to the manager's judgment of the value of proactive measures like risk management. Thus, the following hypothesis is offered:

Hypothesis 1: The perceived ability to react to problems is negatively associated with the use of risk management.

Process-focused risk management policies

The second construct to be adapted from the theory of planned behavior pertains to subjective norms. These are social pressures placed on managers to perform risk management.

These pressures have been examined by prior literature concerning risk management. Repenning and Sterman (2001 p.64) assert that "nobody ever gets credit for fixing problems that never happened". They argue managers are unlikely to be sufficiently rewarded within their organizations for the proactive avoidance of problems. In the context of project risk management, Chapman and Ward (2003 p. 47) refer to this as the problem of "distinguishing between good luck and good management" and between "bad luck and bad management".

In contrast, the rewards for solving problems after they occur are often great. Echoing this point, Taleb (2007, p. xxiii) presents a dark, counterfactual illustration of this idea:

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"Assume that a legislator with courage, influence, intellect, vision, and perseverance manages to enact a law that goes into universal effect and employment on September 10, 2001; it imposes the continuously locked bulletproof doors in every cockpit (at high costs to the struggling airlines)--just in case terrorists decide to use planes to attack the World Trade Center in New York City...The person who imposes locks on cockpit doors gets no statues in public squares, not so much as a quick mention of his contribution in his obituary."

Taleb (2007, p. xxiii) goes on to contrast this to those responding to the September 11 disaster, those "on television performing heroic acts, and those whom you saw trying to give you the impression that they were performing heroic acts. The latter category includes someone like the New York Stock Exchange chairman Richard Grasso, who 'saved the stock exchange' and received a huge bonus for his contribution (the equivalent of several thousand average salaries)." In such situations, even symbolic responses to problems can reap disproportionate rewards while those whose actions may have prevented the problem from being worse or enabled others to respond effectively once the problem occurred rarely merit attention. This was evident in the wake of Brazil's floods, which were the worst single-day disaster in the country's history. The Economist (2001) reported that "disaster relief trumps disaster prevention in Brazil. Though the federal government budgeted 442m reais ($263m) for disaster prevention last year, only 139m reais was in fact spent, according to Contas Abertas, a watchdog group. Less than 1% of money for preventive works in a big federal investment plan (called the PAC) found its way to flood-prone Rio de Janeiro state last year," which was the site of the deadly floods. The government had reduced disaster prevention spending prior to the floods, which ultimately resulted in large, required emergency expenditures after they occurred.

Ouchi (1979) suggests, however, that if managerial behaviors (as opposed to merely the

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outcomes of these behaviors) can be monitored and rewarded, then such a control strategy may be used to motivate managers to perform tasks that are beneficial to the organization. In other words, managers may not receive credit for problems that are prevented from occurring (as per Repenning and Sterman (2001)), but they may receive credit for performing the behaviors associated with risk management. Within the context of risk management, Aubert, Patry, Rivard, and Smith (2001) found evidence that organizational routines supportive of risk management in projects at British Petroleum had been adopted, suggesting that firms may behave in such a manner to encourage certain managerial behaviors.

Monitoring and rewarding the behavior of risk management is only relevant inasmuch as these incentives are present regardless of whether any actual problem occurs. Incentives that are outcome-based are more strongly related to managers' reactions to problems and luck rather than the proactive risk management techniques examined within this study.

Behavioral, process-focused incentives to perform risk-management, therefore, should be associated with a manager's actual practice of risk management, and are an appropriate way to measure the subjective norms influencing managers considering risk management. Process-focused risk management incentives include the production of documentation of risk management activities, negative, punishment for those who skip this task, an evaluation of the quality of these activities, rewards, and communications to employees indicating the organization takes risk management seriously. Process-focused risk management policies are defined to be organizational policies that incentivize managers to perform the behaviors of risk management. These policies could positively influence the actual adoption of proactive risk management by addressing the concerns put forth by Repenning and Sterman (2001) that the management of risks goes unrewarded within organizations since they address problems that

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don't actually happen. The following hypothesis is thus offered.

Hypothesis 2: Process-focused risk management policies are positively associated with the use of risk management.

Ambiguity surrounding the outsourcing arrangement

The third construct to be adapted from the theory of planned behavior is perceived behavioral control. This refers to the confidence the individual has that the behavior can be performed successfully. Successfully performing risk management can be difficult due to the uncertainties associated with outsourcing. These difficulties form the basis for the construct ambiguity surrounding the outsourcing arrangement.

Ambiguity surrounding the outsourcing arrangement is derived from the concept of task analyzability presented by Perrow (1967, 1970). It was later expanded upon by Daft and Lengel (1986) and operationalized by Withey, Daft, and Cooper (1983) and Daft and Macintosh (1981). Analyzable tasks are characterized by the presence of risks that would be likely to readily identified beforehand by the party performing the task. Ambiguity surrounding the outsourcing arrangement is defined to refer to characteristics of an outsourcing arrangement that interfere with the ability of the outsourcing manager to perform a straightforward analysis of the outsourcing arrangement.

Ambiguous situations are more difficult to predict than analyzable situations. Not all key factors that bear importance to the situation are known. Also, data for making decisions regarding the situation may be ambiguous and unavailable. For example, Boeing's highly complex 787 aircraft has been delayed for multiple years due to difficulties managing suppliers (Sanders and Cameron 2011) in addition to regulatory issues that may have a long-term effect on Boeing's ability to maintain production (Kesmodel and Trottman 2011). In ambiguous such as

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these, complexity may also obscure cause and effect relationships, which make determining the ultimate effects of certain actions more difficult.

Ambiguous situations are likely to be the most risky ones in which managers foresee the greatest uncertainties. One could argue that managers would react to this increased perception of risk with increased levels of risk management. However, this need not be the case.

Risk management in this study refers to the a priori identification of risks, the analysis of those risks to identify their likelihood and consequences, the implementation of proactive countermeasures to address those specific risks, and the creation of a response plan for those same risks (Raz, Shenhar, and Dvir 2002). Common to these risk management activities is the burden they place upon managers to identify specific risks before they occur. This type of risk management requires managers to have a sufficient understanding of the situation they are managing to make a reasonable attempt to identify which risks are likely to be most relevant.

Ambiguous situations are ones in which managers are unlikely to be able to properly identify relevant risks. The major risks that managers face in ambiguous situations are likely to be so-called unknown, unknowns (Taleb, 2007). Kaplan and Garrick (1981) refer to these as N+1 risks, i.e. risks beyond those which can be enumerated through an exhaustive analysis. Unforeseeable risks can never be full enumerated prior to their occurring, and thus some residual risks that were not considered will always be present no matter how thorough the analysis to enumerate all risks has been. Such N+1 risks are present for all branches of any decision tree outside of contrived mathematical games where all possible outcomes are provided specified in advance. However, as this study examines risk management of foreseeable risks, managers' perceptions of unforeseeable risks are unlikely to increase the management of foreseeable risks.

The presence of perceived situational ambiguity, and the unforeseeable risks they bring

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will in fact detract from the management of foreseeable risks as managers are forced to allocate their limited attention to other management activities (Simon 1976; MacDuffie 1997). Ambiguous situations in outsourcing have included the 9/11 attacks. Though risks due to global terrorism are now apparent, prior to 9/11, many outsourcing managers were not aware of the possibility or consequences of such events (Leshine 2003). Prior to 9/11, the threat of a terror attack that could have a significant impact the ability of suppliers to fulfill their agreements was not appreciated in the same way as it was afterwards (Leshine 2003). Another example of ambiguity associated with outsourcing was Boeing's outsourcing strategy for the 787, which was publicly forecast to save the company over a billion dollars. The complexity of the outsourcing strategy created too many risks for the firm to manage effectively, and thus Boeing had to buy out suppliers and raise money from partners to finance development costs, which added $12 billion to $18 billion to the planned $5 billion to produce the plane. Despite this result, Boeing managers insist that the issues that came up were likely not foreseeable by the prior managers who had architected the original outsourcing strategy (Gates 2011). Though such outsourcing decisions can be readily identified as errors after the results are observed, situational ambiguity can prevent managers from knowing what risks are faced beforehand.

Thus, the following hypothesis is offered:

Hypothesis 3: Ambiguity surrounding the outsourcing arrangement is negatively associated with the use of risk management.

ANTECEDENTS OF RISK MANAGEMENT EFFECTIVENESS

Ambiguity surrounding the outsourcing arrangement

A further consequence of managers' belief that they face an ambiguous situation is that even if they do choose to implement proactive risk management, they will be unlikely to be successful in

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these efforts. In ambiguous situations managers do not know the critical factors and are unsure of cause-effect relationships, so they will be unlikely to accurately predict what problems may arise. Even if they are successful in accomplishing that, the likelihood that they properly assessed these risks, successfully generated effective countermeasures, or produced accurate response plans will be small. Risk management effectiveness is defined to be the successful identification and assessment of risks, deployment of countermeasures, and execution of response plans. Situations characterized by high levels of ambiguity are unlikely to produce the circumstances that reward in-depth, structured, proactive planning, which includes the type of risk management addressed in this study. Thus, the following hypothesis is offered.

Hypothesis 4: Ambiguity surrounding the outsourcing arrangement is negatively associated with risk management effectiveness.

Use of risk management

Classical economists have assumed rationality when modeling decision-making practices (Keeney and Raiffa, 1976). The low reported usage of risk management in practice (Zwikael and Sadeh, 2007) would imply that risk management must not very useful in accomplishing managerial goals. If risk management lacks utility in preventing problems, then the behavior Zwikael and Sadeh (2007) have found would be a logical, adaptive behavior for the situations that managers face.

The literature suggests, however, that there are a number of effective methods for conducting risk management. The PMI Standards Committee (2004) suggests risk management is a useful endeavor for avoiding problems on a project. Additionally, the methods suggested by Sheffi (2005); Knemeyer, Zinn, and Eroglu (2009) are predicated on the usefulness of risk management. Additionally, risk management has been found to be useful outside of a

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outsourcing context by Zwikael and Sadeh (2007). As outsourcing is a relatively high-risk context, risk management might be even more effective than in more general project planning endeavors.

Since outsourcing managers repeatedly face outsourcing decisions, it is possible that they have learned when performing risk management is likely to be effective, where effective risk management refers to having identified problems before they occur and correctly assessing their consequences, avoiding problems, mitigating the consequences of problems, and effectively executing a risk-response plan. As these are the intended results of proactive risk management practices, the following hypothesis is offered.

Hypothesis 5: The use of risk management is positively related to risk management effectiveness.

Resource slack

The intuitive concept of slack usually triggers a negative image. Lean production claims that a well-running operation ordinarily should have few unused resources, and small buffers (Womack, Jones, and Roos 1990). Eliminating excess resources is tantamount to removing waste that is non-productive. The term slack is often assumed to refer to overcapacity that incurs cost without providing readily ascertainable benefits (Enthoven 2011; Terlep 2011).

In a dynamic environment, however, slack resources that ordinarily go unused may suddenly become crucially important to identifying and responding to problems. Risk, by its very nature, refers to the potential for issues that may occur even when they are unanticipated prior to their occurring. Researchers have argued that resource slack enables firms to adapt to environmental disruptions to improve performance (Carter, 1971; Cyert and March, 1963).

Nohria and Gulati (1997:604) define resource slack to be "the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of

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organizational output." This study modifies this definition to the outsourcing arrangement level. Thus, resource slack refers to the resources available to the people involved in the outsourcing arrangement beyond the minimum needed to produce a given level of output for the outsourcing arrangement. This concept has been of relevance to management scholars because firms must deploy their scarce resources to build capabilities and explore their opportunity set. Resource slack has been positively associated with performance (Bromiley 1991; Tan and Peng 2003). This relationship has been validated in studies of private firms (George 2005). This study uses a modified definition of resource slack so as to apply to an outsourcing arrangement rather than to a firm or business unit.

Slack has been found to exhibit a negative relationship with risk (Bromiley 1991). Managers faced with insufficient slack seek to reestablish their slack by increasing their level of risk-taking. Bromiley (1991), however, finds that this increased risk-taking harms subsequent performance.

Resource slack for the outsourcing arrangement may also affect risk management effectiveness. Low levels of resource slack limit the range of options for management, which can reduce the ability of the organization to adapt flexibly (Miles, 1982). Successful adaptation to environmental changes can require organizational action, so those organizations with high levels of available slack will experience success identifying risks, analyzing and producing countermeasures to mitigate those risks, and ultimately successfully respond to those issues by aggressively executing their response plans. Resource slack can thus serve as a form of strategic flexibility to avert otherwise damaging consequences in high-risk situations (Evans, 1991). Resource slack should therefore be positively associated with the effective management of risk.

Hypothesis 6: Resource slack is positively related to risk management effectiveness.

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RISK MANAGEMENT EFFECTIVENESS AND SUPPLIER PERFORMANCE

Strategy researchers have asserted that firms can succeed by constantly adapting to changing environmental situations by asserting their dynamic capabilities (Teece, Pisano, and Shuen, 1997; Teece 2007) rather than by proactively managing risk. In this view, disruptions are inevitable and unforeseeable. Firms that sense and respond to these disruptions will outperform others. Given the unpredictability of environmental change, elements of proactive risk management including risk avoidance, risk analysis to determine likelihood and consequences, implementation of proactive countermeasures, and pre-made risk response plans do not serve a role. Indeed, Teece (2007) identifies sensing, the ability to identify an environmental change soon after it has already occurred, as important to adaptive change for an organization.

While such reactive capabilities have value, and have been shown their importance empirically (e.g., Cohen and Levinthal, 1990), it does not exclude the possibility that operational activities such as outsourcing are best approached by reacting rather than proactively planning. The execution of a single outsourcing arrangement may not be exposed to enough dynamism over the course of its completion to make prior proactive planning useless. Hendricks and Singhal (2005a; 2005b) have shown that disruptions to the outsourcing process can have significant effects on the value of a business. For such operational tasks, proactive risk management may be important.

While Hendricks and Singhal (2005a) have determined that overall business value can be affected by supply chain disruptions, they have also tied these disruptions to operational performance (2005b). Their data, however, did not allow for a test of how these operational performance penalties manifest. One way might be through supplier performance (defined as meeting or exceeding expectations with respect to product quality; delivery; responsiveness to

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requests for changes; sales, service, and technical support; and overall cost performance). Ineffective risk management of the outsourcing arrangement could result in the supplier being unable to deliver a suitable product to the firm. This would be a proximate effect of the unmanaged risk, which could affect operational financial performance.

The literature also claims support for the view that managing risk can effectively avoid many of the disadvantages of outsourcing (Kliem, 1999). For example, Zsidisin and Smith (2005) describe early supplier involvement as a form of risk management process in outsourcing situations that improves performance. Further, risk management practices in a project context have been associated with project performance (Raz, Shenhar, and Dvir, 2002; Zwikael and Sadeh, 2007). Therefore, the hypothesis that effective risk management is positively related to supplier performance is offered:

Hypothesis 7: The effectiveness of risk management is positively related to supplier performance.

As ambiguity refers to the lack of knowledge of key factors and ambiguous data and cause-effect relationships, ambiguity in the outsourcing situation is likely to imply a more nuanced outsourcing situation. Such outsourcing arrangements that involve ambiguity are likely to cause issues for both the buyer and supplier regardless of whether risk management is performed. Thus, ambiguity is used as a control variable for supplier performance.

Additional controls are considered. The first is firm size as measured by the number of employees at the company. The reason for this is to control for differences in how well firms of different sizes are able to manage risks. Business unit annual revenue is also included for the same reason. Since a large firm may own a small business unit, this measure controls for the size of the unit while ignoring the size of the firm. The final control is the number of years served by the respondent at the company. This control was considered since managers with more

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experience could be more effective at performing proactive risk management since they are familiar with issues that have occurred previously at the firm.

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CHAPTER 4

METHODS

SAMPLING FRAME

The unit of analysis is taken to be an outsourcing instance, which occurs when a buyer buys from a supplier with whom the buyer has a relationship. The target sample consists primarily of manufacturing companies who are likely to have such instances of outsourcing. Specifically, these companies belong to the SIC codes found in Table 3.

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Table 3: SIC codes of industries within sample

SIC codes	Industries
28	Chemical and allied products
29	Petroleum refining and related industries
30	Rubber and miscellaneous plastic products
35	Industrial and commercial machinery and computer equipment
36	Electronic, electrical equipment and components, except computer equipment
37	Transportation equipment
38	Measuring, analyzing, and controlling instruments; photographic, Medical and optical goods; Watches and clocks
39	Miscellaneous manufacturing industries
13	Oil and gas extraction
25	Furniture and fixtures
28	Chemicals and allied products
29	Petroleum refining and related industries
30	Rubber and miscellaneous plastic products
34	Fabricated metal products, except machinery & transport equipment
35	Industrial and commercial machinery and computer equipment
36	Electronic, electrical equipment, and components, except computer equipment
37	Transportation equipment
38	Measurement, analysis, and control equipment; Photography, medical and ophthalmic goods; Watches and clocks
39	Miscellaneous manufacturing industries
73	Business services
7371	Computer programming services
7372	Prepackaged software
7373	Computer integrated systems design

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This dissertation examines outsourcing arrangements from the perspective of individual decision-makers within buyer firms. The profile of these individuals are high-level managers within purchasing organizations. These managers should have primary responsibility for a strategically important outsourcing arrangements with a supplier to their firm.

DATA COLLECTION

A list of managers and their e-mail addresses was provided by the Institute of Supply Management. To ensure that employees were of an appropriately high level within their organizations to have a high probability of having full responsibility for an outsourcing relationship, the list was restricted to Title 1 and Title 2 members belonging to the SIC codes specified in Table 3. Title 1 and Title 2 managers are managers within their organizations and are likely to have sole responsibility for an outsourcing relationship. This sample was chosen in keeping with the key informant approach. These managers are in the best position to assess their own behavior and are likely to be knowledgeable about the conditions that exist within their firms. The average respondent had spent 12.1 years at their firm. The most common job titles held by respondents are reported in Table 4. All respondents were responsible for the outsourcing arrangement about which they were responding.

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Table 4: Most common job titles of respondents*, **

Job title	Percent holding that title
Director	11.9%
Purchasing manager	10.3%
Senior procurement manager	7.1%
Senior manager	6.3%
Supply chain manager	5.6%
Vice president	4.0%
Global sourcing manager/director	4.0%
Senior buyer	4.0%
Director of purchasing	3.2%
Commodity manager	3.2%
Buyer	3.2%

* Some titles were grouped together. For example, "supply chain pattern manager" was grouped under the "supply chain manager" title.

** Less common titles denoted statures similar to those in this list (e.g. purchasing agent, materials manager, senior director).

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The first stage of data collection consisted of six in-depth phone interviews selected randomly from the Institute of Supply Management list. Each was responsible for an outsourcing arrangement at their firm. Additionally, academics studying outsourcing arrangements and risk management were consulted. Secondary data was collected from various outsourcing studies (e.g. Shi 2007; Kliem 2004) on problems occurring within the outsourcing arrangement to gain an understanding of what types of problems risk management might seek to address. Finally, a large-scale e-mail survey provided data to test the hypothesized relationships.

A mailing list was obtained from the Institute of Supply Management. Information included in the mailing list was company names, addresses, phone numbers, contact names, and titles. A cover e-mail using the name of the recipient and a link to an online survey hosted through Qualtrics was sent to 4,994 e-mail addresses. 1,516 e-mail addresses were confirmed as undeliverable. This number, however, may be an under-report since an e-mail server must be configured to provide such bounce-back messages to the sender. This means a maximum of 3,478 were delivered to live recipients.

23 respondents indicated that they did not have information that suited the purpose of the survey. Removing these from the maximum number of live recipients resulted in a maximum of 3,455 eligible recipients of surveys.

The Qualtrics logs indicated that 295 individuals began the survey. Thus, 8.53% of eligible recipients took some action towards attempting a response at the survey.

Including incomplete survey responses 169 raw responses were collected, yielding a raw response rate of 4.89%. Additionally the dropout rate among people who initially began the survey according to the logs was 42.71%. The completion rate was thus 57.29%.

153 usable responses were received. These respondents had responses across all

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constructs of interest. Thus, the usable response rate calculated from the maximum number of eligible respondents (3545) was 4.43%; but it was much higher at 51.86% when based on those who started the survey (295) . Table 5 shows what types of outsourcing arrangements were represented within the sample. Though a portion of the responses were described as commodity purchases rather than outsourcing arrangements, the majority of the projects were of the intended type in that they involved a significant portion of the value chain for the firm's product being performed by the supplier (e.g., engineered products used only by the buying firm).

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Table 5: Types of outsourcing arrangements represented

Type of outsourcing arrangement	Percent of respondents
a service project with an end goal (technology system, consulting, engineering, etc.)	6.4%
an ongoing service agreement (call center, maintenance contract, ongoing technology services, etc.)	12.7%
a product resulting from a project (building, plant machinery, etc.)	7.6%
an engineered product specific to your firm used in production	42%
a knowledge product (database, web site, etc.)	0%
a commodity product used in production	24.2%
Other	7%

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SURVEY INSTRUMENT AND MEASURES

Questionnaire development consisted of multiple stages. First, the relevant literatures on risk management, the theory of planned behavior, and literature specific to individual constructs in the study were reviewed to identify scales that could be adapted to the purpose of the study. Some modifications to scales were needed due to the outsourcing arrangement forming the unit of analysis.

Second, preliminary interviews were conducted with academics and prospective respondents from the Institute of Supply Management familiar with issues of outsourcing. The purpose of this step was to ensure important constructs were identified and the language to be used in the survey was known to respondents and had agreed meanings among respondents. These interviews also sought to enhance validity and response rates. These interviews suggested issues including the importance of risk management policies of the firm or the industry were of primary importance to managers. While these interviews validated most of the theoretical relationships hypothesized, they helped refine the language that was used in the survey to ensure common readings among respondents. The constructs grounded in theory were thus recognized in practice. To reduce the response burden on managers and ensure data would be collected in a manner that could be readily analyzed, five-point Likert scales were used. Research has suggested that the reliability increases as the number of Likert options increases to 5, but improvement is marginal at best as the scale granularity is increased any further (Lissitz and Green 1975), so five-point scales were used to reduce the burden on respondents relative to seven-point scales. The choices ran from “strongly agree” (1) to “strongly disagree” (5). Additional questions were left open-ended to identify demographic information. This included sales figures and the number of employees in the firm. The statements were then presented to the

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executives and industry experts to validate that the statements were appropriately worded to the prospective audience and the research context. Several iterations of modifications were made based on feedback before and after the statements were placed in a questionnaire format. The items for a given construct were placed together. Dillman (1978) suggests that this method of placing like items together reduces confusion and burden on the respondent. Reverse-coded items were included occasionally to ensure that managers remained thoughtful in reading the scales.

Third, 100 respondents were randomly selected and sent a preliminary questionnaire as a pre-test to evaluate the length of the questionnaire, its format, and item content. Information collected through debriefings was incorporated into the design to further enhance the validity of the questionnaire. The survey sent to respondents is replicated in Appendix A.

Fourth, the final e-mail to be sent to respondents was produced, following suggestions of Dillman (2000). This letter stressed the importance of the study and the average time required to complete the survey. This e-mail is replicated in Appendix B.

Unit of analysis: the outsourcing arrangement

Interviews with managers found that the terms outsourcing arrangement, outsourcing project, outsourcing context, outsourcing situation, outsourcing purchase, etc. were problematic. Managers had differing views of what outsourcing was. Multiple interviewees thought it referred to purchases from low-cost countries. Some thought it referred to procuring a service from a low-cost country. Some thought it referred to buying a product or service that the firm had recently produced in-house. Many thought it referred to a purchase of strategic importance. Wacker (2004:637) notes that vague, broad conceptual definitions lead to bad theory: “new formal conceptual definitions should not expand current definitions to make them less precise and

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broader." Additionally, Dillman (2000) repeatedly notes the need for surveys to use words that have a shared definition among all respondents. No matter how precisely outsourcing is defined in any given empirical study of outsourcing, sample surveys of the phenomenon must ensure that the meaning of the terms are clear to respondents.

The unit of analysis of the outsourcing arrangement was thus established as follows. Respondents were asked to consider the one product or service for which they are responsible that causes the most frequent problems for their firm's operations. Specifically, they were asked to consider a recent, completed buy from the most important supplier of this product or service over the past year. A recent buy of a critical product from an important supplier that the respondent had full responsibility for was chosen to enhance recall by the respondents and to ensure that the reported data pertains to the problematic outsourcing arrangements that are of primary concern to the study. The term "outsourcing" was avoided in the survey to avoid contaminating the results with disparate cases that did not conform to the definition of outsourcing applied in this study.

MEASUREMENT

The survey uses scales adapted from the literature. After the identification of constructs, the initial instruments were developed. Respondents answered using a 1-5 Likert scale that measures the extent to which they agree or disagree with each statement. These instruments were pre-tested to establish content validity. Students in the Michigan State University doctoral program and practitioners were used in pretesting to purify the measurement scales. A Q-sort was also performed to ensure convergent and divergent validity (Koste, Malhotra, and Sharma, 2004). In performing the Q-sort, the items were arranged in random order and presented to the respondents along with definitions of the constructs in the study. They were then asked to assign items to

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each construct. Inter-rater reliability was shown to be high, validating that each item could be easily assigned to the construct it is intended to measure. Subsequently, the respondents reviewed the questionnaire to ensure it was complete, clear, readable, and well-structured (Dillman, 1978).

Outsourcing arrangements

To identify the outsourcing context the first item asks the respondent to indicate which type of outsourcing is to be performed: (1) a service project with an end goal (technology system, consulting, engineering, etc.); (2) an ongoing service agreement (call center, maintenance contract, ongoing technology services, etc.); (3) a product resulting from a project (building, plant machinery, etc.); (4) an engineered product specific to your firm used in production; (5) a knowledge product (database, web site, etc.); (6) a commodity product used in production; or (7) other. The type of agreement used for the outsourcing arrangement was also collected (e.g. a standard contract offered by the supplier to all customers, a negotiated contract including terms your company negotiated with the supplier, no contract, or other). Also, the number of months the outsourcing deal covered and the number of years the buying firm had had a relationship with the supplier were collected.

Perceived ability to react to problems

The perceived ability to react to problems refers to the expectations a manager may hold of being able to wait until a problem occurs before attempting to address it. Components of this include the cost and time to respond to a problem, and the degree to which corrective actions are clear to managers. The items for the ability to react to problems after they occur were adapted from Narasimhan and Das's (1999) flexibility measures that consider both time and cost to change.

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Process-focused risk management policies

Process-focused risk management policies examine whether the firm supports the use of risk management whether or not a problem actually occurs. These items refer to the performance of risk management as its own end. This construct is related to the idea of subjective norm within the theory of planned action. The items for risk management policy are adapted from Chen and Paulraj's (2004) top-management-support construct to reflect the risk management concepts from Repenning and Sterman (2001).

Ambiguity surrounding the outsourcing arrangement

Ambiguity surrounding the outsourcing arrangement examines the ability of the decision-maker to reduce work to analyzable steps so that a priori choices can be made with respect to the outsourcing arrangement. This concept derives from Perrow's (1967, 1970) concept of task analyzability. The items were adapted from Withey, Daft, and Cooper (1983) and Daft and Macintosh (1981). These items examine the barriers to making sense of the outsourcing situation. Task analyzability is low when key factors remain unknown, data are ambiguous, and cause-effect-relationships are not obvious. Such a situation leaves an ambiguous situational context within which managers must make decisions.

Use of risk management practices

The use of risk management practices measures the extent to which the following risk management practices are conducted on the project (1) risk identification, (2) probabilistic risk analysis including the likelihood that a risk will occur and the consequences if it occurs, (3) proactive countermeasures to reduce the probability of an adverse risk, (4) proactive countermeasures to reduce the consequences of an adverse risk, (5) and the creation of a risk response plan (Raz, Shenhar, and Dvir 2002). The measures for this construct were adapted from

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Raz, Shenhar, and Dvir (2002) to fit an outsourcing context.

Resource slack

Discretionary slack has been measured subjectively in the literature due to its perceptual nature (Sharma 2000; Simsek, Veiga, and Lubatkin 2007). Resource slack measures the effect a 10% reduction in time and resources would have on the project (Nohria and Gulati 1997). The items are adapted to an outsourcing context from the two measures provided by Nohria and Gulati (1997). Both of these items were reverse-coded items.

Risk management effectiveness

The effectiveness of risk management refers to the successful identification and assessment of risks, deployment of countermeasures, and execution of response plans. This is judged by the extent to which (1) risks were identified, (2) the consequences of problems were correctly assessed, (3) proactive countermeasures were effective in preventing problems, (4) proactive countermeasures reduced the consequences of problems, (5) and a risk response plan was successfully executed. These measures were based off measures from Raz, Shenhar, Dvir (2002) and adapted to fit an outsourcing context.

Supplier performance

Supplier performance measures to what extent the supplier met or exceeded expectations in the areas of product quality, delivery performance, responsiveness to requests for change, sales, service and technical support, and overall cost performance. The items are adapted from Wu, Choi, and Rungtusanatham (2010).

Objective performance measures were not used. As Oktemgil, Greenley, and Broderick (2000) note, "the subjective approach has been used extensively in empirical studies, having been justified by several writers (Dess and Robinson, 1984; Doyle, 1984; Speed, 1991;

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Venkatraman and Ramanujam, 1986)." The appropriateness of accounting measures has been called into question by Day and Wensley (1988) and Fisher and McGowan (1983). Further, such measures are likely to be unavailable and non-comparable among outsourcing situations performed by different companies. Thus, subjective measures were used.

RELIABILITY

Reliability refers to the consistency and repeatability of a given measurement. Items that are designed to measure a single, underlying construct should exhibit very high correlations, which is suggestive of their referring to a single, consistent conceptual idea. Through repeat measurements, reliability can be established.

Reliability is assessed in this study by assessing different aspects of a construct and examining the degree to which these multiple measurements of the different aspects of the construct are similar. This is quantitatively assessed by computed Cronbach Alpha coefficients and applying a minimum cut-off of 0.6. The maximum Cronbach Alpha of one would indicate that all measurements are equal. Table 6 shows that reliability for all constructs well exceed this cut-off.

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Table 6: Reliability and standard factor loadings of measures

Constructs and items	Standard factor loadings
Perceived Ability to React (Cronbach Alpha = 0.766)	
For most of our purchases...after problems happen, the appropriate response is clear.	0.838
For most of our purchases...the appropriate countermeasures are clear once problems occur.	.851
For most of our purchases...the resources for reacting to problems are generally available.	0.536
Risk Management Policy (Cronbach Alpha = 0.846)	
Regardless of whether or not a problem actually occurs, our company…requires documentation of risk management activities.	0.775
Regardless of whether or not a problem actually occurs, our company…will punish those who skip risk management.	0.676
Regardless of whether or not a problem actually occurs, our company…evaluates the quality of risk management activities by employees.	0.874
Regardless of whether or not a problem actually occurs, our company…rewards those who conduct risk management.	0.667
Regardless of whether or not a problem actually occurs, our company…encourages employees to consider risk.	0.639
Ambiguity Surrounding the Outsourcing Arrangement (Cronbach Alpha = 0.744)	
For this purchase…not all key factors were known.	0.620
For this purchase…data for making decisions were ambiguous.	0.676
For this purchase…the cause and effect relationships governing the activities surrounding the purchase were not obvious.	0.779
Use of risk management (Cronbach Alpha = 0.884)	
For this purchase, an identification of specific risks was attempted.	0.703
For this purchase…an analysis of the likelihood and consequences of known risks was attempted.	0.804
For this purchase…proactive countermeasures to reduce the probability of known risks were implemented.	0.900
For this purchase…proactive countermeasures to reduce the consequences of known risks were implemented.	0.828
For this purchase…a risk response plan for known risks was created.	0.664

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Table 6 (cont'd)

Constructs and items	Standard factor loadings
Resource slack (Cronbach Alpha = 0.880)	
If the people involved had 10% less time to spend, the purchase would have been seriously compromised. [reverse coded]	0.995
If the people involved had 10% fewer resources to spend, the purchase would have been seriously compromised. [reverse coded]	0.797
Risk management effectiveness (Cronbach Alpha = 0.910)	
For this purchase…risks were successfully identified before they became problems.	0.805
For this purchase…the consequences of known risks were correctly assessed before they occurred.	0.764
For this purchase…proactive countermeasures were effective in preventing known problems.	0.872
For this purchase…proactive countermeasures were effective in reducing the consequences of known problems.	0.797
For this purchase…the pre-planned responses to known problems were executed successfully.	0.859
Supplier performance (Cronbach Alpha = 0.818)	
For this purchase...the supplier met or exceeded product quality expectations.	0.466
For this purchase…the supplier met or exceeded deliver performance expectations.	0.768
For this purchase…the supplier met or exceeded expectations for responsiveness for requests for changes.	0.806
For this purchase…the supplier met or exceeded expectations for sales, service, and/or technical support.	0.761
For this purchase…the supplier met or exceeded overall cost performance expectations.	0.506

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DATA QUALITY AND CONSTRUCT VALIDITY ASSESSMENT

The normality of the data was assessed by examining kurtosis and skewness. Kurtosis for all items was below 2.0, and skewness was below 5.0. Thus, normality was determined to be a reasonable assumption. Means and standard deviations are available in Table 7. The means do not suggest any issues with the scale endpoints. The standard deviations do not suggest insufficient variance for any of the items considered. These statistics were computed using IBM SPSS Statistics 19.0.0.1.

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Table 7: Means and standard deviations of constructs

Construct	Mean	Standard deviation
Perceived ability to react to problems	2.50	0.65
Process-focused risk management policies	3.08	0.81
Ambiguity surrounding the outsourcing arrangement	2.94	0.78
Use of risk management	3.75	0.85
Risk management effectiveness	2.60	0.90
Resource slack	2.59	0.99
Supplier performance	3.41	0.79

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An exploratory factor analysis was used to purify the scales. Items with high-cross loadings with constructs that they were not originally designed to measure were dropped. Additionally, items with low factor loadings were dropped. The remaining items for each construct retained sufficient breadth to cover the qualitatively pertinent aspects of each construct.

Cronbach's alpha was used to assess reliability of each construct. These alpha values were well above the minimum standard suggested by Nunnally (1967). The values can be found in Table 6, indicating that all constructs display high internal consistency.

Chen and Paulraj (2004) describe how reliability can be tested:

> "The three-step approach presented by Flynn et al. (1994) was adopted in selecting constructs after the calculation of Cronbach's alpha. First the constructs were accepted if the Cronbach's alpha value was greater than 0.7. Second, the constructs with an acceptable Cronbach alpha of at least 0.6 were further evaluated for the possibility of improvement. Items that contributed least to the overall internal consistency were the first to be considered for exclusion. The item inter-correlation matrix was utilized in determining the items that contributed the least and thus were the best candidates for deletion. The items that negatively correlated to other items within a scale were first discarded. Also, items with a correlation value below 0.10 were discarded. The cut-off value of 0.30 as given by Flynn et al. (1994) was not used to delete the items, but to mark them for possible deletion. Third, a similar elimination procedure was performed on the constructs that failed to achieve the minimum alpha value of 0.60. If a construct still failed to achieve the target value of Cronbach alpha, it would have been discarded. Since all the constructs achieved the target value, the analysis moved on the next stage of instrument development."

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Chen and Paulraj's (2004) approach was used in this study for validating adequate reliability.

In the second stage, an exploratory factor analysis was performed and eliminated items that did not load cleanly on the single construct it was originally intended to measure. A varimax rotation was used to clarify the factors. This analysis was performed in SPSS and is presented in Appendix C.

In the third stage, validity and unidimensionality were validated by use of a confirmatory factor analysis (CFA) estimated using EQS 6.1. The raw output is presented in Appendix D. Goodness of fit indices such as CFI, NCFI, AGFI, RMR, NNFI, RMSEA, and the chi-square-to-degrees-of-freedom ratio were used to evaluate the fit of the CFA.

The CFA provided an acceptable fit: χ^2 (330)=559, CFI=0.98, IFI=0.98, GFI=0.76, RMSEA=0.076, RMR=0.071, SRMR=0.069). All factor loadings were statistically significant at the 5% level. Also, all but one factor loadings exceeded 0.5. These factor loadings were displayed above in Table 6 and can be validated in Appendix D.

Discriminant validity was first tested by comparing an unconstrained model to a model with correlations between pairs of constructs constrained to equal one (Bagozzi, Yi, and Phillips 1991; Zaheer, McEvily, and Perrone 1998). Cross-construct correlations were significantly different from 1.0. This suggests that discriminant validity exists among the analyzed constructs.

To further test discriminant validity, average variance extracted was calculated for each construct (Fornell and Larcker 1981). The average variance extracted ranged from 0.69 to 0.91. This exceeds the standard of 0.40 that is seen as acceptable in most research (Hatcher 2003). Additionally, the average variance extracted for all constructs exceeded the square of the correlations among all pairs of constructs, suggesting little threat to discriminant validity. The

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square of the correlations among constructs ranged from 0.00 to 0.43. The average variance extracted scores are displayed in Table 8.

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Table 8: Average variance extracted

Construct	Average variance extracted
Ability to react	0.571
Process-focused risk management policies	0.535
Ambiguity surrounding the outsourcing arrangement	0.483
Resource slack	0.813
Use of risk management	0.615
Risk management effectiveness	0.673
Supplier performance	0.458

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These results together suggest that construct validity exists for the measures used in this study.

STRUCTURAL PATH MODEL RESULTS

Estimation of the structural paths was performed subsequent to the measurement model evaluation using EQS 6.1, and the raw output is presented in Appendix E. This analysis was performed using the correlation matrix displayed in Table 9. Factor scores for each construct were computed in SPSS Version 19 for each construct. Listwise deletion was used to handle missing data. Bartlett scores were selected rather than regression scores since a simulation study has found that these scores more often concur with the original (latent) factor structure.

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Table 9: Correlation matrix of constructs analyzed

Construct	REACT	POLICY	AMBIGUITY	USE	EFFECT	SLACK	SPERF
REACT	1	0.356**	-0.261**	0.453**	0.386**	0.036	0.168*
POLICY		1	-0.095	0.638**	0.586**	-0.091	0.237**
AMBIGUITY			1	-0.292**	-0.347**	-0.029	-0.293**
USE				1	0.655**	-0.072	0.211**
EFFECT					1	0.128	0.351**
SLACK						1	0.106
SPERF							1

** Correlation is significant at the 0.01 level (2-tailed test).

* Correlation is significant at the 0.05 level (2-tailed test).

N=153

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Standardized parameter estimates for the path model are provided in Figure 5. The results of this structural model have satisfactory overall fit: χ^2 (7)=23.0, CFI=0.92, GFI=0.95, AGFI=0.81, RMSEA=0.137, RMR=0.050, SRMR=0.05. These were selected results from Appendix D.

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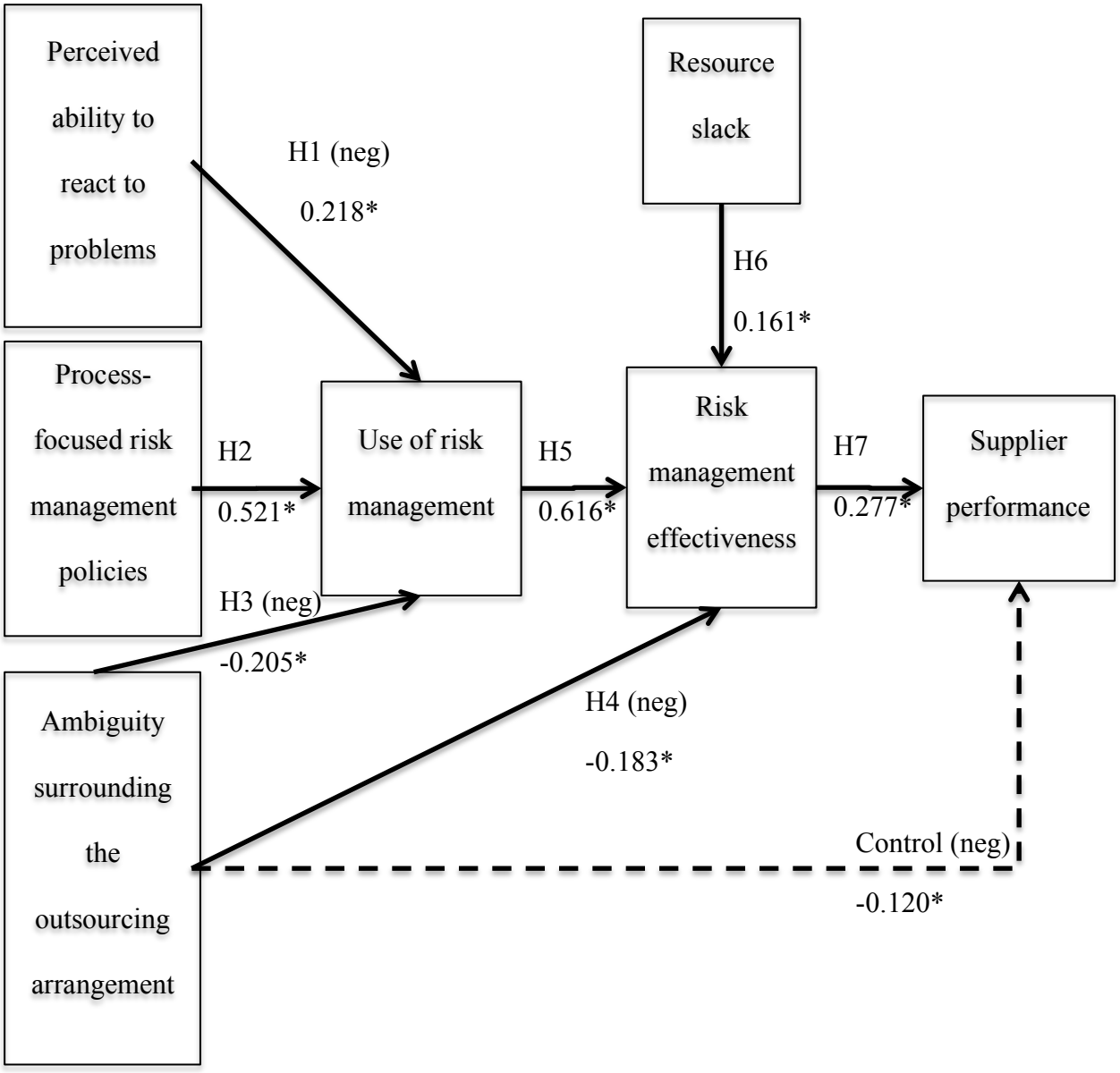
Figure 5: Structural path model results



* indicate significant at 0.05

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The first hypothesis tested was the relationship between the perceived ability to react to problems and the use of risk management. This hypothesis was not supported and was in fact significant in the opposite direction ($b=0.218$, $p<0.05$). The relationship between process-focused risk management policies and the use of risk management was positive and significant ($b=0.549$, $p<0.05$). Hypothesis 2 was thus also supported. Ambiguity surrounding the outsourcing arrangement was also significantly related to the use of risk management ($b=-0.205$), thus offering support for hypothesis 3.

Hypothesis 4 examines the relationship between ambiguity surrounding the outsourcing arrangement and risk management effectiveness. This relationship was significant and negative ($b=-0.183$, $p<0.05$) thus offering support for the hypothesis. The use of risk management was also related to risk management effectiveness, supporting hypothesis 5 ($b=0.616$, $p<0.05$). Hypothesis 6 was supported with resource slack positively related to risk management effectiveness ($b=0.161$, $p<0.05$).

The final hypothesis concerned the relationship between risk management effectiveness and supplier performance. This relationship was significant ($b=0.277$, $p<0.05$).

Character of the outsourcing arrangement

The type of outsourcing arrangement provided by the manager was made into a dummy variable to distinguish between arrangements that moved a significant portion of the value chain to the supplier and arrangements (service projects, service agreements, products resulting from projects, engineered products, and knowledge products) and more traditional types of sourcing (commodity products). The second set included only a small portion of the sample. This data was converted into a dummy variable and included as a predictor of the use of risk management.

This did not change the significance of the hypothesized relationships, and the effect of the

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dummy variable on the use of risk management was non-significant. However, the results suggested that risk management was higher on outsourcing arrangements involving higher value-added activities.

Control variables

The control variable ambiguity surrounding the outsourcing arrangement was not significantly related to supplier performance ($b=-0.120$, $p>0.05$). The sign of the control variable, however, was in the expected direction.

Additional controls for firm size based on the number of employees at the company, business unit annual revenue, and the number of years served by the respondent at the company did not affect the significance of these results or meaningfully affect the coefficient estimates. These were thus excluded from the reported model. Results from including these control variables are presented in Table 10.

The use of risk management controlling for these same variables (excluding ambiguity surrounding the purchase) did not affect the results meaningfully. These were also excluded from the reported model.

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Table 10: Result of including control variables

			Control Variable included			
		Regressor	Number of employees at the firm	ln(Business unit revenue in US dollars)	Years served at the firm	No control
Dependent variable	Use of risk management	Control variable	0.059	0.055	0.057	
		Ability to react	0.206	0.190	0.199	0.218
		Risk management policies	0.541	0.527	0.527	0.521
		Ambiguity	-0.188	-0.183	-0.204	-0.205
	Risk management effectiveness	Use of risk management	0.633	0.622	0.630	0.616
		Ambiguity	-0.202	-0.193	-0.192	-0.113
		Resource slack	0.146	0.139	0.144	0.183
	Supplier performance	Risk management effectiveness	0.248	0.248	0.256	0.277
		Ambiguity	-0.152	-0.176	-0.168	-0.120

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Comparison to an alternative model

The hypothesized model was compared to an alternative path model including the same constructs. This model is shown in Figure 6. This model arises if one considers ambiguity surrounding the outsourcing arrangement to be an exogenous factor that influences the attitudes of the outsourcing manager. Thus, the alternative model proposes that ambiguity surrounding the purchase might influence the perceived ability to react to problems.

In the alternative model, process-focused risk management policies and resource slack would be considered structural factors of the organizational environment in which manager operates. Thus, the model is separated into behavioral influences on risk management and structural influences.

The last distinguishing factor of the model is to suggest that the influence of the use of risk management on supplier performance is direct rather mediated by risk management effectiveness.

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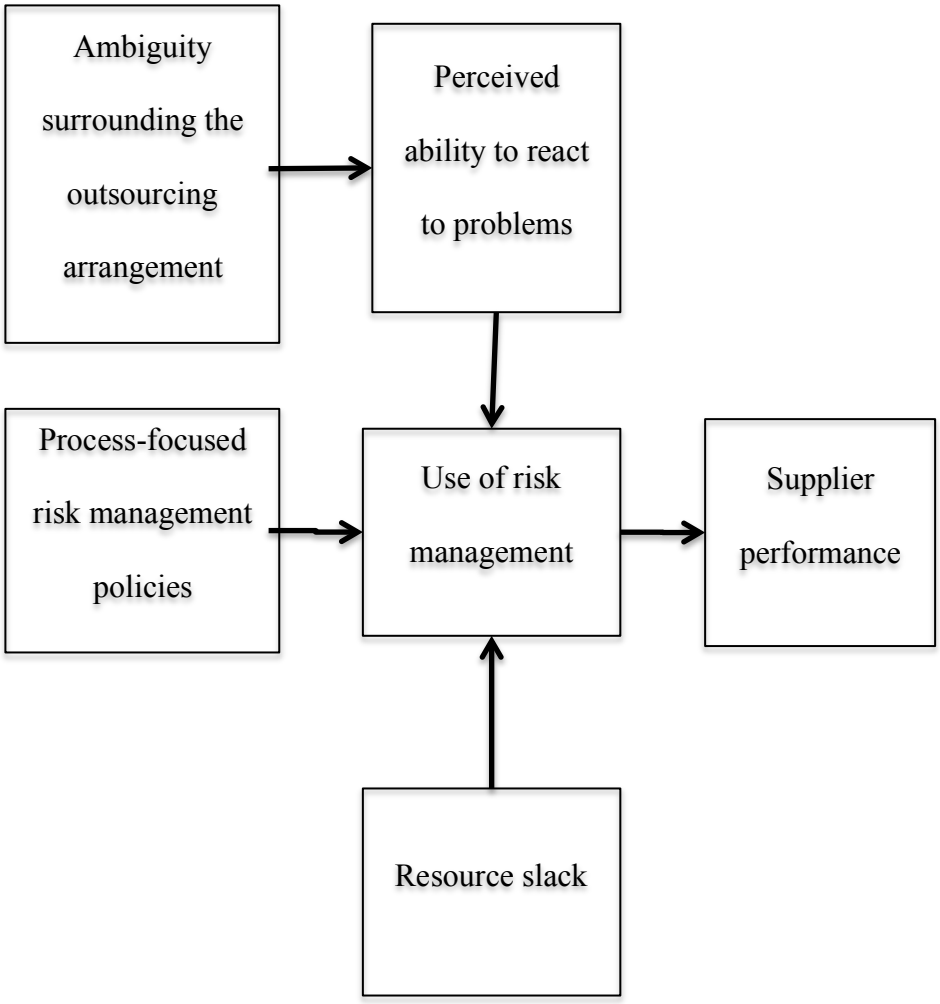
Figure 6: Alternative model



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The model's fit was poor: χ^2 (7)=39.9, CFI=0.75, GFI=0.92, AGFI=0.76, RMSEA=0.187, RMR=0.121, SRMR=0.119. The large discrepancy between the fit of the hypothesized model and this alternative model means that the hypothesized model is preferred according to the rules of model selection put forth by Hull, Tedlie, and Lehn (1995). While the alternative model is more parsimonious, Hull, Tedlie, and Lehn (1995) prescribe that the less parsimonious model is to be preferred when there is a large reduction in the fit of the model. The results of the model are presented in Figure 7. The alternative model EQS results are presented in Appendix F.

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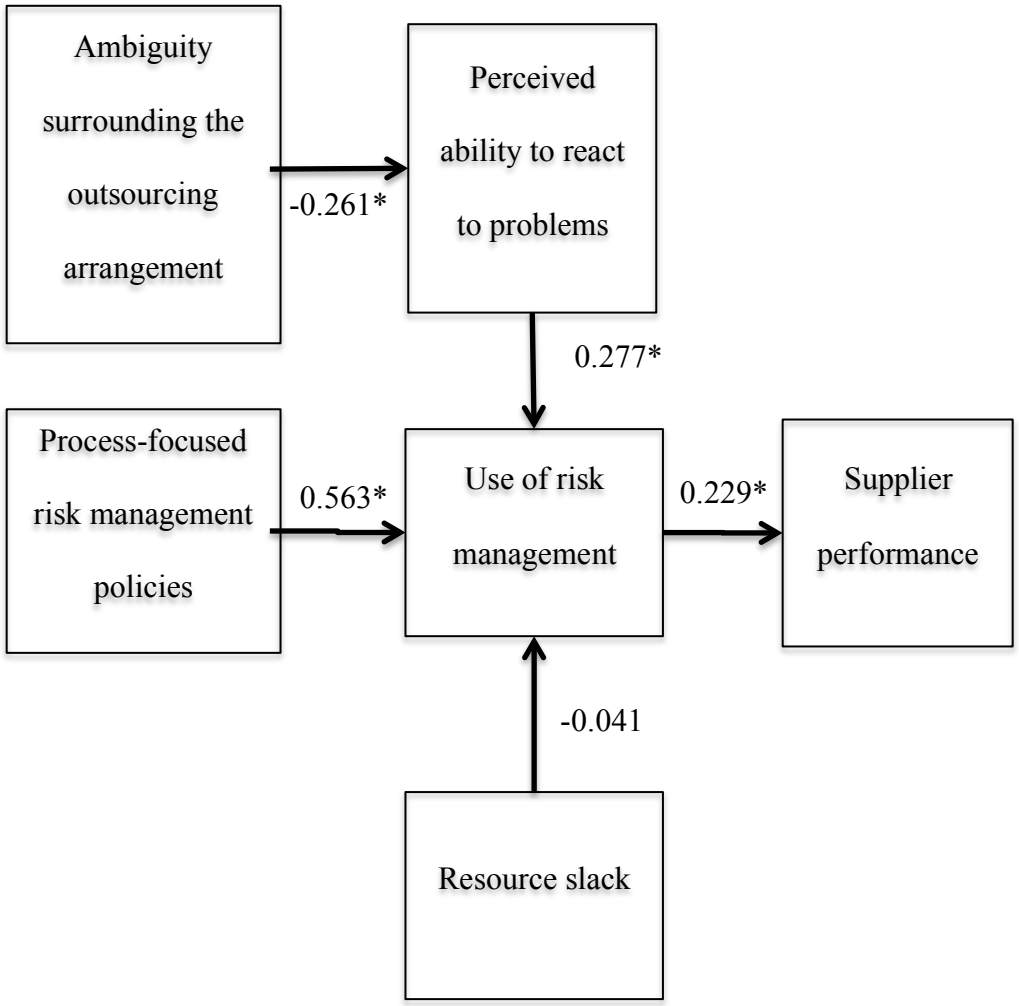
Figure 7: Alternative model results



* indicates significant at 0.05

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CHAPTER 5

DISCUSSION

This section interprets the results of the study. First, the theoretical implications of each hypothesis will be detailed, first addressing the antecedents of risk management and then the consequents. Then, general theoretical implications of the study as they relate to associated research streams will be examined.

ANTECEDENTS OF THE USE RISK MANAGEMENT

The first of the three antecedents of the use of risk management is the ability to react to problems. The positive association implies that managers who trust their ability to react to a problem will be more likely to perform proactive risk management. A possible explanation for this result is that managers feel that it is not worthwhile expending effort to manage risks if noting can be done to respond to risks anyway. In other words, a low perceived ability to react to problems may reflect a sense of helplessness regarding risk and the view that whatever problems that may occur must simply be accepted.

The implication is that a manager's conduct of risk management depends on more than just perceptions of risk (March and Shapira 1987), but also on perceptions of the reactive capacity of the organization and thereby on the usefulness of risk management. This is a determinant of the manager's attitude toward risk management.

Though this study doesn't examine the accuracy of manager's perceptions of resiliency, this would be an interesting area of study for future work. Authors such as Taleb (2007) have argued that certain events are inherently of such magnitude and unpredictability that even if reactive capacities are well developed they may be overwhelmed. However, in such cases proactive risk management itself may not be of assistance.

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It might be reasonable to ask whether the perceived ability to react to problems may exhibit a curvilinear relationship on risk management. The reason for this would be that when the ability to react is very low, managers may decide that the outsourcing arrangement isn't worth investing much time into. This possibility was not studied in this dissertation since this idea is not implied by the theory of planned behavior. However, a comparison of the proposed model with a curvilinear model may be an avenue of interest for future research.

The second antecedent of the use of risk management is process-focused risk management policies. The positive association implies that specific types of incentives for managers can be used to encourage risk management.

Since risks are often not realized, a self-interested, rational manager may choose to forgo risk management in the interest of gaining the benefits of being associated with positive-outcome projects as long as the risk does not materialize. When the risk eventually is realized on a outsourcing arrangement the manager is associated with, the firm will be unlikely to seek recourse in those benefits given to the manager. Thus, the manager gains much as long as risks are not realized and loses little when they are. The issue with such a situation is a mismatch between the goals and incentives of the manager and those of the organization.

While this study isn't a direct test of the logic put forth by Repenning and Sterman (2001), their claims suggest that outcome control techniques are unlikely to be feasible. The process-focused risk management policies studied here offer another path toward the proper management of risk when a manager and his firm would not otherwise have their incentives well aligned. This shows that policies informed by Repenning and Sterman's claims are likely to produce additional risk management behaviors.

The third antecedent of the use of risk management is ambiguity surrounding the

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outsourcing arrangement. This negative association implies that those managers who face highly complex environments that make the aspects of the outsourcing arrangement difficult to predict feel that proactive risk is unlikely to be helpful.

Ambiguity surrounding a outsourcing arrangement relates to the amount of control felt by the manager. Since risk is inherent to any situation (Kaplan and Garrick 1981), all situations are unpredictable, but not all situations may be ambiguous. Ambiguity specifically relates to the manager's lack of understanding of the situation, an understanding that is necessary for behavioral control of the situation to be achieved.

This finding speaks to the fact that some managers may find themselves facing unforeseeable risks that cannot be conceived of beforehand due to a lack of sufficient situational knowledge (Kaplan Garrick 1981). These managers face a difficult challenge in executing proactive risk management since they believe many of the risks they are likely to face are unlike those they are able to identify. Even if foreseeable risks are likely to materialize or unforeseeable risks share important aspects with foreseeable risks, these managers have already committed to not performing proactive risk management.

The finding also suggests that organizations might wish to limit process-focused risk management policies when ambiguity is high. This might be done by retaining policies in all cases except when facing radically new outsourcing arrangement that involve highly dynamic aspects. This might be the case when outsourcing products or services that are engineered specifically for the company using new technologies. Also, when the organization doesn't have sufficient experience to know what issues are likely to occur on a specific type of project, the level of process-focused risk management policies could be altered.

Of course, this assumes that the organization is likely to have a reliable way to determine

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which projects are ambiguous. If managers are polled, the organization might risk managers exaggerating the ambiguity of the situation in order to escape the risk management task. Organizations should thus be wary of making such exemptions.

ANTECEDENTS OF RISK MANAGEMENT EFFECTIVENESS

Ambiguity surrounding the outsourcing arrangement was found to be negatively associated with the effectiveness of risk management. This implies that managers are likely somewhat rational in reducing the amounts of risk management they perform in ambiguous outsourcing arrangements. If managers feel their understanding of cause-effect relationships is poor and data are ambiguous, then the proactive risk management they perform is unlikely to be well informed or helpful should they attempt it. Another implication is that managers do have insight into how ambiguous the outsourcing arrangement they are managing are.

The finding that the use of risk management leads to risk management effectiveness implies that the relatively low levels of use of risk management reported in the literature are a concern (Zwikael and Sadeh 2007). Managers who forego risk management are missing the benefits of risk management. This finding provides the basis for the concerns that motivate the work on normative risk management techniques. Though this study does not examine specific techniques but instead defines risk management by a managerial attempt, it nevertheless shows that even the attempt can provide benefits regardless of the particular techniques used. If managers are able to improve the quality of their techniques applied, then the benefits to performing risk management should increase accordingly.

Since risk management effectiveness is measured by the success the manager experienced in each attempt to manage risk (i.e., successfully identifying risk, correctly assessing consequences, preventing known problems, reducing the consequences of known problems, and

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successfully executing a risk response plan), risk management attempts work in the way managers intend them to. The implication here is that the techniques currently used by managers who perform risk management are adequate to gain the intended benefits. While these benefits could likely be enhanced through better techniques, the risk management skills currently employed by managers are effective.

The finding that resource slack is positively related to risk management effectiveness implies that the maintenance of extra slack can be beneficial to the organization that seeks to receive the benefits of risk management. This supports the research of scholars such as Tan and Peng (2003) in finding a positive effect of slack on performance. Managers should thus seek to maintain their resource slack. However, as noted by Bromiley (1991), managers should avoid taking risk in the hopes of reestablishing slack since such gambles have been found to reduce performance.

This finding supports the conclusion reached by Miles (1982) that slack can increase flexibility, which is an important factor in managing risk (Sheffi 2005). Slack thus does appear to increase the strategic flexibility of the firm as noted by Evans (1991).

The finding that the effectiveness of risk management of supplier performance implies that the benefits of managing risk can cross the divide between the buyer that manages risk and the supplier who supplies the product. Though supplier performance is ostensibly determined primarily by the capabilities of the supplier, this study finds that the buying organization can influence the supplier's performance by managing risk. Effective management of risk thus serves a similar role as other buyer behaviors that can influence supplier performance such as maintaining close supplier relations (Richardson 1993) and supplier evaluation programs (Prahinski and Benton 2004).

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That risk management by the buyer can influence supplier performance supports the claim of interconnectedness between the two partners of a buyer-supplier relationship. It reveals that organizations have influence over supplier performance that goes beyond merely selecting a capable supplier.

THEORETICAL IMPLICATIONS

The three antecedents to risk managed complement the normative work performed on risk management. Though several frameworks for how risk management ought to be performed have been proposed (e.g., Sheffi 2005; Sheffi and Rice 2005; Lonsdale 1999; Johnson 2001) and these works often refer to successful instances of risk management at other firms (e.g., Abort, Patry, Rivard, and Smith 2001), the fact that the particular techniques used in exemplar cases work in certain instances, does not mean that general attempts at risk management are helpful for supply chain organizations as a whole. This work provides that link, and thus provides a basis upon which the value of normative research on risk management techniques is justified.

This work also builds on existing work on behavioral operations. Scholars including Zwikael and Sadeh (2007) have examined ways to effectively implement risk management. Neiger, Rotaru, and Churilov (2009) have proposed methods for performing risk management. Braunsheidel and Suresh (2009) have examined antecedents of risk mitigation and response, but they did not examine the behavioral elements that affect managers to make their choices. While Ellis, Henry, and Shockley (2010) have examined perceptions of supply disruption risk, they do not address the relationship between these perceptions and risk management activities. They do, however, call for an examination of the relationship between these perceptions of supply disruption risk and risk management. The present study extends this work on behavioral risk theory by examining the antecedents to risk management. Additionally, it also complements

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other research within the field of behavioral operations management such as Bendoly and Swink (2007) and Narasimhan, Nair, Griffith, Arlbjorn, and Bendoly (2009). Bendoly, Donohue, and Schultz (2006) have recently made calls to revisit assumptions within the existing literature through the use of behavioral research within the area of operations management. This study does that by examining the rational-actor assumption identified by Bendoly, Donohue, and Schultz (2006) and builds on existing behavioral studies by examining behavior in conducting risk management in outsourcing arrangements. These findings could complement additional studies of this assumption that could be performed using controlled experimental methods or vignettes in additional survey research.

The findings of this study specifically address the problem of managerial decision-making behavior within operations management. Similar prior studies include Mantel, Tatikonda, and Liao's (2006) examination of managerial make-versus-buy decisions. While Mantel, Tatikonda, and Liao (2006) use a survey-based experiment to examine behavior, empirical studies of managerial decision-making behavior are also possible. Dilts and Pence (2006) also examined factors used by managers in their decisions to terminate projects. A third area of such inquiry is covered by Schweitzer and Action's (2000) study of decision biases with respect to the classic newsvendor problem. That work found that the amount of inventory chosen by decision-makers did not conform to the analytic results of Wagner and Whitin (1958). Decision-makers often can employ mental models that do not match analytic recommendations. While normative work exists in these areas as to how such decisions ought to be made, situational and personal factors may intervene to prevent managers from applying standard analytic methods without modification. This has been an under-researched area of risk management with scholarly development of risk management techniques relatively well-developed even as scholars

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acknowledge that existing techniques are underutilized. The results of this study could be examined with respect to some of these specific techniques. For example, Knemeyer, Zinn, and Eroglu (2009) provide a well-developed method for planning for catastrophic risks that would likely involve a dedicated effort by a firm to implement. Because of the method's sophistication, implementation issues would likely be a barrier to adoption, and the factors identified with this study along with others in the organizational change-management literature could be used to examine adoption behaviors at a specific firm interested in the technique.

The present study also contributes to existing research on adoption behaviors. While the Technology Acceptance Model is a prominent example of research on adoption in a business context, adoption behaviors within the field of operations management have been performed. These include Sarkis, Gonzalez-Torre, and Adenso-Diaz's (2010) examination of the adoption of environmental practices. Additional work by Ketokivi and Schroeder (2004) considers the adoption of manufacturing practices. Autry, Grawe, Daugherty, and Richey (2010) examine supply chain technology adoption through an adaptation of the technology acceptance model. The present study builds on these studies in further considering the adoption behaviors of managers and establishes that there are antecedents to these behaviors that when missing serve as barriers to the adoption of beneficial practices. The study thus helps establish risk management adoption as a relevant topic of interest within the field of supply chain risk managements.

The study contributes to the existing research on the theory of planned behavior . It follows studies such as Ajzen and Driver (1992), Schifter and Ajzen (1985), Sparks and Shepherd (1992), and Pavlou and Fygenson (2006) in its application of the framework to a specific situation examining planned, decision-making behavior. The results indicate that the theory of planned behavior does apply to the context of managers making decisions to execute proactive

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risk management practices.

Another implication of the results is that the assumptions held by managers and researchers that proactive risk management practices in outsourcing arrangements are justified. This is a practice-performance link of which there are already several in the supply chain management literature. This includes work on supplier integration (Vickery, Jayaram, Droge, and Calantone 2003); just-in-time practices (Christensen, Germain, and Birou 2005); and modular product design (Hoetker, Swaminathan, and Mitchell (2007). Proactive risk management joins these as practices that deliver benefits to the firms who perform them.

MANAGERIAL IMPLICATIONS

The results of the study provide direction to top managers who seek to encourage risk management practices within their firms. First, managers should seek to reconsider the ease with which problems can be addressed after a problem has already occurred. Since managers are more likely to perform risk management when they perceive problem resolution as taking little effort, an investigation a deeper consideration of just how much time and effort problem resolution will take may be justified. One way to do this might be to track the actual cost of problem resolution efforts in typical scenarios faced by the firm. This might demonstrate to managers exactly what can be done to address problems.

Additionally top managers should seek to implement risk management policies within their companies. These policies should be geared toward the actual practice of risk management rather than merely the results of the project. The policies should thus be process-focused rather than outcome-oriented. Managers should not be given the opportunity to profit in their reviews from good luck but should instead be rewarded for the rigorous performance of risk management irrespective of whether the risk management effort is ultimately necessary.

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Another way in which top managers can encourage risk management is to reduce ambiguity surrounding the outsourcing arrangement. This might be addressed through better training, more detailed analysis of outsourcing decisions, and through the accumulation of experience in certain outsourcing scenarios. Knowledge management systems can be used as a way to make use of experiences of individuals across the firm to managers who did not directly participate in the project (Alavi and Leidner 2001). These actions may lead to organizational learning that reduce ambiguity around the outsourcing function and thus give managers a stronger basis for performing risk management activities.

When reviewing the practice of risk management within an organization, top managers should pay particular attention to ambiguous situations since these are the ones on which managers are most likely to forgo risk management. Additionally, though this study does not examine the relative risks of different types of outsourcing, ambiguous outsourcing arrangements are likely to have more unpredictable types of risks. This makes monitoring of the risk management process across outsourcing arrangements an important process.

The research also provides insights to individual managers managing outsourcing arrangement as to when they are likely to be tempted to skip proactive risk management. If they manage a portfolio of outsourcing arrangements, they can examine whether they are avoiding proactive risk management of more ambiguous outsourcing arrangements or outsourcing arrangements that they perceive they can recover from. By becoming aware of these tendencies, they can self-monitor to try to perform risk management practices even when their tendency would be to forgo it.

Another implication of the study is that the benefits of proactive risk management practices are tangible. Though the benefits of the practices may not be erratic, there is a significant

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improvement in risk management effectiveness and supplier performance. This means that organizations are justified in allocating time and effort to encouraging and performing risk management practices.

Managers who seek to avoid performing risk management or are incapable of performing risk management could make use of this finding by using resource slack instead of risk management. Since resource slack improves risk management effectiveness, it can be viewed as a substitute for risk management. In particular, when the three antecedents of risk management are lacking, resource slack serves as a lever managers can use to gain the benefits that would otherwise require risk management. Resource slack and risk management can thus be considered two distinct strategies to manage risk. The preferred strategy is likely to depend on the situation. If resource slack is relatively expensive to maintain in an outsourcing arrangement, then proactive risk management should be adopted. However, when an organization encounters irresolvable difficulties performing risk management, resource slack can be considered. When both strategies are options, risk management is likely to be the superior one since performing risk management is more likely to develop organizational skills than simply maintaining excess slack. Also, organizations routinely may seek to eliminate slack in cycles, so an individual outsourcing manager who relies on resource slack may find not be able to rely on the strategy indefinitely.

Another implication for managers is that effectively managing risk serves as a way to influence supplier performance of existing suppliers. Effectively managing risk, thus, can be used as an option when supplier performance is poor, but alternative suppliers are unavailable or switching costs are high.

A final managerial implication concerns managing supplier performance. Suppliers may

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wish to encourage their customers to perform risk management when outsourcing since this improves their own performance as perceived by the customer. The research is suggestive of specific techniques the supplier may be able to use. Suppliers could assist customers in making their outsourcing arrangements less ambiguous. This could include providing data with which the customer can make risk management decisions and communicating what problems can occur with outsourcing arrangements and how they may be addressed. For example, this may include a list of common issues that prior customers have faced. This would provide the customer with a set of historical data to use as an input to risk management. By assisting in the identification of known risks, this reduces the role of unforeseeable risks in discouraging risk management. Further, by ranking the risks by severity and frequency, customers could be provided with a guide as to where their attention is best applied (Sheffi and Rice 2005).

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

McGrath (1982) writes about the limitations of different research methods: field studies, field experiments, experimental simulations, laboratory experiments, judgment tasks, sample surveys, formal theory, and computer simulations. These vary in their degree of intrusiveness to the participant (and thus the risk that the researcher will change the behavior of subject that is to be studied) and in their concern for universal behavior versus specific behavior. Among these research methods, survey research is relatively more concerned with universal behavior rather than particular behavior (which is generally better served through techniques such as field studies). Survey research is also relatively unobtrusive to the participant as compared to highly intrusive research methods such as laboratory experiments. Figure 8 depicts McGrath's framework and where each method lies in these particular trade-offs.

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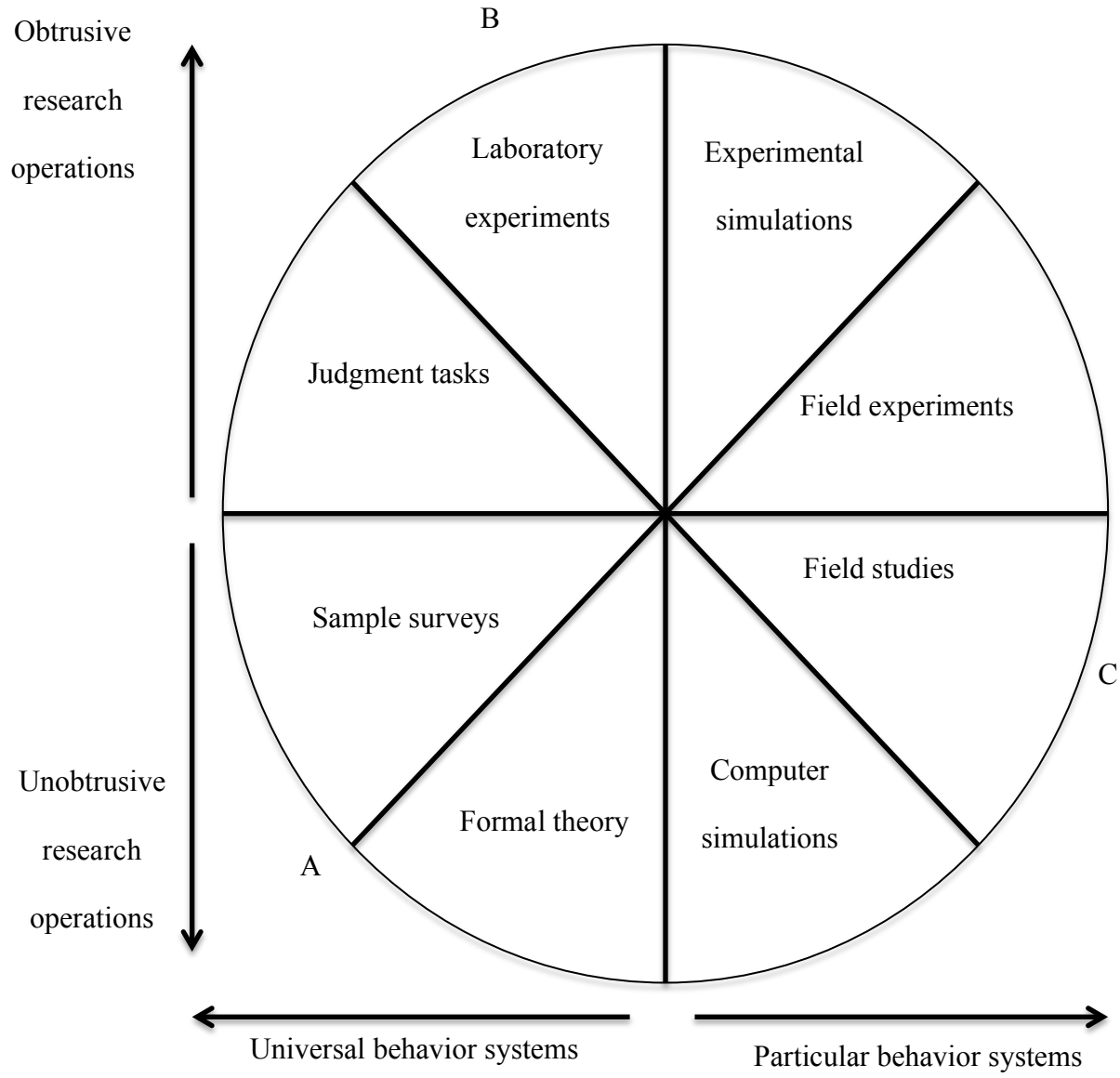
Figure 8: Framework of research strategies (McGrath 1982:73)



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These characteristics of survey research represent a choice among three competing desiderata that McGrath (1982) calls the three-horned dilemma. The three desiderata are: "(A) generalizability with respect to a population, (B) precision in control and measurement of variables related to the behavior(s) of interest, and (C) existential realism, for the participants, of the context within which those behaviors are observed" (McGrath 1982:74). These three are always in conflict with one another, so any of the eight research methods McGrath considers must necessarily choose which desiderata to sacrifice in the name of the other. The points at which each desideratum is maximized is depicted in Figure 8.

This study's choice of a sample survey method reflects a strong concern for broad sampling of general proactive risk management behaviors in outsourcing in non-contrived scenarios. Thus, the present study is likely to have population generalizability, but necessarily has low levels of precision measuring all possible variables of interest to a particular outsourcing scenario. The study lacks anything that can be considered experimental control. Though suspected control variables were measured and tested, a variety of situational factors are left unmeasured. Further, the realism of the scenario is low compared to alternative methods such as field studies. Though the respondent is asked to respond with respect to a real, recently experienced context, the respondent is nevertheless outside of the context itself and in the context of answering a survey.

While these are serious concerns, and indeed McGrath (1982) accuses all single research methods of suffering from some fatal flaws, the survey study technique applied here is nevertheless an important contribution to the existing research. McGrath writes "methodological discussions should not waste time arguing about which is the right strategy, or the best one; they are all poor in an absolute sense. Instead such discussions might better engage in questions of

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how best to combine multiple strategies (not within one study, but over studies within a program) so that information can be gained about a given problem by multiple means that do not share the same weaknesses" (McGrath 1982:80).

Field studies are one alternative research method that complements the weaknesses and strengths of a sample survey. Field studies do not suffer from the flaw of taking the respondent out of the situation they are in and imposing a demand that the respondent only describe behaviors of universal interest. The existential realism for the participants is thus maximized. Field studies could be conducted by examining specific outsourcing situations within a variety of firms. However, this method shares the weakness of the survey method in that it does not allow precise experimental controls and variable measurement.

To gain a degree of experimental control, laboratory experiments or experimental simulations could be used. While these are obtrusive methods for respondents, they allow the variables of interest to be isolated in a way that isn't possible with field studies or sample surveys.

Two alternative methods that lie between field studies and laboratory experiments that could be considered are field experiments or experimental simulations. These are methods that sacrifice generalizability, which is the strength of the sample survey. However, they outperform sample surveys in offering a compromise between precision of measurement and situational realism for the respondents. Field experiments would require a specific intervention in a firm and a measurement of practices and their effects over time. An example of a manipulation would be change in process-focused risk management policies. This would provide some degree of certainty over the manipulation (though the manipulation is likely to be the result of the firm's choice) and some degree of realism. Experimental simulations would require a realistic scenario

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to be constructed in which respondents are subject to manipulations controlled by the researcher. This represents a situation with more realism than a strict laboratory experiment but somewhat less precision in the manipulation.

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APPENDICES

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Appendix A: Survey

Of all the products or services outsourced by your firm that you are responsible for, consider the one that causes the most frequent problems for your company's operations and the most important supplier of that product or service.
Please answer the questions that follow as they relate to a recent, completed purchase from that supplier. If the purchases are ongoing, please consider purchases over the past year.
Which of the following best describes the product or service provided by the supplier?
a service project with an end goal (technology system, consulting, engineering, etc.)
an ongoing service agreement (call center, maintenance contract, ongoing technology services, etc.)
a product resulting from a project (building, plant machinery, etc.)
an engineered product specific to your firm used in production
a knowledge product (database, web site, etc.)
a commodity product used in production
other _____

Please describe the type of agreement your company used for the purchase.
Standard contract offered by the supplier to all customers
Negotiated contract including terms your company negotiated with the supplier
No formal contract
Other contract type (Please specify.) _____

Time and resource pressure

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
If the people involved had 10% less time to spend, the purchase would have been seriously compromised.					
If the people involved had 10% fewer resources to spend, the purchase would have been seriously compromised.					

Risks are potential problems that negatively affect your company's operations. These risks may be known in advance (known risks) or unforeseeable (unforeseeable risks).
Risk management is defined as a proactive attempt to identify risks with this supplier including steps to

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identify risks,
analyze them,
implement proactive countermeasures, and
develop a risk response plan.

Proactive management of known risks

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
For this purchase...					
...an identification of specific risks was attempted.					
...an analysis of the likelihood and consequences of known risks was attempted.					
...proactive countermeasures to reduce the probability of known risks were implemented.					
...proactive countermeasures to reduce the consequences of known risks were implemented.					
...a risk response plan for known risks was created.					

Effectiveness of the management of known risks
If no problems occurred that needed the following responses, please choose "problem did not occur".

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Problem did not occur

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	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Problem did not occur
For this purchase...						
...risks were successfully identified before they became problems.						
...the consequences of known risks were correctly assessed before they occurred.						
...proactive countermeasures were effective in preventing known problems.						
...proactive countermeasures were effective in reducing the consequences of known problems.						
...the pre-planned responses to known problems were executed successfully.						

Ambiguity of activities surrounding the purchase

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
For this purchase...					
..the potential for surprises was thought to be high.					
...uncontrollable factors were thought to play an important role.					
...not all key factors were known.					

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	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
...data for making decisions were ambiguous.					
...the cause and effect relationships governing the activities surrounding the purchase were not obvious.					

Supplier's performance	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
For this purchase...					
...the supplier met or exceeded product quality expectations.					
...the supplier met or exceeded delivery performance expectations.					
...the supplier met or exceeded expectations for responsiveness to requests for changes.					
...the supplier met or exceeded expectations for sales, service, and/or technical support.					
...the supplier met or exceeded overall cost performance expectations.					

Your company's risk management policies	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree

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	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Regardless of whether or not a problem actually occurs, our company...					
...requires documentation of risk management activities.					
...will punish those who skip risk management.					
...evaluates the quality of risk management activities by employees.					
...rewards those who conduct risk management.					
...encourages employees to consider risk.					

Ability to react	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
For most of our purchases...					
...after problems happen, the appropriate response is clear.					
...the appropriate countermeasures are clear once problems occur.					

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	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
...the resources for reacting to problems are generally available.					
...the cost of reacting to problems is usually reasonable.					
...the time to solve problems is usually reasonable.					

Please provide your best estimate when appropriate.

Number of employees at your company _____

Your business unit's annual revenue in US dollars _____

Your job title _____

Number of years you have served at your company _____

Please click the arrow at the bottom of the page to ensure your answers are saved!
Also, if you did not enter an e-mail address above, you will not receive your customized, powerpoint-style report since we have no other way of determining who has responded!

If you have any questions about this study, please contact Bob Viswanathan at riskstudy@bus.msu.edu.
Statement of Confidentiality: Your responses will be kept strictly confidential and used only in developing aggregate statistics. Your privacy will be protected to the maximum extent allowable by law. Your participation is voluntary. You may choose not to participate at all, or you may refuse to participate in certain procedures or answer certain questions or discontinue your participation at any time without penalty or loss of benefits. If you have any questions or concerns regarding your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact –anonymously, if you wish, riskstudy@bus.msu.edu.

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Appendix B: Invocation letter

Dear _____,

By participating in this research you will find out what benefits are available to you through the conduct of risk management, and you will learn how to make risk management a part of your organization's culture. As you know, each node in your supply chain is a potential point of failure. This risk of failure has only increased as companies have engaged in supply base reductions, lowered inventories, and established stronger relationships with individual suppliers.

A disruption in supply is not the only risk. Short term problems may include higher costs or a loss of confidential information. Long term consequences may include lock-in to a particular supplier, lower rates of innovation, a loss of internal knowledge, and a loss of control over strategic assets. Risk management practices exist so that you can identify potential problems and plan accordingly.

Few organizations, however, consistently implement risk management at the employee level. Some of your employees might consider it an administrative hassle or a distraction. Since each supplier is a source of risk though, risk management is important.

This research study will help you get the uniform application of risk management practices across your organization. It will help you identify the reasons those people who are conducting risk management now do so that we can understand why others do not do it. What's more, the research will help identify what the benefits of risk management practices are to your firm today. This information can help you sell risk management practices to others in you firm.

To participate in this research, please click the link at the end of this e-mail. The survey has taken prior respondents about 15 minutes to complete. Your participation would be greatly appreciated.

Sincerely,

Bob Viswanathan
Michigan State University
riskstudy@bus.msu.edu

Informed consent: You are being asked to participate in a research study of risk management in purchasing. You must be at least 18 years old to participate in this research. Your participation in this research project is completely voluntary. You have the right to say no. You may change your mind at any time and withdraw by closing your browser window. You may choose not to answer specific questions or to stop participating at any time. There is no compensation for participation. There is no cost to participate in this experiment beyond any normal computer use or internet access charges you might incur for visiting an online web site. If you have concerns or questions about this study, such as scientific issues or how to do any part of it, please contact the researcher (Bob Viswanathan; N336 North Business Complex, Michigan State University, East Lansing, MI 48824-1121; riskstudy@bus.msu.edu, 281-804-7677 .

By clicking on the link below, you indicate your voluntary agreement to participate in this online survey.

[QUALTRICS SURVEY LINK]

If you would like to be removed from this mailing list and avoid any further association with this study, please reply, and say you would like to unsubscribe. I will remove you from any further communications.

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Appendix C: Exploratory factor analysis of constructs

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
slack_1							.939
slack_2							.934
RMuse_1			.766				
RMuse_2			.735				
RMuse_3			.802				
RMuse_4			.714				
RMuse_5			.516				
perf1_1	.857						
perf1_2	.884						
perf1_3	.874						
perf1_4	.859						
perf1_5	.870						
pred_1					.530		
pred_2					.664		
pred_3					.768		
pred_4					.746		
pred_5					.655		
perf4_1				.681			
perf4_2				.779			
perf4_3				.804			
perf4_4				.837			
perf4_5				.614			
policy_1		.848					
policy_2		.674					
policy_3		.807					
policy_4		.679					
policy_5		.700					
react_3						.627	
react_4						.861	
react_5						.799	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

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a. Rotation converged in 7 iterations.

Command run in SPSS:

```
FACTOR
  /VARIABLES slack_1 slack_2 RMuse_1 RMuse_2 RMuse_3 RMuse_4 RMuse_5 perf1_1 perf
1_2 perf1_3
    perf1_4 perf1_5 pred_1 pred_2 pred_3 pred_4 pred_5 perf4_1 perf4_2 perf4_3 perf4_4 perf4_
5 policy_1
    policy_2 policy_3 policy_4 policy_5 react_1 react_2 react_3 react_4 react_5
  /MISSING LISTWISE
  /ANALYSIS slack_1 slack_2 RMuse_1 RMuse_2 RMuse_3 RMuse_4 RMuse_5 perf1_1 perf1
_2 perf1_3 perf1_4
    perf1_5 pred_1 pred_2 pred_3 pred_4 pred_5 perf4_1 perf4_2 perf4_3 perf4_4 perf4_5 policy
_1
    policy_2 policy_3 policy_4 policy_5 react_3 react_4 react_5
  /PRINT INITIAL EXTRACTION ROTATION
  /FORMAT BLANK(.499)
  /CRITERIA FACTORS(7) ITERATE(100)
  /EXTRACTION PC
  /CRITERIA ITERATE(100)
  /ROTATION VARIMAX
  /METHOD=CORRELATION.
```


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Appendix D: CFA Model and Output from EQS

EQS, A STRUCTURAL EQUATION PROGRAM MULTIVARIATE SOFTWARE, INC.

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PROGRAM CONTROL INFORMATION

```
 1  /TITLE
 2  Model built by EQS 6 for Windows
 3  /SPECIFICATIONS
 4  DATA='C:\Users\czhang\Downloads\data-169 straight from qualtrics-avg-cfa.ESS';
 5  VARIABLES=28; CASES=169;
 6  METHOD=ML; ANALYSIS=COVARIANCE; MATRIX=RAW;
 7  /LABELS
 8  V1=SLACK_1; V2=SLACK_2; V3=RMUSE_1; V4=RMUSE_2; V5=RMUSE_3;
 9  V6=RMUSE_4; V7=RMUSE_5; V8=PERF1_1; V9=PERF1_2; V10=PERF1_3;
10  V11=PERF1_4; V12=PERF1_5; V13=V33_A; V14=V34_A; V15=V35_A;
11  V16=PERF4_1; V17=PERF4_2; V18=PERF4_3; V19=PERF4_4; V20=PERF4_5;
12  V21=POLICY_1; V22=POLICY_2; V23=POLICY_3; V24=POLICY_4;
V25=POLICY_5;
13  V26=ABILITY; V27=V90_A; V28=V91_A;
14  /EQUATIONS
```


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```
15  V1 =   *F1 + E1;
16  V2 =   *F1 + E2;
17  V3 =   *F2 + E3;
18  V4 =   *F2 + E4;
19  V5 =   *F2 + E5;
20  V6 =   *F2 + E6;
21  V7 =   *F2 + E7;
22  V8 =   *F3 + E8;
23  V9 =   *F3 + E9;
24  V10 =   *F3 + E10;
25  V11 =   *F3 + E11;
26  V12 =   *F3 + E12;
27  V13 =   *F4 + E13;
28  V14 =   *F4 + E14;
29  V15 =   *F4 + E15;
30  V16 =   *F5 + E16;
31  V17 =   *F5 + E17;
32  V18 =   *F5 + E18;
33  V19 =   *F5 + E19;
34  V20 =   *F5 + E20;
35  V21 =   *F6 + E21;
36  V22 =   *F6 + E22;
```


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37 V23 = *F6 + E23;

38 V24 = *F6 + E24;

39 V25 = *F6 + E25;

40 V26 = *F7 + E26;

41 V27 = *F7 + E27;

42 V28 = *F7 + E28;

43 /VARIANCES

44 F1 = 1;

45 F2 = 1;

46 F3 = 1;

47 F4 = 1;

48 F5 = 1;

49 F6 = 1;

50 F7 = 1;

51 E1 = 0.01;

52 E2 = *;

53 E3 = *;

54 E4 = *;

55 E5 = *;

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```
56  E6 = *;
57  E7 = *;
58  E8 = *;
59  E9 = *;
60  E10 = *;
61  E11 = *;
62  E12 = *;
63  E13 = *;
64  E14 = *;
65  E15 = *;
66  E16 = *;
67  E17 = *;
68  E18 = *;
69  E19 = *;
70  E20 = *;
71  E21 = *;
72  E22 = *;
73  E23 = *;
74  E24 = *;
75  E25 = *;
76  E26 = *;
77  E27 = *;
```


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```
78   E28 = *;
79  /COVARIANCES
80  F1,F2 = *;
81  F1,F3 = *;
82  F2,F3 = *;
83  F1,F4 = *;
84  F2,F4 = *;
85  F3,F4 = *;
86  F1,F5 = *;
87  F2,F5 = *;
88  F3,F5 = *;
89  F4,F5 = *;
90  F1,F6 = *;
91  F2,F6 = *;
92  F3,F6 = *;
93  F4,F6 = *;
94  F5,F6 = *;
95  F1,F7 = *;
96  F2,F7 = *;
97  F3,F7 = *;
98  F4,F7 = *;
99  F5,F7 = *;
100  F6,F7 = *;
```


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```
  101  /PRINT
  102  EIS;
  103  FIT=ALL;
  104  TABLE=EQUATION;
  105  /END


    105 RECORDS OF INPUT MODEL FILE WERE READ


   DATA IS READ FROM C:\Users\czhang\Downloads\data-169 straight from qualtrics-avg-
cfa.ESS
   THERE ARE  28 VARIABLES AND   169 CASES
   IT IS A RAW DATA ESS FILE


*** WARNING ***    47 CASES ARE SKIPPED BECAUSE A VARIABLE IS MISSING--
     8    20    23    38    39    48    51    56    57    59
    68    71    76    80    84    95   102   123   129   131
   139   142   143   144   145   146   147   148   149   150
   151   152   153   154   155   156   157   158   159   160
   161   162   163   164   165   167   168


28-Dec-11      PAGE:  3  EQS     Licensee:
```


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TITLE: Model built by EQS 6 for Windows

SAMPLE STATISTICS BASED ON COMPLETE CASES

UNIVARIATE STATISTICS

VARIABLE	SLACK_1	SLACK_2	RMUSE_1	RMUSE_2	RMUSE_3
	V1	V2	V3	V4	V5
MEAN	7.6557	7.5410	11.9590	12.1311	12.2377
SKEWNESS (G1)	.2927	.4695	1.4720	.9571	.8073
KURTOSIS (G2)	-.7859	-.7151	2.5839	.3901	-.2462
STANDARD DEV.	1.0505	1.0377	.8944	.9787	1.1064

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VARIABLE	RMUSE_4	RMUSE_5	PERF1_1	PERF1_2	PERF1_3
	V6	V7	V8	V9	V10
MEAN	12.2295	12.5738	2.5082	2.4590	2.7213
SKEWNESS (G1)	.7167	.4369	.7889	.8967	.4591
KURTOSIS (G2)	-.3349	-.8147	-.2965	.0540	-.7915
STANDARD DEV.	1.0428	1.1636	1.0621	1.0053	1.1301

VARIABLE	PERF1_4	PERF1_5	V33_A	V34_A	V35_A
	V11	V12	V13	V14	V15
MEAN	2.5410	2.6066	7.5410	7.9918	8.1066
SKEWNESS (G1)	.8207	.5004	.5119	-.2104	-.0907
KURTOSIS (G2)	-.2796	-.5081	-.7765	-.9577	-1.3420
STANDARD DEV.	1.0135	1.0005	.9547	.9578	.9343

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VARIABLE	PERF4_1	PERF4_2	PERF4_3	PERF4_4	PERF4_5
	V16	V17	V18	V19	V20
MEAN	7.3689	8.0164	7.6639	7.5738	7.6557
SKEWNESS (G1)	1.0170	.1577	.7085	.7090	.4447
KURTOSIS (G2)	.4419	-1.1452	-.1570	.0564	-.7164
STANDARD DEV.	.9975	1.2263	1.0173	.9528	1.0186

VARIABLE	POLICY_1	POLICY_2	POLICY_3	POLICY_4	POLICY_5
	V21	V22	V23	V24	V25
MEAN	12.7787	13.3689	13.1557	13.2705	12.1721
SKEWNESS (G1)	.1597	-.1898	-.0326	-.2899	1.2003
KURTOSIS (G2)	-1.1315	-.7832	-1.0989	-.5355	1.4069

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STANDARD DEV. 1.1749 .9377 1.0758 .9710 .9421

VARIABLE ABILITY V90_A V91_A

V26 V27 V28

MEAN 7.2295 7.3115 7.2705

SKEWNESS (G1) .6350 .7006 1.3657

KURTOSIS (G2) .0617 .1955 1.9027

STANDARD DEV. .8211 .7723 .8434

MULTIVARIATE KURTOSIS

MARDIA'S COEFFICIENT (G2,P) = 77.3896

NORMALIZED ESTIMATE = 10.4274

ELLIPTICAL THEORY KURTOSIS ESTIMATES

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MARDIA-BASED KAPPA = .0921 MEAN SCALED UNIVARIATE KURTOSIS = -.0753

MARDIA-BASED KAPPA IS USED IN COMPUTATION. KAPPA= .0921

CASE NUMBERS WITH LARGEST CONTRIBUTION TO NORMALIZED MULTIVARIATE KURTOSIS:

CASE NUMBER	19	43	109	128	137
ESTIMATE	298.6348	293.9976	325.2169	329.7762	312.5911

28-Dec-11 PAGE: 4 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

COVARIANCE MATRIX TO BE ANALYZED: 28 VARIABLES (SELECTED FROM 28 VARIABLES)

BASED ON 122 CASES.

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		SLACK_1	SLACK_2	RMUSE_1	RMUSE_2	RMUSE_3
		V1	V2	V3	V4	V5
SLACK_1	V1	1.104				
SLACK_2	V2	.865	1.077			
RMUSE_1	V3	.019	-.002	.800		
RMUSE_2	V4	.087	.119	.675	.958	
RMUSE_3	V5	.132	.143	.605	.737	1.224
RMUSE_4	V6	.038	.123	.464	.598	.937
RMUSE_5	V7	.067	.109	.437	.693	.705
PERF1_1	V8	-.220	-.079	.385	.503	.539
PERF1_2	V9	-.122	-.011	.350	.452	.452
PERF1_3	V10	-.064	.028	.360	.533	.811
PERF1_4	V11	-.176	-.138	.394	.499	.730
PERF1_5	V12	-.153	-.066	.422	.564	.623
V33_A	V13	-.060	-.080	-.226	-.179	-.254
V34_A	V14	.038	.046	-.133	-.197	-.188
V35_A	V15	.120	.198	-.169	-.179	-.273
PERF4_1	V16	-.145	-.119	.065	.034	.135
PERF4_2	V17	.014	.074	.356	.304	.385
PERF4_3	V18	-.059	-.007	.118	.160	.138
PERF4_4	V19	-.082	-.015	.049	.015	-.022
PERF4_5	V20	-.037	-.044	.118	.103	.165

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POLICY_1 V21	.006	.046	.330	.558	.458
POLICY_2 V22	.103	.162	.271	.356	.474
POLICY_3 V23	.079	.130	.304	.517	.574
POLICY_4 V24	.168	.191	.251	.427	.464
POLICY_5 V25	.027	.088	.288	.390	.322
ABILITY V26	-.119	-.034	.150	.185	.300
V90_A V27	-.016	.012	.195	.207	.330
V91_A V28	-.030	-.040	.234	.212	.381

	RMUSE_4 V6	RMUSE_5 V7	PERF1_1 V8	PERF1_2 V9	PERF1_3 V10
RMUSE_4 V6	1.087				
RMUSE_5 V7	.694	1.354			
PERF1_1 V8	.469	.508	1.128		
PERF1_2 V9	.381	.354	.790	1.011	
PERF1_3 V10	.651	.500	.812	.724	1.277
PERF1_4 V11	.652	.480	.632	.584	.854
PERF1_5 V12	.529	.509	.747	.670	.848
V33_A V13	-.175	-.123	-.236	-.209	-.096
V34_A V14	-.172	-.243	-.293	-.285	-.168
V35_A V15	-.223	-.169	-.336	-.355	-.317
PERF4_1 V16	.171	.001	.158	.110	.178

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PERF4_2	V17	.269	.313	.430	.414	.624
PERF4_3	V18	.185	.128	.255	.147	.401
PERF4_4	V19	.049	.065	.094	.015	.186
PERF4_5	V20	.146	.191	.176	.159	.159
POLICY_1	V21	.374	.616	.477	.450	.665
POLICY_2	V22	.344	.390	.332	.366	.533
POLICY_3	V23	.526	.604	.515	.465	.746
POLICY_4	V24	.483	.521	.374	.255	.423
POLICY_5	V25	.373	.413	.292	.259	.362
ABILITY	V26	.269	.264	.213	.233	.246
V90_A	V27	.267	.241	.204	.170	.294
V91_A	V28	.326	.298	.167	.172	.258

		PERF1_4	PERF1_5	V33_A	V34_A	V35_A
		V11	V12	V13	V14	V15
PERF1_4	V11	1.027				
PERF1_5	V12	.653	1.001			
V33_A	V13	-.179	-.223	.912		
V34_A	V14	-.235	-.226	.409	.917	
V35_A	V15	-.405	-.288	.413	.472	.873
PERF4_1	V16	.154	.146	-.102	-.080	-.221

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PERF4_2	V17	.322	.436	-.273	-.256	-.217
PERF4_3	V18	.225	.313	-.098	-.085	-.055
PERF4_4	V19	.026	.211	-.148	-.078	-.020
PERF4_5	V20	.237	.153	-.118	-.160	-.186
POLICY_1	V21	.385	.524	.079	-.118	-.034
POLICY_2	V22	.410	.369	-.069	-.022	-.089
POLICY_3	V23	.461	.574	.006	.001	-.058
POLICY_4	V24	.365	.430	.018	-.097	-.103
POLICY_5	V25	.344	.300	.080	-.131	-.134
ABILITY	V26	.222	.215	-.051	-.106	-.157
V90_A	V27	.260	.297	-.104	-.154	-.207
V91_A	V28	.290	.256	-.057	-.105	-.136

		PERF4_1	PERF4_2	PERF4_3	PERF4_4	PERF4_5
		V16	V17	V18	V19	V20
PERF4_1	V16	.995				
PERF4_2	V17	.473	1.504			
PERF4_3	V18	.274	.749	1.035		
PERF4_4	V19	.382	.676	.632	.908	
PERF4_5	V20	.401	.444	.462	.307	1.038
POLICY_1	V21	-.009	.351	.231	.103	.196
POLICY_2	V22	-.046	.267	.092	-.015	.004

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POLICY_3 V23	.132	.452	.276	.141	.137
POLICY_4 V24	.056	.243	.141	.042	.160
POLICY_5 V25	.043	.179	.149	.074	.209
ABILITY V26	.072	.153	.003	-.017	.104
V90_A V27	.074	.135	.006	.026	.067
V91_A V28	.114	.144	.083	.009	.135

	POLICY_1 V21	POLICY_2 V22	POLICY_3 V23	POLICY_4 V24	POLICY_5 V25
POLICY_1 V21	1.380				
POLICY_2 V22	.669	.879			
POLICY_3 V23	.853	.587	1.157		
POLICY_4 V24	.556	.304	.610	.943	
POLICY_5 V25	.567	.357	.551	.499	.887
ABILITY V26	.175	.146	.212	.235	.150
V90_A V27	.136	.083	.191	.229	.103
V91_A V28	.184	.213	.247	.149	.209

	ABILITY V26	V90_A V27	V91_A V28

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ABILITY	V26	.674		
V90_A	V27	.457	.596	
V91_A	V28	.309	.279	.711

BENTLER-WEEKS STRUCTURAL REPRESENTATION:

NUMBER OF DEPENDENT VARIABLES = 28

DEPENDENT V'S : 1 2 3 4 5 6 7 8 9 10

DEPENDENT V'S : 11 12 13 14 15 16 17 18 19 20

DEPENDENT V'S : 21 22 23 24 25 26 27 28

NUMBER OF INDEPENDENT VARIABLES = 35

INDEPENDENT F'S : 1 2 3 4 5 6 7

INDEPENDENT E'S : 1 2 3 4 5 6 7 8 9 10

INDEPENDENT E'S : 11 12 13 14 15 16 17 18 19 20

INDEPENDENT E'S : 21 22 23 24 25 26 27 28

NUMBER OF FREE PARAMETERS = 76

NUMBER OF FIXED NONZERO PARAMETERS = 36

*** WARNING MESSAGES ABOVE, IF ANY, REFER TO THE MODEL PROVIDED.

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CALCULATIONS FOR INDEPENDENCE MODEL NOW BEGIN.

*** WARNING MESSAGES ABOVE, IF ANY, REFER TO INDEPENDENCE MODEL.

CALCULATIONS FOR USER'S MODEL NOW BEGIN.

3RD STAGE OF COMPUTATION REQUIRED 117379 WORDS OF MEMORY.

PROGRAM ALLOCATED 80000000 WORDS

DETERMINANT OF INPUT MATRIX IS .75418D-08

PARAMETER ESTIMATES APPEAR IN ORDER,

NO SPECIAL PROBLEMS WERE ENCOUNTERED DURING OPTIMIZATION.

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

		SLACK_1	SLACK_2	RMUSE_1	RMUSE_2	RMUSE_3
		V1	V2	V3	V4	V5
SLACK_1	V1	.000				

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SLACK_2	V2	.000	.000		
RMUSE_1	V3	-.042	-.050	.000	
RMUSE_2	V4	.011	.059	.180	.000
RMUSE_3	V5	.036	.067	-.021	-.047	.000
RMUSE_4	V6	-.045	.057	-.078	-.082	.077
RMUSE_5	V7	-.008	.050	-.049	.085	-.064
PERF1_1	V8	-.083	.030	-.013	.005	-.092
PERF1_2	V9	.002	.087	-.008	.004	-.115
PERF1_3	V10	.095	.153	-.098	-.042	.083
PERF1_4	V11	-.046	-.035	.018	.028	.134
PERF1_5	V12	-.015	.043	.022	.063	-.011
V33_A	V13	-.108	-.118	-.092	-.012	-.042
V34_A	V14	-.014	.004	.013	-.014	.043
V35_A	V15	.061	.152	-.005	.026	-.014
PERF4_1	V16	-.112	-.093	-.002	-.050	.029
PERF4_2	V17	.080	.126	.220	.134	.170
PERF4_3	V18	-.001	.039	.000	.012	-.049
PERF4_4	V19	-.031	.025	-.056	-.116	-.187
PERF4_5	V20	-.001	-.015	.044	.010	.048
POLICY_1	V21	-.080	-.022	-.048	.086	-.140
POLICY_2	V22	.043	.115	.009	.027	.057
POLICY_3	V23	-.010	.060	-.086	.028	-.044
POLICY_4	V24	.107	.143	-.018	.091	.038

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POLICY_5	V25	-.030	.043	.039	.078	-.073
ABILITY	V26	-.056	.015	-.055	-.072	-.024
V90_A	V27	.044	.059	-.001	-.038	.021
V91_A	V28	.011	-.008	.100	.044	.168

		RMUSE_4	RMUSE_5	PERF1_1	PERF1_2	PERF1_3
		V6	V7	V8	V9	V10
RMUSE_4	V6	.000				
RMUSE_5	V7	.027	.000			
PERF1_1	V8	-.077	.018	.000		
PERF1_2	V9	-.110	-.085	.133	.000	
PERF1_3	V10	.021	-.064	-.030	-.033	.000
PERF1_4	V11	.135	.018	-.058	-.036	.059
PERF1_5	V12	-.020	.017	.013	.010	.002
V33_A	V13	.008	.041	-.003	.000	.172
V34_A	V14	.029	-.064	-.039	-.057	.126
V35_A	V15	.002	.032	-.050	-.098	.012
PERF4_1	V16	.079	-.081	.003	-.029	-.001
PERF4_2	V17	.083	.146	.115	.131	.262
PERF4_3	V18	.023	-.017	-.019	-.099	.086
PERF4_4	V19	-.094	-.064	-.148	-.202	-.093

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PERF4_5	V20	.044	.100	.004	.005	-.039
POLICY_1	V21	-.145	.152	-.056	-.029	.051
POLICY_2	V22	-.017	.067	-.040	.033	.105
POLICY_3	V23	-.010	.125	-.036	-.030	.111
POLICY_4	V24	.114	.191	-.006	-.086	-.014
POLICY_5	V25	.031	.106	-.060	-.057	-.044
ABILITY	V26	-.012	.012	-.039	.006	-.045
V90_A	V27	-.002	.001	-.037	-.047	.016
V91_A	V28	.141	.133	.001	.023	.067

		PERF1_4	PERF1_5	V33_A	V34_A	V35_A
		V11	V12	V13	V14	V15
PERF1_4	V11	.000				
PERF1_5	V12	-.041	.000			
V33_A	V13	.040	.010	.000		
V34_A	V14	.005	.029	.026	.000	
V35_A	V15	-.135	-.001	-.017	.001	.000
PERF4_1	V16	.007	-.010	-.035	-.006	-.139
PERF4_2	V17	.024	.120	-.138	-.108	-.050
PERF4_3	V18	-.034	.038	.020	.043	.090
PERF4_4	V19	-.203	-.032	-.044	.036	.108
PERF4_5	V20	.075	-.020	-.044	-.079	-.095

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POLICY_1	V21	-.118	-.012	.126	-.067	.023
POLICY_2	V22	.060	-.004	-.037	.014	-.049
POLICY_3	V23	-.060	.021	.054	.054	.001
POLICY_4	V24	.006	.048	.051	-.061	-.063
POLICY_5	V25	.011	-.054	.110	-.097	-.096
ABILITY	V26	-.016	-.039	.080	.038	.004
V90_A	V27	.032	.055	.021	-.017	-.053
V91_A	V28	.134	.090	.029	-.011	-.031

		PERF4_1	PERF4_2	PERF4_3	PERF4_4	PERF4_5
		V16	V17	V18	V19	V20
PERF4_1	V16	.000				
PERF4_2	V17	.035	.000			
PERF4_3	V18	-.108	-.023	.000		
PERF4_4	V19	.044	-.006	.038	.000	
PERF4_5	V20	.161	-.042	.039	-.067	.000
POLICY_1	V21	-.136	.093	.007	-.095	.055
POLICY_2	V22	-.135	.087	-.064	-.153	-.094
POLICY_3	V23	.001	.186	.045	-.063	-.009
POLICY_4	V24	-.034	.060	-.018	-.099	.060
POLICY_5	V25	-.041	.009	.001	-.057	.115

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ABILITY	V26	.037	.083	-.057	-.071	.066
V90_A	V27	.041	.069	-.052	-.025	.030
V91_A	V28	.092	.098	.044	-.026	.110

		POLICY_1	POLICY_2	POLICY_3	POLICY_4	POLICY_5
		V21	V22	V23	V24	V25
POLICY_1	V21	.000				
POLICY_2	V22	.092	.000			
POLICY_3	V23	-.003	-.010	.000		
POLICY_4	V24	-.033	-.106	.001	.000	
POLICY_5	V25	.020	-.024	-.014	.109	.000
ABILITY	V26	-.038	-.002	-.008	.083	.009
V90_A	V27	-.068	-.059	-.020	.084	-.032
V91_A	V28	.044	.116	.102	.050	.117

		ABILITY	V90_A	V91_A
		V26	V27	V28
ABILITY	V26	.000		
V90_A	V27	.005	.000	
V91_A	V28	-.001	-.018	.000

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AVERAGE ABSOLUTE RESIDUAL = .0525

AVERAGE OFF-DIAGONAL ABSOLUTE RESIDUAL = .0563

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

STANDARDIZED RESIDUAL MATRIX:

	SLACK_1	SLACK_2	RMUSE_1	RMUSE_2	RMUSE_3
	V1	V2	V3	V4	V5
SLACK_1 V1	.000				
SLACK_2 V2	.000	.000			
RMUSE_1 V3	-.044	-.054	.000		
RMUSE_2 V4	.011	.058	.206	.000	
RMUSE_3 V5	.031	.058	-.021	-.043	.000
RMUSE_4 V6	-.041	.053	-.084	-.080	.067
RMUSE_5 V7	-.006	.041	-.047	.074	-.050

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PERF1_1	V8	-.074	.027	-.014	.004	-.078
PERF1_2	V9	.002	.083	-.009	.004	-.103
PERF1_3	V10	.080	.131	-.097	-.038	.067
PERF1_4	V11	-.043	-.034	.020	.028	.119
PERF1_5	V12	-.014	.041	.024	.065	-.010
V33_A	V13	-.108	-.119	-.108	-.013	-.040
V34_A	V14	-.014	.004	.016	-.015	.041
V35_A	V15	.062	.156	-.006	.028	-.013
PERF4_1	V16	-.107	-.089	-.002	-.051	.026
PERF4_2	V17	.062	.099	.201	.111	.125
PERF4_3	V18	-.001	.037	.000	.012	-.043
PERF4_4	V19	-.031	.025	-.066	-.124	-.178
PERF4_5	V20	-.001	-.014	.048	.010	.042
POLICY_1	V21	-.065	-.018	-.045	.074	-.108
POLICY_2	V22	.044	.118	.010	.029	.055
POLICY_3	V23	-.009	.053	-.089	.027	-.037
POLICY_4	V24	.105	.142	-.020	.095	.036
POLICY_5	V25	-.030	.044	.046	.085	-.070
ABILITY	V26	-.065	.018	-.074	-.089	-.026
V90_A	V27	.054	.074	-.001	-.050	.024
V91_A	V28	.013	-.009	.132	.053	.180

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		RMUSE_4	RMUSE_5	PERF1_1	PERF1_2	PERF1_3
		V6	V7	V8	V9	V10
RMUSE_4	V6	.000				
RMUSE_5	V7	.022	.000			
PERF1_1	V8	-.070	.015	.000		
PERF1_2	V9	-.105	-.073	.125	.000	
PERF1_3	V10	.018	-.049	-.025	-.029	.000
PERF1_4	V11	.128	.015	-.054	-.035	.051
PERF1_5	V12	-.019	.014	.012	.010	.002
V33_A	V13	.008	.037	-.003	.000	.159
V34_A	V14	.029	-.057	-.038	-.059	.116
V35_A	V15	.002	.030	-.050	-.105	.012
PERF4_1	V16	.076	-.070	.003	-.029	-.001
PERF4_2	V17	.065	.102	.088	.106	.189
PERF4_3	V18	.022	-.014	-.018	-.097	.075
PERF4_4	V19	-.095	-.057	-.146	-.211	-.086
PERF4_5	V20	.041	.084	.004	.005	-.034
POLICY_1	V21	-.118	.111	-.045	-.025	.038
POLICY_2	V22	-.017	.061	-.040	.035	.100
POLICY_3	V23	-.009	.100	-.031	-.028	.092
POLICY_4	V24	.113	.169	-.005	-.088	-.013
POLICY_5	V25	.031	.097	-.060	-.061	-.041

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ABILITY	V26	-.014	.013	-.045	.007	-.048
V90_A	V27	-.002	.001	-.045	-.060	.019
V91_A	V28	.161	.135	.002	.028	.070

		PERF1_4	PERF1_5	V33_A	V34_A	V35_A
		V11	V12	V13	V14	V15
PERF1_4	V11	.000				
PERF1_5	V12	-.041	.000			
V33_A	V13	.042	.011	.000		
V34_A	V14	.005	.031	.029	.000	
V35_A	V15	-.143	-.001	-.020	.001	.000
PERF4_1	V16	.007	-.010	-.037	-.007	-.149
PERF4_2	V17	.020	.098	-.118	-.092	-.044
PERF4_3	V18	-.033	.037	.021	.045	.095
PERF4_4	V19	-.210	-.034	-.048	.040	.121
PERF4_5	V20	.072	-.020	-.045	-.081	-.100
POLICY_1	V21	-.099	-.010	.112	-.059	.021
POLICY_2	V22	.063	-.004	-.041	.015	-.056
POLICY_3	V23	-.055	.019	.053	.052	.001
POLICY_4	V24	.007	.050	.055	-.065	-.069
POLICY_5	V25	.012	-.058	.123	-.108	-.109
ABILITY	V26	-.020	-.047	.102	.048	.006

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V90_A	V27	.041	.071	.029	-.024	-.074
V91_A	V28	.157	.106	.037	-.014	-.039

		PERF4_1	PERF4_2	PERF4_3	PERF4_4	PERF4_5
		V16	V17	V18	V19	V20
PERF4_1	V16	.000				
PERF4_2	V17	.029	.000			
PERF4_3	V18	-.106	-.018	.000		
PERF4_4	V19	.047	-.006	.039	.000	
PERF4_5	V20	.158	-.033	.038	-.069	.000
POLICY_1	V21	-.116	.065	.006	-.085	.046
POLICY_2	V22	-.144	.076	-.067	-.171	-.098
POLICY_3	V23	.001	.141	.041	-.062	-.008
POLICY_4	V24	-.035	.051	-.018	-.107	.060
POLICY_5	V25	-.043	.008	.001	-.063	.120
ABILITY	V26	.045	.083	-.069	-.090	.079
V90_A	V27	.054	.073	-.066	-.034	.039
V91_A	V28	.109	.095	.051	-.033	.128

		POLICY_1	POLICY_2	POLICY_3	POLICY_4	POLICY_5

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	V21	V22	V23	V24	V25
POLICY_1 V21	.000				
POLICY_2 V22	.084	.000			
POLICY_3 V23	-.002	-.010	.000		
POLICY_4 V24	-.029	-.117	.001	.000	
POLICY_5 V25	.018	-.027	-.014	.119	.000
ABILITY V26	-.039	-.003	-.009	.104	.012
V90_A V27	-.075	-.082	-.023	.112	-.043
V91_A V28	.045	.147	.113	.061	.147

	ABILITY	V90_A	V91_A
	V26	V27	V28
ABILITY V26	.000		
V90_A V27	.008	.000	
V91_A V28	-.002	-.028	.000

AVERAGE ABSOLUTE STANDARDIZED RESIDUAL = .0519

AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUAL = .0557

LARGEST STANDARDIZED RESIDUALS:

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NO.	PARAMETER	ESTIMATE	NO.	PARAMETER	ESTIMATE
1	V19, V9	-.211	11	V13, V10	.159
2	V19, V11	-.210	12	V20, V16	.158
3	V4, V3	.206	13	V28, V11	.157
4	V17, V3	.201	14	V15, V2	.156
5	V17, V10	.189	15	V16, V15	-.149
6	V28, V5	.180	16	V28, V25	.147
7	V19, V5	-.178	17	V28, V22	.147
8	V22, V19	-.171	18	V19, V8	-.146
9	V24, V7	.169	19	V22, V16	-.144
10	V28, V6	.161	20	V15, V11	-.143

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

DISTRIBUTION OF STANDARDIZED RESIDUALS

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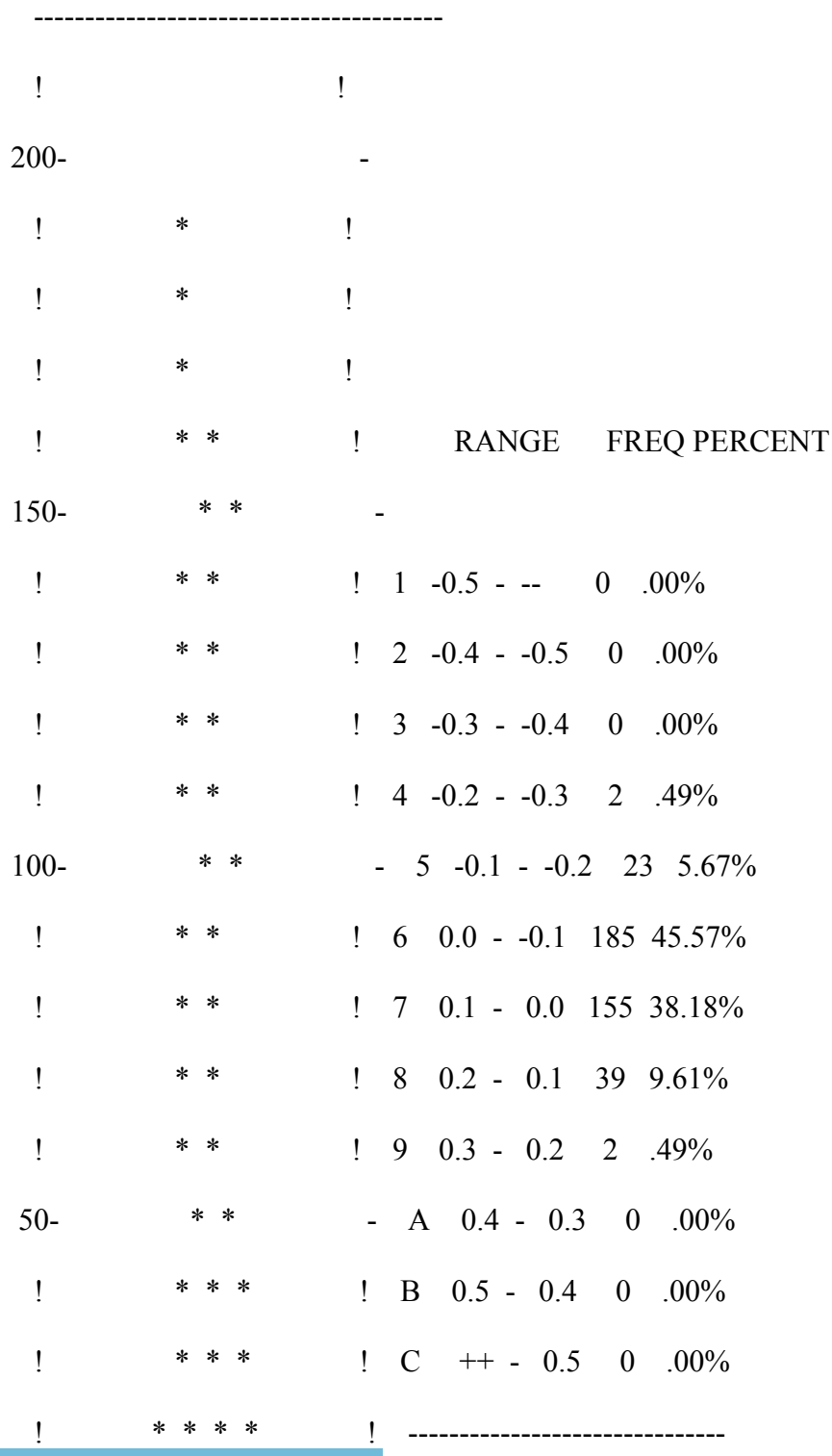

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! * * * * ! TOTAL 406 100.00%

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1 2 3 4 5 6 7 8 9 A B C EACH "*" REPRESENTS 10 RESIDUALS

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

GOODNESS OF FIT SUMMARY FOR METHOD = ML

INDEPENDENCE MODEL CHI-SQUARE = 14911.398 ON 379 DEGREES OF FREEDOM

INDEPENDENCE AIC = 14153.398 INDEPENDENCE CAIC = 12711.674

MODEL AIC = -100.914 MODEL CAIC = -1356.241

CHI-SQUARE = 559.086 BASED ON 330 DEGREES OF FREEDOM

PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS .00000

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THE NORMAL THEORY RLS CHI-SQUARE FOR THIS ML SOLUTION IS 523.186.

FIT INDICES

BENTLER-BONETT NORMED FIT INDEX = .963

BENTLER-BONETT NON-NORMED FIT INDEX = .982

COMPARATIVE FIT INDEX (CFI) = .984

BOLLEN'S (IFI) FIT INDEX = .984

MCDONALD'S (MFI) FIT INDEX = .391

JORESKOG-SORBOM'S GFI FIT INDEX = .764

JORESKOG-SORBOM'S AGFI FIT INDEX = .710

ROOT MEAN-SQUARE RESIDUAL (RMR) = .071

STANDARDIZED RMR = .069

ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA) = .076

90% CONFIDENCE INTERVAL OF RMSEA (.065, .086)

RELIABILITY COEFFICIENTS

CRONBACH'S ALPHA = .872

RELIABILITY COEFFICIENT RHO = .933

STANDARDIZED FACTOR LOADINGS FOR THE FACTOR THAT GENERATES

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MAXIMAL RELIABILITY FOR THE UNIT-WEIGHT COMPOSITE

BASED ON THE MODEL (RHO):

SLACK_1	SLACK_2	RMUSE_1	RMUSE_2	RMUSE_3	RMUSE_4
.132	.106	.594	.680	.761	.700

RMUSE_5	PERF1_1	PERF1_2	PERF1_3	PERF1_4	PERF1_5
.561	.679	.645	.735	.672	.724

V33_A	V34_A	V35_A	PERF4_1	PERF4_2	PERF4_3
-.148	-.162	-.186	.248	.408	.428

PERF4_4	PERF4_5	POLICY_1	POLICY_2	POLICY_3	POLICY_4
.404	.269	.667	.582	.753	.574

POLICY_5	ABILITY	V90_A	V91_A
.550	.420	.426	.268

ITERATIVE SUMMARY

	PARAMETER		
ITERATION	ABS CHANGE	ALPHA	FUNCTION
1	.236855	1.00000	6.99014
2	.047344	1.00000	4.69961
3	.018319	1.00000	4.62829

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4	.004848	1.00000	4.62167
5	.001953	1.00000	4.62073
6	.000716	1.00000	4.62054

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

MEASUREMENT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

SLACK_1 =V1 = 1.046*F1 + 1.000 E1

.068

15.415@

SLACK_2 =V2 = .828*F1 + 1.000 E2

.078

10.595@

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RMUSE_1 =V3 = .628*F2 + 1.000 E3

.073

8.621@

RMUSE_2 =V4 = .787*F2 + 1.000 E4

.075

10.443@

RMUSE_3 =V5 = .996*F2 + 1.000 E5

.080

12.479@

RMUSE_4 =V6 = .863*F2 + 1.000 E6

.079

10.908@

RMUSE_5 =V7 = .773*F2 + 1.000 E7

.097

7.999@

PERF1_1 =V8 = .855*F3 + 1.000 E8

.081

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10.504@

PERF1_2 =V9 = .768*F3 + 1.000 E9

.079

9.731@

PERF1_3 =V10 = .985*F3 + 1.000 E10

.083

11.905@

PERF1_4 =V11 = .808*F3 + 1.000 E11

.078

10.348@

PERF1_5 =V12 = .859*F3 + 1.000 E12

.074

11.617@

MEASUREMENT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS (CONTINUED)

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

V33_A =V13 = .592*F4 + 1.000 E13

.090

6.569@

V34_A =V14 = .648*F4 + 1.000 E14

.090

7.231@

V35_A =V15 = .727*F4 + 1.000 E15

.087

8.404@

PERF4_1 =V16 = .465*F5 + 1.000 E16

.093

5.014@

PERF4_2 =V17 = .942*F5 + 1.000 E17

.102

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9.242@

PERF4_3 =V18 = .820*F5 + 1.000 E18

.083

9.849@

PERF4_4 =V19 = .725*F5 + 1.000 E19

.079

9.128@

PERF4_5 =V20 = .515*F5 + 1.000 E20

.094

5.500@

POLICY_1=V21 = .910*F6 + 1.000 E21

.094

9.718@

POLICY_2=V22 = .634*F6 + 1.000 E22

.079

8.067@

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POLICY_3=V23 = .941*F6 + 1.000 E23

.081

11.638@

POLICY_4=V24 = .648*F6 + 1.000 E24

.082

7.927@

MEASUREMENT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS (CONTINUED)

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

POLICY_5=V25 = .602*F6 + 1.000 E25

.080

7.493@

ABILITY =V26 = .688*F7 + 1.000 E26

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.070

9.887@

V90_A =V27 = .657*F7 + 1.000 E27

.065

10.065@

V91_A =V28 = .452*F7 + 1.000 E28

.077

5.890@

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

V F

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I F1 - F1 1.000 I

I I

I I

I I

I F2 - F2 1.000 I

I I

I I

I I

I F3 - F3 1.000 I

I I

I I

I I

I F4 - F4 1.000 I

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I F5 - F5 1.000 I

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I I

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I F6 - F6 1.000 I

I I

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I I

I I

I F7 - F7 1.000 I

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I I

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28-Dec-11 PAGE: 12 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

E D

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E1 -SLACK_1 .010 I I

I I

I I

I I

E2 -SLACK_2 .392*I I

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.051 I I

7.656@I I

I I

E3 -RMUSE_1 .405*I I

.057 I I

7.115@I I

I I

E4 -RMUSE_2 .338*I I

.052 I I

6.511@I I

I I

E5 -RMUSE_3 .232*I I

.048 I I

4.818@I I

I I

E6 -RMUSE_4 .342*I I

.055 I I

6.263@I I

I I

E7 -RMUSE_5 .757*I I

.105 I I

7.244@I I

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I I

E8 -PERF1_1 .397*I I

.060 I I

6.676@I I

I I

E9 -PERF1_2 .421*I I

.061 I I

6.941@I I

I I

E10 -PERF1_3 .307*I I

.052 I I

5.866@I I

I I

E11 -PERF1_4 .375*I I

.056 I I

6.736@I I

I I

E12 -PERF1_5 .263*I I

.043 I I

6.084@I I

I I

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES (CONTINUED)

E13 -V33_A .562*I I

.090 I I

6.260@I I

I I

E14 -V34_A .498*I I

.088 I I

5.660@I I

I I

E15 -V35_A .344*I I

.085 I I

4.057@I I

I I

E16 -PERF4_1 .779*I I

.106 I I

7.379@I I

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I I

E17 -PERF4_2 .616*I I

.110 I I

5.615@I I

I I

E18 -PERF4_3 .363*I I

.073 I I

5.004@I I

I I

E19 -PERF4_4 .382*I I

.067 I I

5.715@I I

I I

E20 -PERF4_5 .772*I I

.106 I I

7.284@I I

I I

E21 -POLICY_1 .552*I I

.087 I I

6.314@I I

I I

E22 -POLICY_2 .477*I I

.068 I I

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6.974@I I

I I

E23 -POLICY_3 .273*I I

.059 I I

4.653@I I

I I

E24 -POLICY_4 .523*I I

.075 I I

7.013@I I

I I

28-Dec-11 PAGE: 14 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES (CONTINUED)

E25 -POLICY_5 .526*I I

.074 I I

7.124@I I

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I I

E26 -ABILITY .201*I I

.055 I I

3.678@I I

I I

E27 -V90_A .165*I I

.049 I I

3.389@I I

I I

E28 -V91_A .507*I I

.070 I I

7.214@I I

I I

28-Dec-11 PAGE: 15 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

COVARIANCES AMONG INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

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V F

--- ---

I F2 - F2 .092*I

I F1 - F1 .095 I

I .970 I

I I

I F3 - F3 -.154*I

I F1 - F1 .093 I

I -1.648 I

I I

I F4 - F4 .077*I

I F1 - F1 .105 I

I .737 I

I I

I F5 - F5 -.067*I

I F1 - F1 .099 I

I -.679 I

I I

I F6 - F6 .090*I

I F1 - F1 .097 I

I .933 I

I I

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I F7 - F7 -.087*I

I F1 - F1 .099 I

I -.882 I

I I

I F3 - F3 .741*I

I F2 - F2 .050 I

I 14.741@I

I I

I F4 - F4 -.359*I

I F2 - F2 .099 I

I -3.626@I

I I

I F5 - F5 .229*I

I F2 - F2 .099 I

I 2.308@I

I I

I F6 - F6 .660*I

I F2 - F2 .063 I

I 10.481@I

I I

I F7 - F7 .473*I

I F2 - F2 .084 I

I 5.644@I

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I I

I F4 - F4 -.460*I

I F3 - F3 .091 I

I -5.032@I

I I

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

COVARIANCES AMONG INDEPENDENT VARIABLES (CONTINUED)

I F5 - F5 .391*I

I F3 - F3 .090 I

I 4.348@I

I I

I F6 - F6 .685*I

I F3 - F3 .059 I

I 11.519@I

I I

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I F7 - F7 .429*I

I F3 - F3 .087 I

I 4.932@I

I I

I F5 - F5 -.243*I

I F4 - F4 .109 I

I -2.221@I

I I

I F6 - F6 -.086*I

I F4 - F4 .111 I

I -.776 I

I I

I F7 - F7 -.322*I

I F4 - F4 .105 I

I -3.056@I

I I

I F6 - F6 .300*I

I F5 - F5 .098 I

I 3.066@I

I I

I F7 - F7 .108*I

I F5 - F5 .107 I

I 1.007 I

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I I

I F7 - F7 .340*I

I F6 - F6 .095 I

I 3.565@I

I I

28-Dec-11 PAGE: 17 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

STANDARDIZED SOLUTION: R-SQUARED

SLACK_1 =V1 = .995*F1 + .095 E1 .991

SLACK_2 =V2 = .797*F1 + .603 E2 .636

RMUSE_1 =V3 = .703*F2 + .712 E3 .494

RMUSE_2 =V4 = .804*F2 + .594 E4 .647

RMUSE_3 =V5 = .900*F2 + .435 E5 .811

RMUSE_4 =V6 = .828*F2 + .561 E6 .685

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RMUSE_5 =V7 = .664*F2 + .748 E7 .441

PERF1_1 =V8 = .805*F3 + .594 E8 .648

PERF1_2 =V9 = .764*F3 + .645 E9 .584

PERF1_3 =V10 = .872*F3 + .490 E10 .760

PERF1_4 =V11 = .797*F3 + .604 E11 .635

PERF1_5 =V12 = .859*F3 + .513 E12 .737

V33_A =V13 = .620*F4 + .785 E13 .384

V34_A =V14 = .676*F4 + .737 E14 .457

V35_A =V15 = .779*F4 + .627 E15 .606

PERF4_1 =V16 = .466*F5 + .885 E16 .218

PERF4_2 =V17 = .768*F5 + .640 E17 .590

PERF4_3 =V18 = .806*F5 + .592 E18 .649

PERF4_4 =V19 = .761*F5 + .649 E19 .579

PERF4_5 =V20 = .506*F5 + .863 E20 .256

POLICY_1=V21 = .775*F6 + .632 E21 .600

POLICY_2=V22 = .676*F6 + .737 E22 .457

POLICY_3=V23 = .874*F6 + .485 E23 .764

POLICY_4=V24 = .667*F6 + .745 E24 .445

POLICY_5=V25 = .639*F6 + .770 E25 .408

ABILITY =V26 = .838*F7 + .546 E26 .702

V90_A =V27 = .851*F7 + .526 E27 .723

V91_A =V28 = .536*F7 + .844 E28 .287

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

CORRELATIONS AMONG INDEPENDENT VARIABLES

V		F	
	I F2 -	F2	.092*I
	I F1 -	F1	I
	I		I
	I F3 -	F3	-.154*I
	I F1 -	F1	I
	I		I
	I F4 -	F4	.077*I
	I F1 -	F1	I
	I		I
	I F5 -	F5	-.067*I
	I F1 -	F1	I
	I		I

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I F6 - F6 .090*I

I F1 - F1 I

I I

I F7 - F7 -.087*I

I F1 - F1 I

I I

I F3 - F3 .741*I

I F2 - F2 I

I I

I F4 - F4 -.359*I

I F2 - F2 I

I I

I F5 - F5 .229*I

I F2 - F2 I

I I

I F6 - F6 .660*I

I F2 - F2 I

I I

I F7 - F7 .473*I

I F2 - F2 I

I I

I F4 - F4 -.460*I

I F3 - F3 I

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I I

I F5 - F5 .391*I

I F3 - F3 I

I I

I F6 - F6 .685*I

I F3 - F3 I

I I

I F7 - F7 .429*I

I F3 - F3 I

I I

I F5 - F5 -.243*I

I F4 - F4 I

I I

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

CORRELATIONS AMONG INDEPENDENT VARIABLES (CONTINUED)

---

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I F6 - F6 -.086*I

I F4 - F4 I

I I

I F7 - F7 -.322*I

I F4 - F4 I

I I

I F6 - F6 .300*I

I F5 - F5 I

I I

I F7 - F7 .108*I

I F5 - F5 I

I I

I F7 - F7 .340*I

I F6 - F6 I

I I

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E N D O F M E T H O D

1

Execution begins at 18:29:12

Execution ends at 18:29:12

Elapsed time = .00 seconds

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Appendix E: Path Model out Output from EQS

1

EQS, A STRUCTURAL EQUATION PROGRAM MULTIVARIATE SOFTWARE, INC.

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PROGRAM CONTROL INFORMATION

```
 1  /TITLE
 2  Model built by EQS 6 for Windows
 3  /SPECIFICATIONS
 4  DATA='C:\Users\czhang\Downloads\data-169 straight from qualtrics-avg-path.ESS';
 5  VARIABLES=7; CASES=169;
 6  METHOD=ML; ANALYSIS=COVARIANCE; MATRIX=RAW;
 7  /LABELS
 8  V1=SLACK; V2=RMUSE; V3=PERF1; V4=AMBIG; V5=PERF4;
 9  V6=POLICY; V7=REACT;
10  /EQUATIONS
11  V2 =   *V4 + *V6 + *V7 + E2;
12  V3 =   *V1 + *V2 + *V4 + E3;
13  V5 =   *V3 + *V4 + E5;
14  /VARIANCES
```


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```
15   V1 = *;
16   V4 = *;
17   V6 = *;
18   V7 = *;
19   E2 = *;
20   E3 = *;
21   E5 = *;
22  /COVARIANCES
23  V1,V4 = *;
24  V1,V6 = *;
25  V4,V6 = *;
26  V1,V7 = *;
27  V4,V7 = *;
28  V6,V7 = *;
29  /PRINT
30  EIS;
31  FIT=ALL;
32  TABLE=EQUATION;
33  /END
```

33 RECORDS OF INPUT MODEL FILE WERE READ

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DATA IS READ FROM C:\Users\czhang\Downloads\data-169 straight from qualtrics-avg-path.ESS

THERE ARE 7 VARIABLES AND 169 CASES

IT IS A RAW DATA ESS FILE

*** WARNING *** 47 CASES ARE SKIPPED BECAUSE A VARIABLE IS MISSING--

8 20 23 38 39 48 51 56 57 59

68 71 76 80 84 95 102 123 129 131

139 142 143 144 145 146 147 148 149 150

151 152 153 154 155 156 157 158 159 160

161 162 163 164 165 167 168

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TITLE: Model built by EQS 6 for Windows

SAMPLE STATISTICS BASED ON COMPLETE CASES

UNIVARIATE STATISTICS

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VARIABLE	SLACK	RMUSE	PERF1	AMBIG	PERF4
	V1	V2	V3	V4	V5
MEAN	.0013	-.0275	-.0598	-.0659	.0827
SKEWNESS (G1)	.3960	.7254	.7276	.0942	.4347
KURTOSIS (G2)	-.4991	.4354	.1234	-.5844	-.1376
STANDARD DEV.	.9986	1.0227	.9880	.9870	.9754

VARIABLE	POLICY	REACT
	V6	V7
MEAN	.0349	.0225
SKEWNESS (G1)	.2491	.7385
KURTOSIS (G2)	-.2222	.8718

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STANDARD DEV. 1.0005 1.0125

MULTIVARIATE KURTOSIS

MARDIA'S COEFFICIENT (G2,P) = 7.2767

NORMALIZED ESTIMATE = 3.5801

ELLIPTICAL THEORY KURTOSIS ESTIMATES

MARDIA-BASED KAPPA = .1155 MEAN SCALED UNIVARIATE KURTOSIS = -.0006

MARDIA-BASED KAPPA IS USED IN COMPUTATION. KAPPA= .1155

CASE NUMBERS WITH LARGEST CONTRIBUTION TO NORMALIZED MULTIVARIATE KURTOSIS:

CASE NUMBER 17 19 26 53 109

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ESTIMATE 127.2040 163.2135 168.5304 192.4655 283.1448

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TITLE: Model built by EQS 6 for Windows

COVARIANCE MATRIX TO BE ANALYZED: 7 VARIABLES (SELECTED FROM 7 VARIABLES)

BASED ON 122 CASES.

		SLACK	RMUSE	PERF1	AMBIG	PERF4
		V1	V2	V3	V4	V5
SLACK	V1	.997				
RMUSE	V2	.099	1.046			
PERF1	V3	-.112	.666	.976		
AMBIG	V4	.060	-.298	-.368	.974	
PERF4	V5	-.053	.207	.310	-.216	.951
POLICY	V6	.126	.621	.583	-.073	.220
REACT	V7	-.056	.450	.386	-.237	.124

	POLICY	REACT

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		V6	V7
POLICY	V6	1.001	
REACT	V7	.326	1.025

BENTLER-WEEKS STRUCTURAL REPRESENTATION:

NUMBER OF DEPENDENT VARIABLES = 3

DEPENDENT V'S : 2 3 5

NUMBER OF INDEPENDENT VARIABLES = 7

INDEPENDENT V'S : 1 4 6 7

INDEPENDENT E'S : 2 3 5

NUMBER OF FREE PARAMETERS = 21

NUMBER OF FIXED NONZERO PARAMETERS = 3

*** WARNING MESSAGES ABOVE, IF ANY, REFER TO THE MODEL PROVIDED.

CALCULATIONS FOR INDEPENDENCE MODEL NOW BEGIN.

*** WARNING MESSAGES ABOVE, IF ANY, REFER TO INDEPENDENCE MODEL.

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CALCULATIONS FOR USER'S MODEL NOW BEGIN.

3RD STAGE OF COMPUTATION REQUIRED 5658 WORDS OF MEMORY.

PROGRAM ALLOCATED 80000000 WORDS

DETERMINANT OF INPUT MATRIX IS .15512D+00

PARAMETER ESTIMATES APPEAR IN ORDER,

NO SPECIAL PROBLEMS WERE ENCOUNTERED DURING OPTIMIZATION.

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

		SLACK	RMUSE	PERF1	AMBIG	PERF4
		V1	V2	V3	V4	V5
SLACK	V1	.000				
RMUSE	V2	.057	.000			
PERF1	V3	.034	-.009	-.011		
AMBIG	V4	.000	.000	.000	.000	
PERF4	V5	-.006	-.012	-.003	.000	-.001

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POLICY	V6	.000	.000	.219	.000	.112
REACT	V7	.000	.000	.064	.000	.008

		POLICY	REACT
		V6	V7
POLICY	V6	.000	
REACT	V7	.000	.000

AVERAGE ABSOLUTE RESIDUAL = .0191

AVERAGE OFF-DIAGONAL ABSOLUTE RESIDUAL = .0250

STANDARDIZED RESIDUAL MATRIX:

		SLACK	RMUSE	PERF1	AMBIG	PERF4
		V1	V2	V3	V4	V5
SLACK	V1	.000				
RMUSE	V2	.056	.000			
PERF1	V3	.034	-.009	-.011		

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AMBIG	V4	.000	.000	.000	.000	
PERF4	V5	-.007	-.012	-.003	.000	-.001
POLICY	V6	.000	.000	.221	.000	.115
REACT	V7	.000	.000	.064	.000	.008

		POLICY	REACT
		V6	V7
POLICY	V6	.000	
REACT	V7	.000	.000

AVERAGE ABSOLUTE STANDARDIZED RESIDUAL = .0193

AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUAL = .0252

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

LARGEST STANDARDIZED RESIDUALS:

NO.	PARAMETER	ESTIMATE	NO.	PARAMETER	ESTIMATE

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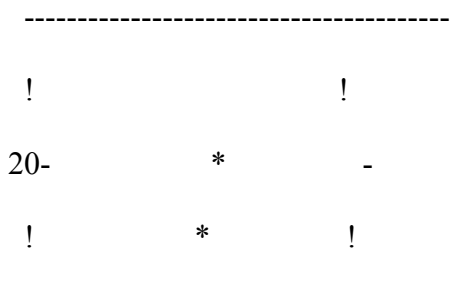
1	V6, V3	.221	11	V5, V3	-.003
2	V6, V5	.115	12	V5, V5	-.001
3	V7, V3	.064	13	V6, V4	.000
4	V2, V1	.056	14	V7, V1	.000
5	V3, V1	.034	15	V6, V6	.000
6	V5, V2	-.012	16	V1, V1	.000
7	V3, V3	-.011	17	V7, V4	.000
8	V3, V2	-.009	18	V7, V6	.000
9	V7, V5	.008	19	V7, V2	.000
10	V5, V1	-.007	20	V6, V2	.000

DISTRIBUTION OF STANDARDIZED RESIDUALS



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```
 !            *           !
 !            *           !
 !            *           !        RANGE     FREQ PERCENT
15-            *           -
 !            *           !   1  -0.5  -  --      0   .00%
 !            *           !   2  -0.4  -  -0.5    0   .00%
 !            *           !   3  -0.3  -  -0.4    0   .00%
 !            *           !   4  -0.2  -  -0.3    0   .00%
10-            *           -   5  -0.1  -  -0.2    0   .00%
 !            *           !   6   0.0  -  -0.1    6 21.43%
 !            *           !   7   0.1  -   0.0   20 71.43%
 !            *           !   8   0.2  -   0.1    1  3.57%
 !          * *           !   9   0.3  -   0.2    1  3.57%
 5-         * *           -   A   0.4  -   0.3    0   .00%
 !          * *           !   B   0.5  -   0.4    0   .00%
 !          * *           !   C    ++  -   0.5    0   .00%
 !          * *           !   ------------------------------
 !          * * * *       !        TOTAL      28 100.00%
 ---------------------------------------
   1 2 3 4 5 6 7 8 9 A B C   EACH "*" REPRESENTS   1 RESIDUALS
```


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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

GOODNESS OF FIT SUMMARY FOR METHOD = ML

INDEPENDENCE MODEL CHI-SQUARE = 221.631 ON 21 DEGREES OF FREEDOM

INDEPENDENCE AIC = 179.631 INDEPENDENCE CAIC = 99.747

MODEL AIC = 8.968 MODEL CAIC = -17.660

CHI-SQUARE = 22.968 BASED ON 7 DEGREES OF FREEDOM

PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS .00173

THE NORMAL THEORY RLS CHI-SQUARE FOR THIS ML SOLUTION IS 21.277.

FIT INDICES

BENTLER-BONETT NORMED FIT INDEX = .896

BENTLER-BONETT NON-NORMED FIT INDEX = .761

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COMPARATIVE FIT INDEX (CFI) = .920

BOLLEN'S (IFI) FIT INDEX = .926

MCDONALD'S (MFI) FIT INDEX = .937

JORESKOG-SORBOM'S GFI FIT INDEX = .952

JORESKOG-SORBOM'S AGFI FIT INDEX = .809

ROOT MEAN-SQUARE RESIDUAL (RMR) = .050

STANDARDIZED RMR = .050

ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA) = .137

90% CONFIDENCE INTERVAL OF RMSEA (.077, .201)

RELIABILITY COEFFICIENTS

CRONBACH'S ALPHA = .516

ITERATIVE SUMMARY

	PARAMETER		
ITERATION	ABS CHANGE	ALPHA	FUNCTION
1	.348605	1.00000	2.14766

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2	.171180	1.00000	.79901
3	.088241	1.00000	.29429
4	.032891	1.00000	.19085
5	.002209	1.00000	.18982
6	.000007	1.00000	.18982

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

MEASUREMENT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

RMUSE =V2 = -.213*V4 + .533*V6 + .220*V7 + 1.000 E2

.070 .071 .072

-3.016@ 7.466@ 3.044@

PERF1 =V3 = .599*V2 - .160*V1 - .185*V4 + 1.000 E3

.065 .064 .068

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9.161@ -2.501@ -2.723@

PERF4 =V5 = .272*V3 - .119*V4 + 1.000 E5

.091 .091

3.007@ -1.303

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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

	V		F	
	---		---	
V1 -SLACK	.997*I	I		I
	.128 I	I		
	7.778@I	I		
	I	I		
V4 -AMBIG	.974*I	I		

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.125 I I

7.778@I I

I I

V6 -POLICY 1.001*I I

.129 I I

7.778@I I

I I

V7 -REACT 1.025*I I

.132 I I

7.778@I I

I I

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

E D

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---   ---

E2 -RMUSE .553*I I

.071 I I

7.778@I I

I I

E3 -PERF1 .492*I I

.063 I I

7.778@I I

I I

E5 -PERF4 .841*I I

.108 I I

7.778@I I

I I

28-Dec-11 PAGE: 9 EQS Licensee:

TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

COVARIANCES AMONG INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

المنارة للاستشارات
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	V	F
	---	---
V4 -AMBIG	.060*I	I
V1 -SLACK	.090 I	I
	.672 I	I
	I	I
V6 -POLICY	.126*I	I
V1 -SLACK	.092 I	I
	1.380 I	I
	I	I
V7 -REACT	-.056*I	I
V1 -SLACK	.092 I	I
	-.613 I	I
	I	I
V6 -POLICY	-.073*I	I
V4 -AMBIG	.090 I	I
	-.807 I	I
	I	I
V7 -REACT	-.237*I	I
V4 -AMBIG	.093 I	I
	-2.536@I	I
	I	I

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V7 -REACT .326*I I

V6 -POLICY .097 I I

3.367@I I

I I

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

STANDARDIZED SOLUTION: R-SQUARED

RMUSE =V2 = -.205*V4 + .521*V6 + .218*V7 + .727 E2 .471

PERF1 =V3 = .616*V2 - .161*V1 - .183*V4 + .706 E3 .502

PERF4 =V5 = .277*V3 - .120*V4 + .940 E5 .116

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TITLE: Model built by EQS 6 for Windows

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

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CORRELATIONS AMONG INDEPENDENT VARIABLES

	V		F	
	---		---	
V4 -AMBIG	.061*I			I
V1 -SLACK	I			I
	I		I	
V6 -POLICY	.126*I			I
V1 -SLACK	I			I
	I		I	
V7 -REACT	-.056*I			I
V1 -SLACK	I			I
	I		I	
V6 -POLICY	-.074*I			I
V4 -AMBIG	I			I
	I		I	
V7 -REACT	-.237*I			I
V4 -AMBIG	I			I
	I		I	
V7 -REACT	.322*I			I

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V6 -POLICY I I

I I

E N D O F M E T H O D

1

Execution begins at 15:45:48

Execution ends at 15:45:48

Elapsed time = .00 seconds

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Appendix F: Path Results for Alternative Model from EQS

1

EQS, A STRUCTURAL EQUATION PROGRAM MULTIVARIATE SOFTWARE, INC.

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PROGRAM CONTROL INFORMATION

```
 1  /TITLE
 2  Model built by EQS 6 for Windows
 3  /SPECIFICATIONS
 4  DATA='c:\users\czhang\downloads\data-169 straight from qualtrics-avg-path.ess';
 5  VARIABLES=7; CASES=169;
 6  METHOD=ML; ANALYSIS=COVARIANCE; MATRIX=RAW;
 7  /LABELS
 8  V1=SLACK; V2=RMUSE; V3=PERF1; V4=AMBIG; V5=PERF4;
 9  V6=POLICY; V7=REACT;
10  /EQUATIONS
11  V2 =   *V1 + *V6 + *V7 + E2;
12  V5 =   *V2 + E5;
13  V7 =   *V4 + E7;
14  /VARIANCES
```


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```
 15   V1 = *;
 16   V4 = *;
 17   V6 = *;
 18   E2 = *;
 19   E5 = *;
 20   E7 = *;
 21  /COVARIANCES
 22  V1,V4 = *;
 23  V1,V6 = *;
 24  V4,V6 = *;
 25  /PRINT
 26  EIS;
 27  FIT=ALL;
 28  TABLE=EQUATION;
 29  /END
```

29 RECORDS OF INPUT MODEL FILE WERE READ

DATA IS READ FROM c:\users\czhang\downloads\data-169 straight from qualtrics-avg-path.ess

THERE ARE 7 VARIABLES AND 169 CASES

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IT IS A RAW DATA ESS FILE

*** WARNING *** 33 CASES ARE SKIPPED BECAUSE A VARIABLE IS MISSING--

38 39 48 51 57 80 84 142 143 144

145 146 147 148 149 150 151 152 153 154

155 156 157 158 159 160 161 162 163 164

165 167 168

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SAMPLE STATISTICS BASED ON COMPLETE CASES

UNIVARIATE STATISTICS

VARIABLE	SLACK	RMUSE	AMBIG	PERF4	POLICY
	V1	V2	V4	V5	V6
MEAN	.0320	-.0550	.0322	-.0280	.0009

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SKEWNESS (G1) .3039 .7081 .0388 .4419 .1118

KURTOSIS (G2) -.6802 .4222 -.7071 -.0522 -.1968

STANDARD DEV. 1.0155 1.0139 1.0160 .9971 1.0274

VARIABLE REACT

V7

MEAN .0000

SKEWNESS (G1) .6787

KURTOSIS (G2) .9402

STANDARD DEV. 1.0000

MULTIVARIATE KURTOSIS

---

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MARDIA'S COEFFICIENT (G2,P) = 4.7525

NORMALIZED ESTIMATE = 2.8283

ELLIPTICAL THEORY KURTOSIS ESTIMATES

MARDIA-BASED KAPPA = .0990 MEAN SCALED UNIVARIATE KURTOSIS = -.0152

MARDIA-BASED KAPPA IS USED IN COMPUTATION. KAPPA= .0990

CASE NUMBERS WITH LARGEST CONTRIBUTION TO NORMALIZED MULTIVARIATE KURTOSIS:

CASE NUMBER	17	19	26	53	109
ESTIMATE	141.4952	165.9086	173.7074	211.4691	204.5293

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COVARIANCE MATRIX TO BE ANALYZED: 6 VARIABLES (SELECTED FROM 7 VARIABLES)

BASED ON 136 CASES.

		SLACK	RMUSE	AMBIG	PERF4	POLICY
		V1	V2	V4	V5	V6
SLACK	V1	1.031				
RMUSE	V2	.086	1.028			
AMBIG	V4	.075	-.303	1.032		
PERF4	V5	-.055	.242	-.313	.994	
POLICY	V6	.107	.661	-.107	.265	1.056
REACT	V7	-.036	.459	-.265	.168	.366

		REACT
		V7
REACT	V7	1.000

BENTLER-WEEKS STRUCTURAL REPRESENTATION:

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NUMBER OF DEPENDENT VARIABLES = 3

DEPENDENT V'S : 2 5 7

NUMBER OF INDEPENDENT VARIABLES = 6

INDEPENDENT V'S : 1 4 6

INDEPENDENT E'S : 2 5 7

NUMBER OF FREE PARAMETERS = 14

NUMBER OF FIXED NONZERO PARAMETERS = 3

*** WARNING MESSAGES ABOVE, IF ANY, REFER TO THE MODEL PROVIDED.

CALCULATIONS FOR INDEPENDENCE MODEL NOW BEGIN.

*** WARNING MESSAGES ABOVE, IF ANY, REFER TO INDEPENDENCE MODEL.

CALCULATIONS FOR USER'S MODEL NOW BEGIN.

3RD STAGE OF COMPUTATION REQUIRED 4222 WORDS OF MEMORY.

PROGRAM ALLOCATED 80000000 WORDS

DETERMINANT OF INPUT MATRIX IS .39148D+00

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PARAMETER ESTIMATES APPEAR IN ORDER,

NO SPECIAL PROBLEMS WERE ENCOUNTERED DURING OPTIMIZATION.

RESIDUAL COVARIANCE MATRIX (S-SIGMA) :

		SLACK	RMUSE	AMBIG	PERF4	POLICY
		V1	V2	V4	V5	V6
SLACK	V1	.000				
RMUSE	V2	-.005	.096			
AMBIG	V4	.000	-.179	.000		
PERF4	V5	-.076	.023	-.284	.005	
POLICY	V6	.000	.092	.000	.131	.000
REACT	V7	-.017	.178	.000	.102	.338

		REACT
		V7
REACT	V7	.000

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AVERAGE ABSOLUTE RESIDUAL = .0726

AVERAGE OFF-DIAGONAL ABSOLUTE RESIDUAL = .0948

STANDARDIZED RESIDUAL MATRIX:

		SLACK V1	RMUSE V2	AMBIG V4	PERF4 V5	POLICY V6
SLACK	V1	.000				
RMUSE	V2	-.004	.094			
AMBIG	V4	.000	-.174	.000		
PERF4	V5	-.075	.022	-.280	.005	
POLICY	V6	.000	.088	.000	.128	.000
REACT	V7	-.017	.175	.000	.102	.329

		REACT V7
REACT	V7	.000

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AVERAGE ABSOLUTE STANDARDIZED RESIDUAL = .0711

AVERAGE OFF-DIAGONAL ABSOLUTE STANDARDIZED RESIDUAL = .0929

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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

LARGEST STANDARDIZED RESIDUALS:

NO.	PARAMETER	ESTIMATE	NO.	PARAMETER	ESTIMATE
1	V7, V6	.329	11	V7, V1	-.017
2	V5, V4	-.280	12	V5, V5	.005
3	V7, V2	.175	13	V2, V1	-.004
4	V4, V2	-.174	14	V6, V4	.000
5	V6, V5	.128	15	V4, V1	.000
6	V7, V5	.102	16	V7, V4	.000
7	V2, V2	.094	17	V1, V1	.000
8	V6, V2	.088	18	V6, V6	.000
9	V5, V1	-.075	19	V6, V1	.000
10	V5, V2	.022	20	V4, V4	.000

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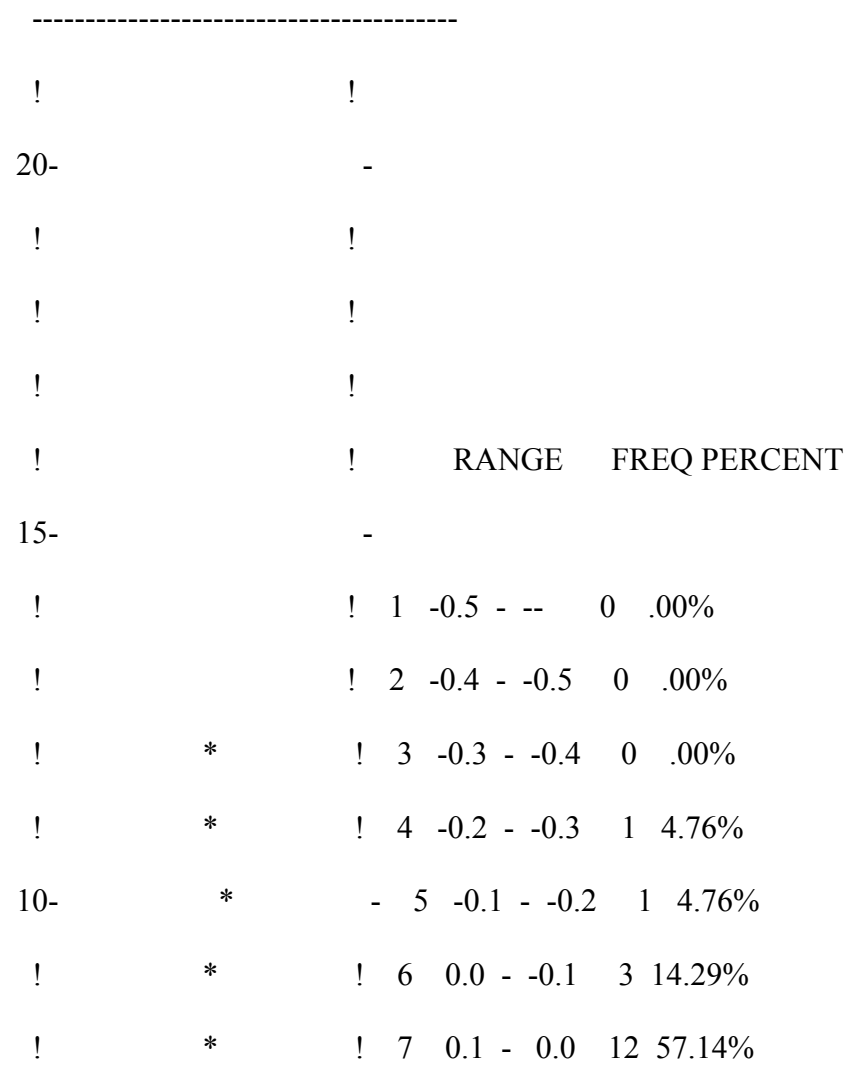
DISTRIBUTION OF STANDARDIZED RESIDUALS



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```
  !            *           !   8   0.2  -   0.1    3  14.29%
  !            *           !   9   0.3  -   0.2    0   .00%
 5-            *           -   A   0.4  -   0.3    1   4.76%
  !            *           !   B   0.5  -   0.4    0   .00%
  !          * * *         !   C   ++   -   0.5    0   .00%
  !          * * *         !   ------------------------------
  !       * * * * *   *      !         TOTAL       21 100.00%
  ----------------------------------------
    1 2 3 4 5 6 7 8 9 A B C    EACH "*" REPRESENTS    1 RESIDUALS
```

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GOODNESS OF FIT SUMMARY FOR METHOD = ML

INDEPENDENCE MODEL CHI-SQUARE = 145.284 ON 15 DEGREES OF FREEDOM

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INDEPENDENCE AIC = 115.284 INDEPENDENCE CAIC = 56.594

MODEL AIC = 25.902 MODEL CAIC = -1.486

CHI-SQUARE = 39.902 BASED ON 7 DEGREES OF FREEDOM

PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS .00000

THE NORMAL THEORY RLS CHI-SQUARE FOR THIS ML SOLUTION IS 35.592.

FIT INDICES

BENTLER-BONETT NORMED FIT INDEX = .725

BENTLER-BONETT NON-NORMED FIT INDEX = .459

COMPARATIVE FIT INDEX (CFI) = .747

BOLLEN'S (IFI) FIT INDEX = .762

MCDONALD'S (MFI) FIT INDEX = .886

JORESKOG-SORBOM'S GFI FIT INDEX = .919

JORESKOG-SORBOM'S AGFI FIT INDEX = .758

ROOT MEAN-SQUARE RESIDUAL (RMR) = .121

STANDARDIZED RMR = .119

ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA) = .187

90% CONFIDENCE INTERVAL OF RMSEA (.132, .244)

RELIABILITY COEFFICIENTS

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CRONBACH'S ALPHA = .367

ITERATIVE SUMMARY

ITERATION	PARAMETER ABS CHANGE	ALPHA	FUNCTION
1	.250905	1.00000	.53059
2	.082858	1.00000	.29784
3	.003185	1.00000	.29583
4	.001137	1.00000	.29560
5	.000358	1.00000	.29557

MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

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MEASUREMENT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

RMUSE =V2 = .268*V7 + .038*V1 + .529*V6 + 1.000 E2

.064 .063 .063

4.187@ .608 8.451@

PERF4 =V5 = .236*V2 + 1.000 E5

.086

2.732@

REACT =V7 = -.257*V4 + 1.000 E7

.082

-3.142@

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VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

	V	F
	---	---
V1 -SLACK	1.031*I	I
	.126 I	I
	8.216@I	I
	I	I
V4 -AMBIG	1.032*I	I
	.126 I	I
	8.216@I	I
	I	I
V6 -POLICY	1.056*I	I
	.128 I	I
	8.216@I	I
	I	I

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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

	E	D
	---	---
E2 -RMUSE	.552*I	I
	.067 I	I
	8.216@I	I
	I	I
E5 -PERF4	.937*I	I
	.114 I	I
	8.216@I	I
	I	I
E7 -REACT	.932*I	I
	.113 I	I
	8.216@I	I
	I	I

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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

COVARIANCES AMONG INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

	V		F
	---		---
V4 -AMBIG	.075*I		I
V1 -SLACK	.089 I		I
	.845 I		I
	I		I
V6 -POLICY	.107*I		I
V1 -SLACK	.090 I		I
	1.185 I		I
	I		I
V6 -POLICY	-.107*I		I
V4 -AMBIG	.090 I		I
	-1.183 I		I
	I		I

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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

STANDARDIZED SOLUTION: R-SQUARED

RMUSE =V2 = .277*V7 + .041*V1 + .563*V6 + .769 E2 .408

PERF4 =V5 = .229*V2 + .973 E5 .052

REACT =V7 = -.261*V4 + .965 E7 .068

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MAXIMUM LIKELIHOOD SOLUTION (NORMAL DISTRIBUTION THEORY)

CORRELATIONS AMONG INDEPENDENT VARIABLES

V F

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```
          ---                    ---
V4  -AMBIG          .073*I                  I
V1  -SLACK             I                    I
                       I                    I
V6  -POLICY         .102*I                  I
V1  -SLACK             I                    I
                       I                    I
V6  -POLICY        -.102*I                  I
V4  -AMBIG             I                    I
                       I                    I
```

E N D O F M E T H O D

1

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Execution begins at 17:48:55

Execution ends at 17:48:55

Elapsed time = .00 seconds

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