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Abstract

This study uses emerging meta-analytic methods, in combination with structural equations methodology, to synthesize empirical studies and extend the understanding of relationships amongthe correlates (antecedents and/or outcomes) of innovation in organizations. this study draws upon a meta-analytic database of 155 independent samples from 108 studies from the period of 1970 through 2004. Specifically, the study examines the impact of 26 determinants and 3 performance outcomes of innovation with an overall sample size of 229,395. Organizational resources account for the majority of unique variance explained in predicting innovation generation. Overall findings indicate that innovation is significantly and positively related to superior performance. Additionally, a multivariate based generalized least squares (GLS) moderator analysis indicates that measurement factors and research design considerations in model specification significantly biases the observed effects within a given study. Using a dichotomous measure of innovation deflates observed effect sizes, while studying innovation cross-sectionally and within one industry sector inflates the observed effect. The findings also help resolve a number of conflicting results. Finally, this study tests an integrative model of product innovation and finds support for innovation as a mediator between environmental and organizational variables and financial performance. The study also identifies surpluses and shortages in the empirical literature on innovation.

Key Words: Product innovation; Literature review; Meta-analysis; Performance; Organizational capabilities; Organizational structure; Organizational demographics; Innovation strategy

1. Introduction

Numerous studies in economics, organizational theory, strategic management, and marketing have focused on studying innovation. Innovation is thought to provide organizations with a means of creating a sustainable competitive advantage and is considered to be an essential component of economic growth (Brown and Eisenhardt 1995; Mandel 2004). In fact, innovation is a key strategic initiative undertaken by organizations that provides a mechanism for alignment with market conditions (Schoonhoven, Eisenhardt and Lyman 1990). Additionally, scholars have stated that innovation is a mechanism by which organizations can draw upon core competencies and transition these into performance outcomes critical for success (Reed and DeFillippi 1991; Barney 1991). While the importance of this domain has not gone unnoticed, there seems to be a lack of clarity on the drivers and performance implications associated with innovation in both academic research and the popular press (Hof 2004; Mandel 2004). To further illustrate this point, scholars have pointed out that past research in this arena has largely been inconclusive, inconsistent, and lacking explanatory power (Wolfe 1994). The lack of consistency within the innovation literature has not gone unnoticed by other scholars. Damanpour (1991) provided an early quantitative synthesis of innovation adoption to address these concerns. Recent reviews of the innovation literature have been limited in their focus, to research on integrated product development (Gerwin and Barrowman 2002), new product development (Brown and Eisenhardt 1995; Krishnan and Ulrich 2001; Sheremata 2000), and mathematical modeling of concurrent engineering (Krishnan et al 1997; Loch and Terwiesch 1998). However, over this time period a substantial but fragmentary body of empirical innovation research has been conducted, but the field still lacks a systematic understanding of the key learnings

Overview of Innovation Research. While scholars and practitioners alike agree on the importance of innovation, the empirical literature examining this important phenomenon is plagued with inconsistent results. Past research highlights several discrepancies present in the literature with regards to the impact of organizational variables on innovation. In fact, the most consistent finding within the innovation literature is that the results are inconsistent with regards to innovation (Camison-Zornoza 2004; Wolfe 1994). For the most frequently investigated organizational antecedents of innovation, the results are conflicting. Variables such as organization size, resource level, diversification, and centralization have received a great deal of attention within the literature, yet no consistent generalization for the relationship between these variables and innovation has emerged. For example, in this study, age has been examined in 22 studies and roughly 9 studies find a

positive relationship between age and innovation, while 6 support a negative relationship and 7 find no relationship at all. Perhaps of even greater interest is the lack of clarity surrounding the innovation-performance link. For example, the relationship between innovation and performance has been found to be positive for financial performance (Ahuja 2000; Robinson 1990; Tsai 2001) while at the same time, several other studies have found the opposite to be true (Boeker 1997; Greve 2003; Kotabe 1990; Mishina, Pollock and Porac 2004). Additionally, the link between innovation and efficiency outcomes is also unclear. Past research has found innovation to have positive (Moorman 1995; Rosner 1968; Souder and Jenssen 1990), negative, and no effect (Majumdar and Venkataraman 1998; Markham and Griffin 1998) on organizational efficiency. It appears that the field will gain from a systematic understanding of the potential sources leading to these inconsistent findings present within the innovation literature. Such an understanding will help in answering which antecedent factors should firms focus on in terms of promoting the generation of innovation, and furthermore, does innovation really pay off for the organization.

Against this backdrop, the objectives of this article are: (1) to provide an up-to-date synthesis of the empirical literature on innovation including antecedents and consequences and uncover the sources of inconsistency present in the innovation literature and (2) to aid in the development of a much needed theory of innovation by testing a more comprehensive model of innovation. Study 1 provides an overall synthesis of the innovation literature and attempts to shed some much needed light on the impact of differing innovation and typologies on observed effects. Study 2 seeks to address the issues of inconsistent results and piecemeal theory development present within the innovation literature by examining antecedents, innovation, and outcomes together in one model.

Sources of Inconsistency in the Innovation Literature.

Innovation Adoption versus Innovation Generation. Organizational innovation studies can be broadly classified into two categories: (1) those where the organization is the adopter of an innovation, and (2) those where the organization generates the innovation (Camison-Zornoza et al 2004). For the most part, past research has failed to distinguish between these two very different activities. This distinction becomes important because the activities behind each type and the performance implications associated with these two activities are markedly different. By combining innovation generation and innovation adoption together it becomes difficult to isolate out the true effect of each. For example, organizational structure has often been touted as being important in the adoption of innovation, while capability and resource variables significantly enhance

the organization's ability to generate innovation. It is absolutely imperative to understand the generation of innovation inside organizations. Innovations generated by the organization, rather than simply adopted by the organization, have the potential to become rare, valuable, imperfectly imitable, and nonsubstitutable resources and have a higher probability of leading to superior performance outcomes for the organization (Barney 1991). Innovation is postulated as a key strategic initiative that is necessary for survival and it is the generation of an innovation that provides firms with the means of using innovation to achieve a competitive advantage within the marketplace.

The activities leading to innovation generation are also different from those that impact innovation adoption. Past syntheses of the innovation literature have primarily focused on innovation adoption by the organization and the organizational variables that impact the propensity of an organization to adopt an innovation (see Damanpour 1991 for a review of this literature). Damanpour (1991) defines innovation as, "the *adoption* of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization" (p. 556). This definition has a broad scope so as to include different types of innovation impacting all parts of the organization and operation activities. However, there has been a tremendous effort within the literature to shift the focus from the adoption of innovation to one of understanding the drivers and performance implications associated with innovation generated by the organization. Given the importance of the generation of innovations, the focus of this synthesis is on innovations developed within the organization. Here we focus on the supply side of innovation rather than the demand side issue of diffusion of innovations among organizations (or innovation adoption). Therefore, for the purpose of our study, we define *innovation as the internal generation of a device, system, policy, program, process, product, or service that is new to the organization* and focus only on integrating those studies that address innovation within this definition[1]. To the best of our knowledge, ours is the first study to empirically synthesize the literature addressing innovation generation. While past reviews have tended to be narrative and/or focused on only one small piece of the innovation literature (new product development, concurrent engineering, integrated product development), our goal is to provide empirical generalizations from a much broader perspective, innovation generation as a whole.

No standard definition/typology of innovation. Past scholars have often found it necessary to categorize and distinguish innovations in order to understand the true nature of the construct (Downs and Mohr 1976). Studies focused on innovation

[1] From this point forward, the term innovation refers to innovation generation.

generation have primarily used the following typologies: (1) product versus process, and (2) radical versus incremental[2]. These different typologies were developed in order to bring some clarity to the study of innovation. While the objective was to help gain a broader understanding of innovation, it is difficult to integrate the research on innovation together with so many different typologies examined. One potential reason for the inconsistent results within the literature is that some studies focus on either product or process innovations, while others do not make the distinction and instead aggregate the two types together. For example, when examining the combination of both product and process innovations the overall result indicates that innovation actually hinders financial performance. However, when one focuses on product innovation in isolation the opposite finding is true. To add to the confusion present within this domain, past research has also demonstrated that the drivers and mechanisms behind the generation of innovation differ for these types of innovation. The question remains as to whether the type of innovation moderates the relationship between: (1) antecedents and innovation, and (2) innovation and performance.

No standard innovation measure. Another reason for conflicting innovation results are that there is no standard measure of innovation (Downs and Mohr 1976). For example, some studies utilize a frequency count measure of innovation that taps into the number of innovations developed by the organization (an output measure). In contrast, several studies use R&D intensity, which is clearly a resource required for innovation generation, and thus taps into the input side of innovation generation. Give that these measures are both considered to accurately reflect organization innovation generation, in reality they may be measuring different components of the innovation process. Therefore one would expect the measure of innovation used to moderate observed effect sizes. We identify 5 different measures of innovation and empirically test whether or not these different measures lead to similar or different conclusions. Ours is the first study to address the issue of measurement bias within this vast literature.

Piecemeal theory development. Another potential reason for conflicting results, in addition to the moderators already discussed, is that the theory development within this domain has largely been piecemeal. All innovation begins with creative ideas. In other words, it is creativity that provides the starting point for innovation generation to occur within an organization. While there have been several different theoretical approaches to examining innovation inside the organization, no one

[2] While we do acknowledge that there is a third typology present within the innovation literature, administrative versus technical, we do not focus on the administrative/technical typology in this study because the majority of the empirical research addressing administrative and technical innovations has been through an innovation adoption lens and there were too few studies that examine innovation generation. Therefore, we are unable to examine it as a source of heterogeneity in innovation generation studies.

comprehensive model of innovation has emerged within the literature. In addition, because innovation can be influenced by so many different variables, it is not possible to empirically examine all of them in one study. Therefore each study has focused on only one narrow set of variables and their impact on innovation in isolation. For example, a great deal of research has focused only the organization structure antecedents of innovation (Collins et al. 1998, Hage and Dewar 1973; Moorman and Miner 1997; Sivadas and Dwyer 2000). Other scholars have looked at innovation through a dynamic capability and contingency lens and examined the impact of the environment on innovation (Teece, Pisano and Shuen 1997; Eisenhardt and Martin 2000). Additionally, other scholars have approached innovation through a RBV framework and focused on the impact of organizational capabilities on innovation (Greve 2003; Mishina et al. 2004; Nohria and Gulati 1996; Tsai 2001). Finally, other studies examine the role of individuals within an organization in the innovation process (Goes and Park 1997; Sivadas and Dwyer 2000; Keister 2002; Rao and Drazin 2002). Because of these multiple perspectives and narrow focus on innovation-antecedent relationships, no one set of antecedent variables have emerged that can differentiate between organizations that are successful innovators from those that struggle with innovation. Moreover, no single study provides a comprehensive overview of the phenomena due to the fact that the focus of most empirical studies has been either on the antecedent-innovation or innovation-performance link. Therefore it is difficult to build a strong theoretical understanding and a nomological net of the nature of this phenomenon.

Summary. In order to address this need within the innovation literature, we build and test a comprehensive model of innovation that draws from the Componential Model of Innovation, which views that the generation of organizational innovation as a product of resources, motivation, and organizational processes (Amabile et al 1988; Amabile et al 1996). In addition to the organizational variables necessary for innovation, research also suggests that there are factors external to the organization (i.e. environmental variables) that impact the generation of innovations within the organization (Woodman et al 1993). Therefore, in addition to these organizational antecedents, we also examine the role of environmental variables in the generation of organizational innovation. We also examine if the type of innovation mediate the impact of antecedents on innovation. Finally, within a single study, we explore the impact of innovation on performance.In addition, does innovation mediate the impact of these antecedents with innovation? A clear understanding of the impact of these different variables is imperative in order to advance the current knowledge base of the literature.

2. Study 1: Meta-Analysis of Innovation

The primary objective of a meta-analysis examining correlations is to describe the relationship between independent and dependent variables, or in this case, between antecedents of and the construct of innovation itself. However, often there is a substantial amount of variation present in the actual correlations, suggesting the presence of moderator variables (Hunter and Schmidt 2004). Then the goal of the meta-analysis is no longer simply to summarize the correlations, but rather becomes a hypothesis-testing tool to examine these moderators (Mathieu and Zajac 1990).

In this study, the procedures for conducting a meta-analysis by Hunter and Schmidt (2004) are followed. Study correlations are open to statistical artifacts, such as sampling error and measurement unreliability. Once these artifacts are controlled for, then a chi-square test should be conducted in order to determine if sufficient variance remains in the results to justify a search for moderator variables. Without sufficient variance, one can conclude that inconsistent findings are in fact completely explained by statistical artifacts.

Sampling Frame. Only studies that actually measured innovation are included in the meta-analysis. In order to identify these studies, the following procedure based upon Capon, Farley and Hoenig (1990) and Gerwin and Barrowman (2002) was used: (1) search of online bibliographic databases (ABI Inform Complete, UMI Dissertation Database, and Business Source Premier) using key words that referred to innovation, (2) manual search of sixteen economic, management and marketing journals covering the period from January 1970 to October 2004 for studies on organizational innovation[3], (3) references used in the Damanpour (1991) meta-analysis of innovation examining innovation generation as well as references in studies found in steps 1 and 2, and (4) authors that had studied innovation in the past were contacted for working papers on innovation.

Sample Characteristics. Overall, 108 empirical studies that measure innovation are analyzed in this meta-analysis and 155 independent samples were coded for the analysis.[4] The sample size for the meta-analysis across all studies was 229,395 observations. 85 studies examined innovation in a manufacturing context and 34 in service industries. 36 studies

[3] Economics (*American Economic Review, Journal of Technology Transfer, R&D Management, RAND Journal of Economics, Research Policy, Quarterly Journal of Economics*); Management (*Administrative Science Quarterly, Academy of Management Journal, Journal of Management, Management Science, Organization Science, Strategic Management Journal*); Marketing (*Journal of the Academy of Marketing Science, Journal of Marketing, Journal of Marketing Research, Journal of Product Innovation Management*)

[4] Having an independent investigator code 10% of the samples included in the database checked the quality of the coding. The intercoder reliability was 1.00.

aggregated innovation scores across multiple industries for analysis. 99 of the studies were cross sectional in nature while 56 utilized a longitudinal research design.

Several other study characteristics are also taken into account. 78 studies use a frequency count of innovation as the measure for innovation. 23 studies use a binary (1/0) measure of innovation. 17 studies use R&D intensity to represent organizational innovation, while 13 studies operationalize innovation as a series of steps taken by organizations to promote innovation. Finally, there are 24 studies that use a scale of radicalness, or newness of the innovation, as the measure of organizational innovation. In addition, typology of innovation used was also coded as a potential moderator variable. There are 107 product innovation studies, 25 process innovation studies; 28 address radical innovations, while only 20 focus on incremental innovations.

Meta-Analysis Procedure. We followed the meta-analytical procedure as set forth by Hunter and Schmidt (2004). In addition, we also followed the procedure set forth by Huffcutt and Arthur (1995) for detecting outliers in a meta-analytic dataset[5]. We first correct each correlation for attenuation using the reliabilities reported for each measure, where reliability information is available[6]. After the correlations are corrected for attenuation, the estimated true correlation (r_t) between each independent variable and the innovation construct is calculated. In order to calculate the mean r_t, each corrected correlation for a given study is weighted by the sample size and averaged across studies. The next step is to calculate the estimated population standard deviation (s_p^2) and finally, a chi-square statistic that allows for the assessment of the heterogeneity across the studies after correcting for statistical artifacts (Hunter and Schmidt 2004). A significant chi-square indicates the presence of moderator variables. It is also necessary to compute the 95% confidence interval around the mean corrected correlations. We calculate both bootstrapped and bias confidence intervals to examine the significance of the mean-corrected correlations. Moreover, a fail-safe N is calculated for each variable in order to assess the possibility of publication bias or the "file-drawer" problem in the analysis. This information given in the last column of Table 1 indicates the number of other studies that would have to be included in the analyses in order to change the correlation to $r<0.01$, yielding confidence in the results of the meta-analysis (Hunter and Schmidt 2004). The larger the fail-safe N, the greater the confidence one has

[5] Outliers for this dataset were identified using the sample-adjusted meta-analytic deviancy (SAMD) statistic as proposed by Huffcutt and Arthur (1995). The identification of outliers eliminated 5 innovation correlations out of the sample of 531 innovation correlations coded from the samples.

[6] Corrected r_x = uncorrected r_{xy} * reliability x. reliability y. We corrected for measurement error using Hunter and Schmidt's (2004) artifactual distribution approach, since Cronbach alpha values were not available in every study.

in the results obtained in the overall analysis. For example, variables such as diversification, network, resource level, size, champion, efficiency, and subjective performance would require over 1,000 additional studies each with a correlation of 0 to change the mean correlation with innovation to 0.01.

[Insert Table 1]

Results from Overall Analysis. A summary of the meta-analysis is presented in Table 1. Using the componential model of innovation as a guiding framework, the antecedents of innovation can be broadly grouped into Environmental, Resources, Motivation and Process variables (Amabile 1988; Amabile et al 1998; Woodman et al. 1993). Table 1 also provides a description of the effect size of the relationships between the antecedent variables and innovation in accordance with the guidelines set forth by Cohen and Cohen (1983), where correlations less than 0.10 are considered to be small, correlations ranging from 0.10 to 0.30 are medium, and correlations greater than 0.30 are large. The consequences, or outcomes of innovation, have been categorized into three distinct types: (1) financial performance, (2) efficiency gains, and (3) self-report subjective measures of innovation performance. Classifying variables as either antecedents or consequences provides a useful means for discussing the results (Mathieu and Zajac 1990) (See Table 2 for theoretical rationale underlying these antecedents and outcomes of innovation; Appendix 1 provides the definitions of the antecedent constructs). The overall meta-analysis results are summarized in Figure 1.

[Insert Figure 1] and [Insert Table 2]

Environmental Factors. External factors are expected to be associated with increased levels of innovation. A dynamic environment requires organizations to innovate in order to adapt to the changes (Meyer and Goes 1988; Nohria and Gulati 1996). Prospect Theory argues that in times of great uncertainty, organizations are more likely to be risk seeking and therefore more likely to innovate (Kahneman and Tversky 1979). However, competition and environmental turbulence have a relatively small impact on innovation.

Organizational Resources. The resource-based and dynamic capabilities view of the firm argues that organizational resources and capabilities provide the stimulus necessary to achieve a competitive advantage in the marketplace (Barney 1991; Teece et. al 1997). One potential mechanism through which superior performance can be obtained is through innovation. Therefore, it is expected that organizational resources capabilities will be drivers of innovation. Resources are defined as "everything that the organization has available to aid work in a domain targeted for innovation" (Amabile et al 1996, p. 1156). Overall results suggest that an organization's past innovation (a proxy for innovation stock) and the

presence of an innovation champion have the strongest correlation with innovation. In addition, an organization's diversification, network ties, and specialization are all positively related to innovation. The results of the overall analysis suggest that organizational age, resource level, and size are positively related to innovation the magnitude of this relationship is relatively small. Public ownership also has a significant positive relationship with innovation at the organizational level. Management education level and professionalism are positively correlated with innovation. However, managers' tenure level, which is posited to negatively impact innovation throughout the literature, shows a correlation of zero (Meyer and Goes 1988; Rao and Drazin 2002). Additionally, the urbanization surrounding a company seems to positively impact the generation of organization innovation.

Motivation. In addition to organizational resources, the organization must also possess a desire to generate innovations. Organizational motivation for innovation refers to an increased orientation towards innovation (Amabile 1988). Overall results indicate that clan culture, which stresses employee participation, cohesiveness, and teamwork to promote organizational change, has the strongest relationship with innovation. Not surprisingly, an organization's openness to change has a strong significant relationship with innovation generation in the overall sample. Competitor and customer orientation are also positively related to innovation.

Organizational Processes. The final input necessary for innovation generation are organizational processes that provide the structure necessary for the facilitation of organizational innovation. Past research has argued that organizational structure is the primary driver of innovation because structure and processes provide the formal, internal context that is required in order for innovation to occur inside the organization (Russell 1990; Wolfe 1994). Overall results suggest that structure is in fact positively related to innovation. Organizational complexity, formalization, and interfunctional coordination provide support to the role of organizational processes in the facilitation of innovation. In addition, organizational and team communication are positively related to innovation. Surprisingly, while centralization has been the focus of a great deal of research, the results indicates that it is not significantly related to innovation (Collins, Hage and Hull 1988; Dewar and Dutton 1986; Ettlie and Rubenstein 1987; Hage and Dewar 1978).

Outcomes. The link between innovation and performance is well established in the literature (Han, Kim and Srivastava 1998). The overall analysis partially supports this expectation. Results suggest that innovation is positively related to efficiency and subjective performance outcomes in this analysis. However, the corrected mean correlation between

innovation and financial performance is negative and suggests that on average innovation generated within the organization detracts from firm performance. Innovation has the strongest relationship with efficiency gains in an organization and the weakest relationship with financial performance.

In addition to the overall analysis, we were also interested in examining which set of predictor variables explains the greatest amount of unique variance in innovation. In order to conduct this analysis, a correlation matrix for the dataset was constructed and several regression models were hierarchically run. The unique variance attributable to each variable (Environmental, Resources, Motivation and Processes) is equal to the difference in the adjusted-R^2 between the model with all 4 predictor variable sets included and the model with that particular variable set excluded. The difference between the full model (with all four predictor sets) and each of the 3 predictor set models shows the unique contribution of each (See bottom of Table 4). From the results of this analysis one can see that organizational resources account for the majority of the variance in innovation. Organizational resources uniquely account for 47.8 percent of the variance in innovation, while environmental and motivation variables uniquely account for only 2.9 and 9.9 percent of the variance respectively. Interestingly our results suggest that organizational process (i.e. structure), which past research has demonstrated as being of vital importance for innovation adoption, does not seem to be a key driver of innovation generation and explains only 4.2 percent of the unique variance in innovation.

Moderator Analysis. As a follow up to the overall meta-analysis, we conducted several tests to check for the presence of moderators in our data set. The first indicator of moderators is to examine whether or not statistical artifacts explain the variance in observed correlations (Hunter and Schmidt 2004). The chi-square test (shown in Table 1) indicates that the between study variance was in fact due to statistical artifacts in 2 of the 29 variables examined. Both of the studies are based on seven or fewer samples. However, the remaining 27 analyses indicate that there are potential moderators of the innovation-variable relationship.

In addition to the standard procedure as set forth by Hunter and Schmidt (2004), an omnibus test for the presence of moderators was performed using Structural Equations Modeling (Joreskog and Sorbom 2001). All of the correlations between the independent variables and dependent variables were computed[7]. Additionally a separate correlation matrix was constructed for each independent variable that eliminated outliers and resulted in a non-significant chi-square in the

[7] Where information was available.

previous analysis (a correlation matrix without moderators present). After construction of the two correlation matrices, the variables were analyzed using a multi-group comparison in LISREL 8.51 (Joreskog and Sorbom 2001). The results indicate with certainty that there are in fact differences between the two correlation matrices providing further evidence of moderators within the data set ($\chi^2_{(78)}$ = 48,204.16, RMSEA = 0.29).

To examine the impact of moderators on the innovation-variable relationship, a generalized least squares regression (GLS) approach was taken. GLS can overcome the assumption of independence that is necessary in other multivariate analysis techniques. The correlations in this analysis cannot be treated as independent because each sample in the meta-analysis provided more than one innovation pairwise correlation. Therefore it is necessary to model within-sample dependencies and in turn safeguard against samples that yielded more information biasing the results. In order to model these dependencies, it was necessary to calculate the block diagonal variance-covariance matrices for each sample and analyze them together in a single analysis (Raudenbush et al 1988). As pointed out by Raudenbush et al (1988, p.112):

> "Perhaps most important, the method [GLS] provides a systematic framework for examining whether different outcomes respond similarly or differently to treatments and whether these treatment effects depend on features of study design, sampling, and implementation."

For each sample the variances and covariances were calculated (Becker 1992; Becker and Schram 1994) as:

$$Var(r_{inn,x}) = (1 - \rho^2_{inn,x})^2 / n, \quad [1]$$

$$Cov(r_{inn,x}, r_{inn,y}) = [\frac{1}{2}(2\rho_{x,y} - \rho_{inn,x}\rho_{inn,y}) * (1 - \rho^2_{inn,x} - \rho^2_{inn,y} - \rho^2_{x,y}) + \rho^3_{x,y}] / n, \quad [2]$$

where $r_{inn,x}$ is the sample correlation between innovation and variable x, $\rho_{inn,x}$ is the corresponding population correlation, and n is the sample size. From these calculations, a matrix consisting of variance and covariance values for each sample was constructed (Σ_i), with the full covariance matrix for the meta-analysis denoted as Σ. In order to examine the impact of moderators, the following model was estimated

$$d = X\beta + e, \quad [3]$$

where d is the effect size of the innovation-antecedent variable relationship, and the parameter β is estimated through GLS estimation. In order to estimate β, the following equation was used

$$\beta^* = (X' \sum^{-1} X)^{-1} X' \sum^{-1} d, \quad [4]$$

with the variance-covariance matrix of β* being:

$$V_{\beta^*} = (X' \sum^{-1} X)^{-1}, \quad [5]$$

Four broad categories of moderators have been identified as critical in meta-analytic studies: (1) measurement method, (2) research context, (3) estimation procedure, and (4) model specification (Assmus, Farley and Lehmann 1984;

Capon, Farley and Hoenig 1990; Farley, Lehmann and Sawyer 1995). However, in this study, since the effect size under consideration is the Pearson product moment correlation, it is not affected by either model specification or the estimation procedure. Consequently, we consider three measurement factors: (1) innovation measure, (2) innovation typology, and (3) temporal nature of the data (cross-sectional versus longitudinal). In addition, we examine one research context moderator, namely, industry type (see Figure 2). The rationale behind the impact of these moderators is provided in Table 3.

[Insert Figure 2] and [Insert Table 3]

Moderator Results. The results from the generalized least squares regression are summarized in Table 4.[8] Overall, the results provide support for our moderator hypotheses. A discussion of specific results follows.

Measure of Innovation. It is hypothesized that the measure of innovation employed will significantly impact the correlations observed between innovation and other constructs. The five primary methods of innovation measurement used are: (1) frequency count measure that is the summation of all innovations adopted within an organization, (2) a dichotomous measure of innovation generation, (3) R&D intensity as a surrogate for innovation, (4) a scale of organizational steps geared at the creation of innovation, and (5) a scale of innovation radicalness, or newness to the organization and/or customer base. In particular, Hypothesis 1 predicts that a dichotomous measure of innovation will exhibit lower effect sizes than samples using other measures of innovation. The parameter estimate for Measure 2 is negative (β=–0.692, $p<0.001$) thus supporting Hypothesis 1. Therefore we can conclude that dichotomous measures of innovation negatively bias the observed effect size of innovation relationships. Additionally, the results indicate that the other measures of innovation also bias the observed effect sizes of innovation relationships. Results suggest that measurement of innovation significantly impacts the effect sizes observed and future research can benefit from using multiple measures of innovation.

[Insert Table 4]

Typology of Innovation. Despite the prevalence of these different typologies in innovation studies, the focus of this moderator analysis is the impact of categorizing innovation as being either product or process and radical or incremental in innovation relationships. Product innovations involve the development of a new product while process innovations are new elements that are developed for an organization's production or service operations (Knight 1967; Utterback and Abernathy 1975). In order to conduct the moderator analysis, all samples were coded as a product innovation, a process innovation, or

[8] The GLS regression only examined the impact of variables with a sample size of 10 or greater.

some combination of both. Of the 155 samples, 107 examined product innovations, 25 samples were based on process innovations, and 23 samples examined both product and process innovations together. The results of the moderator analysis finds support for Hypothesis 2a and indicate that studying product innovations and process innovation in isolation tends to inflate the effect size of innovation relationships as compared to examining these same relationships with a pooled sample of the two types of innovation (β=0.446, β=0.682, $p<0.001$, respectively). This finding provides support for Downs and Mohr's (1976) need to categorize innovation in order to gain a true understanding of the nature of innovation.

In addition, recent studies have also focused on the differential impact of radical and incremental innovations within the organization (He and Wong 2004). Radical innovations fundamentally change the activities of an organization and represent clear departures from the previous way of conducting business. Innovations that do not cause significant departure from the status quo are considered incremental in nature (Chandy and Tellis 1998). Therefore we also wanted to understand the differences between focusing on radical and incremental innovations and the effect sizes obtained. Hypothesis 2b argues that studies focusing on radical and incremental innovations in isolation will bias observed effect sizes as compared with those studies that do not discriminate between the degree of change associated with the innovation. We find support for Hypothesis 2b. Studies that focus only on radical innovations positively bias observed effect sizes (β=0..558, $p<0.001$), while studies examining only incremental innovations negatively bias the correlations observed (β=-0.850, $p<0.001$). Therefore results suggest that studying radical and incremental innovations in isolation do in fact yield very different conclusions.

Temporal Design. Hypothesis 3 predicts that examining innovation either with a cross-sectional research design or longitudinally will bias the effect sizes observed. We do not find support for Hypothesis 3 (β=-0.069, $p<0.001$) and results instead suggest that studying innovation at one point in time will deflate the true effect size of these innovation relationships compared to examining the impact of innovation over time. This finding indicates a need for researchers to be cognizant of the differences in studying innovation at one point in time versus longitudinally.

Industry Characteristics. Innovation has been examined in several different contexts. The objective of Hypothesis 4 is to investigate the impact of studying innovation in manufacturing and service industries. Specifically, it addresses the question: whether industry characteristics result in meaningful differences between the effect sizes found between antecedents and consequences of innovation. We find support for Hypothesis 4 and results suggest that studying innovation in either a

manufacturing (β=0.897, p<0.001) or service setting (β=0.493, p<0.001) inflates the effect size of innovation relationships as compared with studying innovation with a pooled sample from both settings. Therefore studying innovations using pooled samples from multiple contexts will lead to weaker results than simply conducting the study within one context.

Study 1 provides an overall synthesis of the innovation literature and offers some explanation as to why there are so many inconsistencies present within the innovation domain through a multivariate moderator analysis. Overall the results suggest that organizational resources explain the greatest proportion of unique variance in the innovation construct compared with that of motivation, process, and environmental variables. In addition, we find that innovation generation is negatively related to financial performance, but has a positive relationship with organizational efficiency. Finally, Study 1 highlights the impact of research design and context on innovation effect sizes, namely that innovation generation is a context-dependent phenomena and future studies should take into account both the nature of the innovation and the context. .

3. Study 2 – Is Innovation a Mediator between Organizational and Environmental Antecedents and Firm Performance?

While the focus of Study 1 is to provide a synthesis of the empirical literature investigating innovation generation and uncover potential reasons for the inconsistency present within the literature, the objective of Study 2 is to test a more comprehensive model of innovation than has been done in the past and thus aid in theory development within this domain. In addition, Study 2 seeks to resolve several conflicting results within the innovation literature. As mentioned earlier, there are multiple perspectives used to investigate innovation generation and past studies focus on examining only a narrow set of innovation relationships.

The Componential Model of Innovation views that the generation of organizational innovation as a product of resources, motivation, and organizational processes (Amabile et al 1988; Amabile et al 1996). Resources consist of anything and everything the organization has available to aid in the generation of an innovation. Motivation refers to the basic orientation of the organization towards innovation and supports for creativity and innovation throughout the organization. Finally, organizational processes must also be present in order for the organization to capitalize upon these resources and the motivation to innovate. Building upon these organizational variables that must be present in order for innovation to occur, research has also suggested that there are factors external to the organization (i.e. environmental variables) that impact the generation of innovations within the organization (Woodman et al 1993). Therefore, in addition to

these organizational antecedents, we also examine the role of environmental variables in the generation of organizational innovation.

Despite the overall findings of Study 1, past research has asserted that there is in fact a direct, robust relationship between organizational innovation and performance (Han et al. 1998). Additionally there is a lack of understanding surrounding the relationship between the antecedents of innovation (resources, motivation, processes, and environment), innovation itself, and organizational performance outcomes. These relationships have yet to be empirically investigated with one sample (Wolfe 1994). The Resource-Based View postulates that innovation is one possible mechanism by which organizations can gain a competitive advantage in the marketplace through unique organizational resources (Barney 1991). Product innovation can be the source of competitive advantage to the innovator and at the same time can lead to a sustainable increase in firm profits (Geroski, Machin and VanReenen 1993; Chandy and Tellis 1998). Past research supports the argument that innovation serves as a key mediator between antecedents of innovation and performance (Conner 1991; Damanpour and Evan 1984; Han et al 1998). In particular, innovation mediates the relationship between environmental uncertainty and performance. Firms faced with intense competition and turbulent environments often rely upon innovation as the primary driver of organizational performance (Gronhaug and Kaufman 1988). Innovation provides organizations with a means of adapting to the changing environment and often is critical for firm survival. Additionally, the relationship between organization level variables and performance are also mediated by innovation. Organization processes provides the internal configuration, including communication and resource flows, necessary for innovation to occur (Russell 1990). Organizational resources provide organizations with the inputs required for innovation that in turn can provide the organization with superior performance (Eisenhardt and Martin 2000).

Testing for Mediation. In addition to providing a quantitative integration of past research within a domain of study, meta-analytic-data is emerging as a means of testing alternative models within a research stream. By combining the principles of traditional meta-analysis and those of structural equations modeling, it is possible to test integrated models involving several constructs in order to advance theory development within the domain (Viswesvaran and Ones 1995). The combination of these two methodologies allows for the optimal testing of integrated models. Correcting artifacts present within a meta-analytical sample and using this data in a SEM analysis achieve accurate assessment of causal models and linkages between constructs of interest.

The first step in testing an overall model of innovation is the construction a complete correlation matrix. Results from the first part of this study indicate that a pooling of correlations across innovation types will lead to significant confounding of the results. Therefore, in order to decrease the amount of variation in the dataset due to moderators, the correlation matrix was constructed for samples addressing only product innovations. Due to an incomplete correlation matrix, several variables had to be excluded from the analysis. Therefore the model was tested using nine antecedents to product innovation (competition, turbulence, age, centralization, formalization, diversification, resource level, size, and innovation champion) and 1 performance outcome (financial performance) using LISREL 8.51 with maximum likelihood estimation. The harmonic mean of the sample size is used in the analysis so as to not give undue influence to studies with larger sample sizes (Viswesvaran and Ones 1995).

Alternate Models and Model Testing. Three models of innovation were analyzed and are reported below. The first model posits innovation as a key mediator between environmental and organizational antecedents and financial performance. Two alternate models were analyzed so as to serve as a robustness check for the full mediation model. The second model estimated allows innovation to serve as a partial mediator between these relationships. Finally, a third model was estimated in which innovation was included as an antecedent to innovation along with the other environmental and organizational variables. The results of the model testing are provided in Table 5.

[Insert Table 5]

Model 1 positions innovation as a key mediator, or mechanism by which environmental and organizational antecedents allow organizations to realize increased financial performance. The model yielded a good fit ($\chi^2_{(37)}$ of 116.71, GFI = 0.98, RMSEA = 0.050). Turbulence, diversification, resource level, size, innovation champion, and openness to change are all significantly related to innovation (see bottom of Table 5 for path coefficients). Organizational age, centralization, and formalization are not significant predictors of product innovation. The model does indicate that product innovation is positively associated with financial performance, (β=0.16, $p<.01$), thus shedding additional light on the nature of the relationship between innovation and performance. Interestingly, while the overall analysis found a negative relationship between innovation and financial performance, this analysis suggests that the opposite is true for product innovation.

Robustness Checks. Much of the power associated with structural equations modeling is the ability to test alternate models[9]. The second model positions innovation as a partial mediator between the antecedents and financial performance. The resulting fit is good ($\chi^2_{(28)}$ of 96.47, GFI = 0.98, RMSEA = 0.051). However, in this model innovation is not found to be a significant predictor of performance. Interestingly, while age is not a significant predictor of innovation, it does have a significant negative relationship with financial performance. Environmental turbulence, innovation champion, diversification, resource level, centralization, and innovation champion do not have a significant relationship with performance. Results suggest that size and openness to change have both a direct and indirect (through innovation) relationship with performance.

Because Model 1 (innovation as a mediator) and 2 (innovation as a partial mediator) are nested, it is possible to conduct a χ^2 difference test to compare the models. The test indicates that there is no significant difference between the two models (Comparison of Model 1 and Model 2: χ^2_{diff} = 20.24, d.f.=9, p>0.10). Therefore, we find support for innovation as a mediator and can conclude that product innovation is a mechanism through which superior financial performance is achieved.

The final model tested did not include product innovation as a mediator, but rather tests the direct linkages between the antecedents of interest, including innovation, and financial performance. This model yielded a significantly poorer fit ($\chi^2_{(37)}$ of 250.73, GFI = 0.95, RMSEA = 0.072). Results indicate that age, size, formalization, openness to change, and innovation are all significantly related to financial performance. However, turbulence, innovation champion, diversification, resource level, and centralization do not have a significant impact on performance. A comparison of Model 1 and Model 3 indicates that innovation does serve as a significant mediator between antecedents and financial performance (Comparison of Model 1 and Model 3: χ^2_{diff} = 134.02, p>0.10).

In addition to overall model testing for mediation, we also conducted more formal statistical tests of mediation (Barron and Kenny 1986; MacKinnon, Warsi and Dwyer 1995). These tests show the extent to which innovation mediates the relationship between environmental and organizational antecedents with financial performance. The formula used to conduct the mediation test follows (MacKinnon, Warsi and Dwyer 1995):

[9] As a further robustness check we followed the procedure set forth by Cheung and Chan (2005) using TSSEM to estimate the structural model on a subsample of the studies included in the analysis. Due to the large number of studies included, it was not possible to conduct this multi-group analysis on the entire sample. The results obtained were consistent with the results in the original model estimation thus eliminating sampling variation as the cause of the results obtained.

$$z = \frac{ab}{\sqrt{b^2 s_a^2 + a^2 s_b^2 + s_a^2 s_b^2}}, \qquad [6]$$

where the path from the independent variable to the mediator is a and its standard error is s_a^2, and the path from the mediator to the dependent variable is b and its standard error is s_b^2. Results show strong support for the role of innovation as a mediator for innovation champion, diversification, resource level, size, and openness to change with that of performance. Marginal support is found for the role of innovation as a mediator in the turbulence-performance relationship (See Table 5). Therefore, one can conclude that innovation does in fact play a role in organizational performance and serves as a link between certain antecedents and financial performance, thereby supporting the mediation model and the resource-based view of the firm. Innovation created by the combination of organizational resources provides organizations with a unique resource that can be capitalized upon in the marketplace (Conner 1991).

Results and Discussion. In addition to using SEM to test model structures, the model testing analysis can also empirically answer the questions regarding the true relationship between innovation and other core constructs (as highlighted in Table 5). The section below empirically addresses several of the inconsistent findings present within the innovation literature.

Environmental Variables. Much of the focus of recent research regarding innovation has been on the role of the environment in the innovation process. Past research has shown that the environment has a positive impact on innovation and that innovation is influenced by environmental pressures (Dosi 1988; Nohria and Gulati 1996). Hypothesis 1 predicts that the level of turbulence present within the environment will be positively related to innovation. Strong support is found for Hypothesis 1 (γ=0.10, $p<0.01$) suggesting that innovation provides organizations with a mechanism for dealing with the uncertainty present within the environment. In times of high turbulence, the uncertainty present in the environment may drive innovation because organizations are constantly scanning their environment for new opportunities (Henderson and Clark 1990; Damanpour and Gopalakrishnan 1998). While environmental turbulence is a driver of innovation, it is not significantly related to financial performance.

Organizational Variables. While the theoretical rationale and proposed relationship behind both of the environmental antecedents are the same, the role of organizational level variables on innovation all have considerable controversy. The impact of age on innovation has been studied quite extensively in the literature with mixed results (see Table 6). On the one hand, older organizations are thought to be better at innovation because they have established resources and procedures

for survival (Chandy and Tellis 2000; Kimberly and Evanisko 1981). Yet other scholars have demonstrated that with age organizations become rigid and are less open to change (Rao and Drazin 2000). The results do not find support for Hypothesis 2 (γ=0.00, p>0.10), indicating that age is not significantly related to organizational product innovation. Perhaps even more surprising is that age is negatively related to financial performance. This finding is somewhat unexpected because past research has found that older firms demonstrate a high potential for survival and are thought to have the capabilities necessary to achieve superior financial performance (Kimberly and Evanisko 1981).

Hypothesis 3 predicts a positive relationship between the presence of an innovation champion and the generation of organizational innovation. Champions nurture the innovation from conceptualization and use their influence to gain the necessary inputs in order for innovation to occur. Our results support this argument and Hypothesis 3 (γ=0.32, p<0.01). Therefore, organizational innovations are more likely to occur when there is an innovation champion. Not surprisingly, the relationship between innovation champion and financial performance was nonsignificant.

Diversification has also been subject to conflicting predictions as to its association with innovation. Our model testing finds that diversification is positively related to product innovation, thereby supporting Hypothesis 4 (γ=0.16, p<0.01). However, diversification is not significantly related to financial performance. It appears that firms that are highly diversified can take advantage of this greater knowledge base and increase their level of product innovation (Hitt et al 1996). However, diversification by itself does not promote or hurt financial performance.

Hypothesis 5 examines the relationship between resource level and innovation. The results of the model testing demonstrate with certainty that resources are a necessary input to product innovation (Goes and Park 1997), thus supporting Hypothesis 5 and the notion that the greater the resource levels of a firm the greater their flexibility to pursue new product innovations (γ=0.22, p<0.01). However, the resource level of an organization does not have a significant relationship with firm financial performance in the model.

As a follow-up to the resource level argument, organizational size is thought to promote innovation through resource availability and knowledge diversity arguments and our model supports this notion and Hypothesis 6 (γ=0.23, p<0.01). Additionally, size is positively related to financial performance. Therefore, results suggest that organizational size does in fact promote innovation through the communication of diverse ideas within the organization and increased access to resources and has both a direct and indirect relationship with performance.

Hypothesis 7 predicts that an organization's openness to change will have a positive relationship with organizational innovation. Openness to change is indicative of an organization's tolerance for change and a culture open to the expression of new ideas (Meyer and Goes 1988; Chandy and Tellis 1998). Results support Hypothesis 7 (γ=0.30, p<0.01). In addition, overall results find that openness to change also has a positive impact on financial performance.

Both the overall meta-analysis and the model testing of product innovation find that the relationship between centralization and innovation is not significant. Therefore we do not find support Hypothesis 8. Not only is centralization unrelated with innovation, it does not have a significant relationship with financial performance in this model either. The take-away from this finding is that a concentration of power within an organization may not directly impact the generation of innovation or financial performance.

Formalization is thought to detract from organizational innovation generation because it limits organizational flexibility (Robbins 1990). Therefore, Hypothesis 9 posits there to be a negative relationship between formalization and innovation. Our results do not support this hypothesis and find no significant relationship between formalization and innovation. There is however, a significant positive relationship between formalization and financial performance (γ=0.17, p<0.01). Therefore, our results suggest that organizational procedures and processes appear to enhance firm financial performance.

Finally, this analysis was able to empirically examine the impact of product innovation on financial performance. Innovation provides organizations with a means of creating a competitive advantage in the marketplace that in turn will provide organizations with superior financial performance (Ahuja 2000; Han et al 1998). However, scholars have often posited that while innovation has the potential to create the opportunity for increased performance, the act of innovation can be very costly and risky and has the potential to decrease financial performance (Markham and Griffin 1998). We find support for this first argument, and thus Hypothesis 10, and results suggest that product innovation does increase financial performance (γ=0.16, p<0.01). Our findings indicate that innovation is a mechanism through which organizations can achieve a competitive advantage in the marketplace.

4. Summary, Limitations, Directions for Future Research, and Conclusion

The key objectives of this study are three-fold. The first objective is to provide an up-to-date synthesis of 35 years of innovation research findings from economic, strategy, and marketing literatures on innovation generation through meta-

analysis. While past research on innovation has primarily focused on innovation adoption, our study is the first to isolate out the generation of innovations at the organizational level. Secondly, we seek to highlight and explain sources for the conflicting findings that have plagued the innovation literature. Finally, we use emerging techniques in meta-analysis to test a more comprehensive model of innovation. We provide empirical evidence of the nature of the relationship between innovation generation and its antecedents and consequences, while at the same time providing answers to conflicting conclusions within this field. The conclusions reached in Study 1 provide a greater understanding of the drivers of innovation generation as well as the implications associated with the phenomena. We are able to isolate out the impact of examining product or process innovations on observed effect sizes, as well as understanding the biasing impact of examining radical versus incremental innovations. Moreover, Study 1 is the first to empirically examine the impact of measurement on observed effect sizes within the innovation literature. Study 2 seeks to aid in building a strong theoretical foundation relating to the nature of the relationship of innovation with key antecedents and outcomes by testing the most comprehensive model of innovation to date. We are able to demonstrate that innovation serves as a mediator of the relationships between organizational and environmental antecedents and firm performance.

Our research sheds some much needed light on the nature of innovation generation at the organizational level. The distinction between innovation generation and adoption is critical because the activities associated with each type are very different. Therefore the conclusions garnered from adoption research may not generalize to issues relating to the generation of innovations. In turn, the performance implications associated with innovation generation and adoption are thought to be different as well. If you look at past syntheses of organizational adoption, the focus has primarily been on the impact of organizational structure and demographics in prediction organizational innovation. Our study takes a different approach and instead focuses on the inputs necessary to generate innovation and the performance implications associated with innovative activities. We find organizational resources to be absolutely essential in the generation of innovations, and in turn, these innovations yield superior performance outcomes for the organization. Future studies need to be clear as to whether they are focusing on innovation generation or adoption.

In the past, studies have tended to treat all innovation as being equal thus leading to inconclusive results and generalizations. Our research demonstrates that one such cause of this inconsistency stems from the use of different innovation typologies within the literature. The question addressed in our research is whether or not the innovation

relationships examined will be stronger or weaker depending upon the type of innovation studied. Our results strongly suggest that the typology of innovation utilized does have a major impact on the conclusions generated by the research. Studying product innovation or process innovation in isolation of one another strengthens the relationship observed as compared with those studies that combine the types of innovation into one broad innovation study. Furthermore, the results from the moderator analysis highlight some interesting differences between product and process innovations. The overall results from the meta-analysis do not find a significant relationship between innovation and performance. However, when product innovation is examined in isolation, the relationship between product innovation and financial performance becomes significant and positive. Some studies have questioned the value of product innovation for the firm (or not found the result) and our study, by aggregating across 107 studies, finds that product innovation does enhance firm performance and can be considered a source of competitive advantage. Therefore, by focusing on innovation generation we are able to answer the controversy as to whether firms should invest in product innovations, and the answer is a resounding yes. The impact of process innovation on firm performance is not quite as clear. It could be the case the perhaps process innovations take longer to payoff for the organization and in fact, they may not directly impact a firm's financial performance. Future research should clarify this relationship between process innovations and financial performance.

Furthermore, our results suggest that examining radical versus incremental innovations yield significantly different conclusions. Radical innovation studies enhanced the effect size observed, while studies examining incremental innovation in isolation negatively bias the observed effect. Results support the argument that innovations that are exploratory (radical) do behave differently than those innovations that are exploitative in nature (incremental). Future studies on innovation need to be clear as to whether they are focusing on product or process innovations, radical or incremental innovations because the results will vary depending on the type of innovation. Therefore, studies that lump innovations together will muddle out the true effects and thus lead to different conclusions than those focused on only one type of innovation.

Our study is also the first in this area to empirically examine the impact of measurement on the conclusions reached within the literature. There are five primary measures used in innovation literature and our results support that each measure is different and matters a lot in the results observed. The measure of innovation used can significantly alter the conclusions garnered from a particular study. Overall, a dichotomous measure of innovation negatively biases the observed correlations. Future research should seek to utilize the measure of innovation best suited for the particular research

question being addressed and possibly use a combination of innovation measures. Studies focused on the implementation of innovations generated by the organization would do well to use a frequency count of innovations. However, studies focused on the development or beginning phases of innovation, would be better suited to use a measure like R&D intensity or scale of organizational steps used to promote innovation over a frequency count measure which only taps into the implementation side of the innovation process.

Finally, we are able to also empirically test relationships with conflicting theoretical rationale and provide some clarity regarding these relationships. In alignment with past research, the focus of this study remains on innovation main effects. Although we were unable to do so in this study, we recognize the possibility for nonlinear relationships between organizational antecedents and innovation as well as interactions between the independent variables. This remains an area for future research.

While there is a vast amount of research within the innovation domain, there is no one overarching theory of innovation. As pointed out earlier, the majority of the theoretical development within this area has been piecemeal. Our research supports that role of organizational resources and motivation account for the majority of the unique variance within the innovation construct, while environmental and organizational process variables explain very little in the creation of an innovation. Our results suggest that managers should be investing in these resource and motivation inputs to innovation in order to promote the generation of new products within the organization.

The focus of the majority of the innovation research has been either on the relationship between innovation and its antecedents or the relationship between innovation and associated performance outcomes. Very few studies have attempted to model the entire relationship and focus on the role of innovation as a mediator, despite the theoretical rationale for its role as a mechanism through which organizational inputs can be transformed into a competitive advantage for the organization. Results from Study 2 empirically support innovation's role as a mediator and in accordance with the componential theory of innovation and Resource Based View and provide strong evidence that product innovation does in fact provide organizations with a means of achieving a competitive advantage in the marketplace. Innovation serves a key mediator for innovation champion, diversification, resource level, organizational size, and openness to change. Additionally, environmental turbulence has both a direct and indirect (through innovation) relationship with financial performance. Organizational variables by themselves are simply not enough to achieve superior performance, but rather the impact of

these resources on performance occurs via innovation. Our results support the argument that innovation is a means by which organizations can address the dynamism present within their environments and still thrive.

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Table 1: Meta-Analysis Results of Antecedents and Consequences of Innovation

	k	N	r	r_t	sd_t	Bootstrapped 95% CI		Bias 95% CI		ES	χ^2	N_{fsR}	N_{fsO}
ENVIRONMENT													
Competition	27	7206	0.09	0.08	0.060	0.020	0.154	0.003	0.147	S	88.77***	356.30	2064.10
Turbulence	26	5608	0.10	0.11	0.067	-0.065	0.217	-0.028	0.218	M	48.07***	461.90	2755.40
RESOURCES													
Age	22	6580	0.05	0.06	0.056	0.004	0.126	0.016	0.138	S	89.97***	171.50	1357.20
Champion	17	2257	0.25	0.29	0.080	0.134	0.480	0.152	0.499	M	38.10***	1024.00	4932.70
Diversification	30	10802	0.12	0.12	0.051	0.038	0.187	0.041	0.190	M	84.72***	1353.50	3475.20
Education	16	2023	0.16	0.12	0.084	0.004	0.281	0.017	0.320	M	45.87***	219.10	1867.60
Network	23	5881	0.23	0.15	0.058	0.050	0.277	0.032	0.261	M	84.03***	1533.20	3521.30
Past Innovation	8	2138	0.33	0.35	0.054	0.115	0.558	0.111	0.558	L	27.31***	589.10	2830.20
Professionalism	12	1357	0.26	0.23	0.086	0.154	0.337	0.148	0.324	M	30.31***	298.70	2784.60
Public Ownership	5	939	0.16	0.15	0.071	0.097	0.211	0.097	0.213	M	8.11*	33.80	755.10
Resources	68	107059	0.18	0.01	0.018	-0.003	0.191	-0.004	0.172	S	1859.90***	8720.70	801.50
Size	72	116222	0.18	0.01	0.022	-0.019	0.162	-0.020	0.162	S	1155.50***	11984.60	302.00
Specialization	5	696	0.24	0.19	0.080	0.107	0.348	0.107	0.353	M	8.13*	48.90	942.90
Tenure	12	2392	0.00	-0.02	0.070	-0.077	0.069	-0.094	0.056	S	27.27***	0.00	0.00
Urbanization	8	1102	0.19	0.17	0.081	0.125	0.229	0.126	0.230	M	21.50***	68.50	1323.10
MOTIVATION													
Clan Culture	3	470	0.33	0.81	0.011	-0.016	1.256	-0.016	1.256	L	6.36**	181.60	2441.20
Competitor Orientation	13	2827	0.10	0.19	0.066	0.041	0.268	0.077	0.276	M	36.03***	222.70	2410.60
Customer Orientation	16	3259	0.20	0.28	0.066	0.178	0.418	0.185	0.418	M	42.82***	1173.00	4532.10
Openness to Change	16	1778	0.24	0.38	0.088	0.098	0.631	0.111	0.635	L	36.98***	760.70	6077.60
PROCESSES													
Centralization	18	3435	0.04	0.03	0.071	-0.041	0.111	-0.042	0.110	S	46.54***	2.60	501.90
Communication Generation	7	1174	0.21	0.20	0.074	0.108	0.296	0.089	0.291	M	10.49	107.30	1364.10
Communication Responsiveness	21	4132	0.18	0.17	0.069	0.081	0.243	0.044	0.230	M	40.96***	865.20	3544.30
Complexity	12	2019	0.22	0.14	0.071	-0.043	0.262	-0.075	0.261	M	43.12***	182.30	1621.50
Formalization	16	2572	0.08	0.14	0.077	0.063	0.207	0.066	0.207	M	40.58***	127.20	2153.30
Interfunctional Coordination	6	1577	0.14	0.16	0.060	0.021	0.243	0.054	0.252	M	6.74	72.00	926.30
Team	10	1966	0.21	0.15	0.068	0.016	0.292	0.006	0.285	M	22.17***	191.30	1520.90
OUTCOMES													
Financial Performance	41	118390	0.06	-0.06	0.014	-0.081	0.084	-0.081	0.078	S	1501.66***	81.70	0.00
Efficiency	18	1552	0.41	0.35	0.087	0.150	0.596	0.105	0.566	L	48.68***	1497.60	6306.80
Subjective Performance	19	4909	0.25	0.32	0.058	0.108	0.511	0.105	0.500	L	36.35***	2950.40	6145.80

k = the number of samples in each analysis; N = the total number of respondents in the k samples; r = the mean uncorrected correlation; r_t = the mean weighted corrected correlation; sd_t = the estimated population standard deviation; ES = effect size, where L is large, M is medium, and S is small (Cohen and Cohen 1983); χ^2 = a chi-square test for variance unaccounted for across the samples; N_{fsR} = fail-safe N (Rosenthal's Method) for each variable; N_{fsO} = fail-safe N (Orwin's Method) for each variable.
*p<.10. **p<.05. ** p<.01.

Table 2: Theoretical Rationale of Innovation Relationships

Variable	Rationale	Relevant Literature
DETERMINANTS		
Competition (+)	It is a generally held view that competition fosters innovation (Utterback 1974; Kimberly and Evanisko 1981). Competition can influence innovation by providing companies with exposure to new ideas. Additionally, a highly competitive environment pressures managers to scan their environment to search for superior alternatives to their current methods as well as making the environment such that innovation is necessary for survival.	Becker and Dietz (2004); Bidault, Despres and Butler (1998); Boeker (1997); Gatignon and Xuereb (1997); Goes and Park (1997); Greve and Taylor (2000); Joshi and Sharma (2004); Kelm, Narayanan and Pinches (1995); Li and Atuahene-Gima (2001); Li and Calantone (1998); Majumdar and Venkataraman (1998); Pelham and Wilson (1996); Powell, Koput and Smith-Doerr (1996); Roberts and Amit (2004); Soultaris (2002); Tsai (2001); Zajac, Golden and Shortell (1991)
Turbulence (+/-)	Environmental turbulence creates an environment characterized by uncertainty and provides a stimulus for organizations to innovate in order to guard against uncertainty. Turbulence forces organization to search for and process information from the environment and search for potential opportunities.	Atuahene-Gima (2004); Calantone, Garcia and Droge (2003); Davila (2003); Ettlie (1983); Gatignon and Xuereb (1997); Geiger and Cashen (2002); Im and Workman, Jr. (2004); Joshi and Sharma (2004); Kahn and Manopichetwattana (1989); Li and Atuahene-Gima (2001); Li and Atuahene-Gima (2002); Meyer and Goes (1988); Mishina, Pollock and Porac (2004); Moorman (1995); Moorman and Miner (1997); Nohria and Gulati (1996); Pelham and Wilson (1996); Sethi, Smith and Park (2001); Souder, Sherman and Davies-Cooper (1998); Soultaris (2002)
Age (+/-)	Older organizations have established formal and informal relationships both internal and external to the organization and are a creature of norms and habits. Older organizations have been found to be more rigid and less open to change (Rao and Drazin 2000). On the other hand, some scholars posit that younger firms are less willing to make changes that might disrupt their current means of conducting business. In addition, past research has found support for a positive relationship between age and innovation. Older organizations have a well-defined resource base and have demonstrated high potential for survival, which allows organizations the ability to pursue innovation (Kimberly and Evanisko 1981).	Atuahene-Gima (2004); Baker and Cullen (1993); Boeker (1997); Bonner and Walker (2004); Day (1994); DeCarolis (2003); Freel (2003); Frost (2001); Galende and de la Fuente (2003); Graves and Langowitz (1993); Hall and Ziedonis (2001); Ibarra (1993); Kahn and Manopichetwattana (1989); Keister (2002); Li and Atuahene-Gima (2001); Mishina, Pollock and Porac (2004); Powell, Koput and Smith-Doerr (1996); Rothaermel and Deeds (2004); Sorenson and Stuart (2000)
Champion (+)	Champions use power and influence to gain the necessary resources and support in order for the innovation to occur. Champions help nurture the innovation from conceptualization to implementation and therefore foster innovation within an organization.	Chandy and Tellis (1998); Day (1994); Ibarra (1993); Joshi and Sharma (2004); Kahn and Manopichetwattana (1989); Markham and Griffin (1998); Meyer and Goes (1988); Sivadas and Dwyer (2000); Souder and Jenssen (1999); Soultaris (2002); Stevens, Burley and Divine (1999)
Diversification (+/-)	Organizations that have very diversified product offerings have to split their R&D resources among several different product lines that can have a detrimental impact on innovation. On the other hand, diversification creates a greater knowledge base within the firm to build upon as well as promoting the dissemination of diverse ideas.	Ahuja (2000); Ahuja and Lampert (2001); Ancona and Caldwell (1992); Becker and Dietz (2004); Bidault, Despres and Butler (1998); Boeker (1997); Cardinal (2001); Day (1994); Galende and de la Fuente (2003); Geiger and Cashen (2002); Hitt, Hoskisson, Johnson and Moesel (1996); Hitt, Hoskisson and Kim (1997); Hoskisson, Hitt, Johnson and Grossman (2002); Kahn and Manopichetwattana (1989); Nohria and Gulati (1996); Pelham and Wilson (1996); Powell, Koput and Smith-Doerr (1996); Rothaermel and Deeds (2004); Shan, Walker and Kogut (1994); Thomas (1990); Wong-Martinez (1995); Wuyts, Dutta and Stremersch (2004)
Education (+)	Individuals with higher education levels tend to be more open minded about organizational change. Education level is also thought to aid in the understanding and interpretation of diverse information that in turn enables innovation.	Atuahene-Gima (2003); Blind and Grupp (1999); Campbell (1993); Faber and Hesen (2004); Ibarra (1993); Kahn and Manopichetwattana (1989); Keister (2002); Kimberly and Evanisko (1981); Meyer and Goes (1988); Romijn and Albaladejo (2002); Scott and Bruce (1994); Soultaris (2002); Zajac, Golden and Shortell (1991)
Network (+)	Networks provide organizations access to knowledge and information about trends present in the environment. An organization's network increases boundary-spanning activities within an organization as well the potential for providing resources required in order for organizations to innovate.	Ahuja (2000); Atuahene-Gima (2003); Bonner and Walker (2004); Faber and Hesen (2004); Goes and Park (1997); Li and Atuahene-Gima (2001); Love and Roper (2001); Powell, Koput and Smith-Doerr (1996); Rao and Drazin (2002); Romijn and Albaladejo (2002); Saez, Marco and Arribas (2002); Shan, Walker and Kogut (1994); Sivadas and Dwyer (2000); Srinivasan, Lilien and Rangaswamy (2002); Soultaris (2002); Stuart (2000); Tsai (2001)
Past Innovation (+)	Organizations that have been successful at innovation in the past are more likely to innovate in the future.	Ahuja and Lampert (2001); Chandy and Tellis (1998); Jones (2003); Rothaermel and Deeds (2004); Tsai (2000); Wuyts, Dutta and Stremersch (2004)
Professionalism (+)	Managers are involved in organizations that increase their boundary-spanning activities and serve as a means for gathering information. These activities provide managers with a diverse set of ideas to carry into their own organizations. Damanpour (1991) found that professionalism of management accounted for 40 percent of the variance in innovation.	Campbell (1993); Cardinal (2001); Goes and Park (1997); Hage and Dewar (1973); Ibarra (1993); Kahn and Manopichetwattana (1989); van Riel, Lemmink and Ouwersloot (2004); Wong-Martinez (1995); Zmud (1984)
Public Ownership (+)	Public organizations may be more open to change then private organizations. Public firms have greater access to resources that are necessary for innovation to occur, as well as market pressures to engage in innovation.	Baker and Cullen (1993); Boeker (1997); Goes and Park (1997); Powell, Koput and Smith-Doerr (1996); Rothaermel and Deeds (2004); Shan, Walker and Kogut (1994)

Variable	Rationale	Relevant Literature
Resources (+/-)	Resources provide organizations with the flexibility to pursue new products (Meyer 1982). Not only do available resources provide the necessary inputs to innovation, but also reduce barriers and risks to the organization when implementing new innovations by enabling an organization to absorb the cost of the innovation and the possibility of failure (Rosner 1968; Burns 1989). On the other hand, too many resources may be an indication of management incompetence and organizational waste, which can detract from innovation.	Ahuja (2000); Ahuja and Lampert (2001); Bharadwaj and Menon (2000); Boeker (1997); Bonner and Walker (2004); Campbell (1993); Chandy and Tellis (1998); Collins, Hage and Hull (1988); Day (1994); DeCarolis (2003); Ettlie (1983); Ettlie and Rubenstein (1987); Faber and Hesen (2004); Gatignon and Xuereb (1997); Geiger and Cashen (2002); Goes and Park (1997); Graves and Langowitz (1993); Greve (2003); Hall and Ziedonis (2001); Ibarra (1993); Hitt, Hoskisson and Kim (1997); Joshi and Sharma (2004); Kahn and Manopichetwattana (1989); Keister (2002); Kelm, Narayanan and Pinches (1995); Laursen and Salter (2004); Lim (2004); Love and Roper (2001); Majumdar and Venkataraman (1998); Meyer and Goes (1988); Mishina, Pollock and Porac (2004); Nohria and Gulati (1996); O'Brien (2003); Powell, Koput and Smith-Doerr (1996); Romijn and Albaladejo (2002); Sakakibara and Branstetter (2001); Scott and Bruce (1994); Sorenson and Stuart (2000); Souder, Sherman and Davies-Cooper (1998); Souder and Jenssen (1999); Soultaris (2002); Srinivasan, Lilien and Rangaswamy (2002); Tsai (2001); Wong-Martinez (1995); Wuyts, Dutta and Stremersch (2004); Yam, Guan, Pun and Tang (2004); Zajac, Golden and Shortell (1991)
Size (+/-)	Large organizations tend to have more resources available to them than smaller organizations. There is also more diversity in the organization, which can lead to a greater number of innovative ideas. However, size can also be associated with organizational inertia and a failure to adapt to changing resource conditions. Organizations that are large are also very complex and may have more difficulty processing information.	Ahuja (2000); Ahuja and Lampert (2001); Ancona and Caldwell (1992); Atuahene-Gima (2003); Atuahene-Gima (2004); Baker and Cullen (1993); Becker and Dietz (2004); Belderbos, Carree, and Lokshin (2004); Bharadwaj and Menon (2000); Blau and McKinley (1979); Boeker (1997); Campbell (1993); Cardinal (2001); Chandy and Tellis (1998); Chandy and Tellis (2000); Collins, Hage and Hull (1988); Day (1994); Davila (2003); Ettlie (1983); Ettlie and Rubenstein (1987); Freel (2003); Galende and de la Fuente (2003); Geiger and Cashen (2002); Goes and Park (1997); Graves and Langowitz (1993); Greve and Taylor (2000); Greve (2003); Hall and Ziedonis (2001); Hitt, Hoskisson, Johnson and Moesel (1996); Hoskisson, Hitt, Johnson and Grossman (2002); Ibarra (1993); Im and Workman, Jr. (2004); Kahn and Manopichetwattana (1989); Kaufmann and Todtling (2001); Keister (2002); Kelm, Narayanan and Pinches (1995); Kotabe (1990); Laursen and Salter (2004); Li and Atuahene-Gima (2001); Love and Roper (2001); Majumdar and Venkataraman (1998); Malerba and Orsenigo (1999); Marinova (2004); Meyer and Goes (1988); Nohria and Gulati (1996); O'Brien (2003); Pelham and Wilson (1996); Powell, Koput and Smith-Doerr (1996); Rao and Drazin (2002); Rothaermel and Deeds (2004); Saez, Marco and Arribas (2002); Scott and Bruce (1994); Shan, Walker and Kogut (1994); Sorenson and Stuart (2000); Souder, Sherman and Davies-Cooper (1998); Souder and Jenssen (1999); Srinivasan, Lilien and Rangaswamy (2002); Thomas (1990); Tsai (2001); Wong-Martinez (1995); Wuyts, Dutta and Stremersch (2004); Zajac, Golden and Shortell (1991); Zmud (1984)
Specialization (+)	Provides a focused knowledge base for the generation of ideas within an organization. It provides the organization with higher levels of technical knowledge that can be incorporated into innovations.	Blau and McKinley (1979); Kahn and Manopichetwattana (1989); Kimberly and Evanisko (1981); Nohria and Gulati (1996); Scott and Bruce (1994); Sethi, Smith and Park (2001); Sherer and Lee (2002)
Tenure (+/-)	Mangers with longer tenure provide legitimacy and knowledge of how to accomplish goals, manage office politics, and ultimately reach organizational goals. On the other hand, managers with higher levels of tenure are less likely to be open to new ideas or radical changes for fear that it may disrupt the status quo.	Ancona and Caldwell (1992); Bharadwaj and Menon (2000); Boeker (1997); Campbell (1993); Davila (2003); Ibarra (1993); Kahn and Manopichetwattana (1989); Kimberly and Evanisko (1981); Meyer and Goes (1988); Rao and Drazin (2002); Scott and Bruce (1994); van Riel, Lemmink and Ouwersloot (2004)
Urbanization (+)	Urban environments provide organizations with increased diversity, larger resource base, and greater accessibility to information that enable innovation.	Baldridge and Burnham (1975); Goes and Park (1997); Majumdar and Venkataraman (1998); Meyer and Goes (1988); Wong-Martinez (1995)
Clan Culture (+)	A clan culture stresses employee participation, teamwork and cohesiveness. Clan cultures are open to change and provide an environment that fosters innovation.	Moorman (1995); Sivadas and Dwyer (2000)
Competitor Orientation (+/-)	Organizations that are focused on their competitors are less likely to come up with radical ideas but are likely to innovate in "me-too" products.	Gatignon and Xuereb (1997); Im and Workman, Jr. (2004); Lukas and Ferrell (2000); Romijn and Albaladejo (2002); Saez, Marco and Arribas (2002); Soultaris (2002); van Riel, Lemmink and Ouwersloot (2004)
Customer Orientation (+)	Organizations that are customer oriented are more likely to gain ideas and information from consumers that can stimulate innovation.	Callahan and Lasry (2004); Gatignon and Xuereb (1997); Im and Workman, Jr. (2004); Li and Calantone (1998); Lukas and Ferrell (2000); Romijn and Albaladejo (2002); Saez, Marco and Arribas (2002); Sethi (2000); Soultaris (2002); van Riel, Lemmink and Ouwersloot (2004)
Openness to Change (+)	A favorable attitude towards change provides organizations with a culture open to innovation. Managerial support of innovation also leads to increased resources provided for innovation. Upper management can provide a very powerful force within an organization, especially if decision-making is concentrated at the top of the organization.	Calantone, Garcia and Droge (2003); Campbell (1993); Chandy and Tellis (1998); Day (1994); Ettlie (1983); Hage and Dewar (1973); Kahn and Manopichetwattana (1989); Kotabe (1990); Meyer and Goes (1988); Soultaris (2002); Zmud (1984)

Variable	Rationale	Relevant Literature
Centralization (+/-)	Centralization is thought to discourage innovation by decreasing employee's awareness, commitment and involvement. Centralization does not allow for lower level individuals to participate in decision-making and therefore they do not feel involved with the innovation or the outcomes associated with the innovation. Centralization does not foster information transfer within the organization/free exchange of ideas that fosters innovation (Khan and Manopichetwattana 1989). On the other hand, other scholars have found the opposite relationship to be true. The concentration of power within the organization is often necessary to overcome organizational opposition to change (Dewar and Dutton 1986).	Atuahene-Gima (2003); Blau and McKinley (1979); Cardinal (2001); Collins, Hage and Hull (1998); Ettlie and Rubenstein (1987); Hage and Dewar (1973); Kahn and Manopichetwattana (1989); Nohria and Gulati (1996); Pelham and Wilson (1996); Powell, Koput and Smith-Doerr (1996); Shan, Walker and Kogut (1994); Sivadas and Dwyer (2000)
Communication Generation (+)	Promotes environmental scanning and the gathering of market relevant information, which promotes new ideas within an organization.	Kahn and Manopichetwattana (1989); Lukas and Ferrell (2000); Moorman (1995); Soultaris (2002)
Communication Responsiveness (+)	Communication responsiveness facilitates the dissemination of information throughout the organization, which in turn increases information exchange as well as the diversity of ideas generated within an organization (Utterback 1971). Past research has shown that communication is extremely important in both innovation creation and implementation (Becker and Whisler 1967).	Ahuja (2000); Ancona and Caldwell (1992); Atuahene-Gima (2003); Ettlie and Rubenstein (1987); Hurley and Hult (1998); Ibarra (1993); Kahn and Manopichetwattana (1989); Lukas and Ferrell (2000); Moorman (1995); Sethi (2000); Sethi, Smith and Park (2001); Sivadas and Dwyer (2000); Srinivasan, Lilien and Rangaswamy (2002); Tjosvold and McNeely (1988); van Riel, Lemmink and Ouwersloot (2004)
Complexity (+)	Complexity increases an organization's awareness of a need for change, improves the dissemination of diverse ideas, and encourages debate among organizational members.	Bidault, Despres and Butler (1998); Blau and McKinley (1979); Collins, Hage and Hull (1988); Ettlie and Rubenstein (1987); Galende and de la Fuente (2003); Geiger and Cashen (2002); Hage and Dewar (1973); Meyer and Goes (1988); Tjosvold and McNeely (1988); Zmud (1984)
Formalization (-)	Formalization limits organizational flexibility and stifles the creativity of employees because of the focus on rules and procedures within the organization. Formalization results in standardized behavior from employees (Robbins 1990), thereby inhibiting innovation.	Blau and McKinley (1979); Cardinal (2001); Collins, Hage and Dewar (1973); Hage and Hull (1988); Kahn and Manopichetwattana (1989); Moorman and Miner (1997); Nohria and Gulati (1996); Pelham and Wilson (1996); Sivadas and Dwyer (2000); Wong-Martinez (1995); Zajac, Golden and Shortell (1991)
Interfunctional Coordination (+)	Promotes the diversity of information and the cross-fertilization of ideas within the organization that can stimulate innovation.	Gatignon and Xuereb (1997); Im and Workman, Jr. (2004); Lukas and Ferrell (2000)
Team Communication (+)	Communication within the team, which increases the diversity of ideas as well as the knowledge base of the team. It also allows for the cross-fertilization of ideas within an organization.	Ancona and Caldwell (1992); Golden and Shortell (1991); Hurley and Hult (1998); Sethi, Smith and Park (2001); Soultaris (2002); Tjosvold and McNeely (1988); Zajac, Pelham and Wilson (1996)
CONSEQUENCES		
Financial Performance (+/-)	Innovation provides organizations with a new method of conducting business ahead of competition. This gives organizations an edge in the marketplace. On the other hand, innovation takes up substantial resources and the organization can lose money on the innovation.	Ahuja (2000); Atuahene-Gima (2004); Basile (2001); Bayus, Erickson and Jacobson (2003); Belderbos, Carree, and Lokshin (2004); Boeker (1997); DeCarolis (2003); Ettlie and Rubenstein (1987); Faber and Hesen (2004); Geroski, Machin and VanReenen (1993); Greve (2003); Hitt, Hoskisson and Kim (1997); Kotabe (1990); Marinova (2004); Markham and Griffin (1998); Meeus and Oerlemaus (2000); Mishina, Pollock and Porac (2004); Moorman (1995); Moorman and Miner (1997); Negassi (2004); O'Brien (2003); Pelham and Wilson (1996); Roberts and Amit (2004); Robinson (1990); Sivadas and Dwyer (2000); Souder, Sherman and Davies-Cooper (1998); Tsai (2001); Stuart (2000)
Efficiency (+/-)	Innovation is often linked with organizational efficiency, especially process innovation. Companies are able to develop more efficient means of conducting business through innovation. However, innovations often require substantial startup costs and investment by the organization that can lead to inefficiency.	Ali, Krapfel and LaBahn (1995); Damanpour and Evan (1984); Majumdar and Venkataraman (1998); Markham and Griffin (1998); Moorman (1995); Rosner (1968); Souder, Sherman and Davies-Cooper (1998); Souder and Jenssen (1999); Tjosvold and McNeely (1988)
Subjective Performance (+)	Most organizations perceive that innovation is directly linked to an organization's performance. Therefore firms that are successful in innovation will rate their performance higher than firms that have failed at innovation.	Atuahene-Gima (2004); Bharadwaj and Menon (2000); Bougrain and Haudeville (2002); Calantone, Garcia and Droge (2003); Damanpour and Evan (1984); Davila (2003); Gatignon and Xuereb (1997); Im and Workman, Jr. (2004); Li and Atuahene-Gima (2001); Li and Calantone (1998); Markham and Griffin (1998); Pelham and Wilson (1996); Souder, Sherman and Davies-Cooper (1998); Tjosvold and McNeely (1988); van Riel, Lemmink and Ouwersloot (2004)

All references used in the meta-analysis are available upon request from the first author.

Table 3: Theoretical Rationale for Proposed Moderators of Innovation Research

Potential Moderator Variables	Rationale
Measurement Factors	
Innovation Measure	There have been five primary means of measuring innovation in the literature: (1) frequency count measure that is the summation of all innovations adopted within an organization, (2) a dichotomous adoption or nonadoption, (3) R&D intensity, (4) implementation scales (steps that organizations take to introduce/implement an innovation), and (5) scale of innovation radicalness. Prior research indicates that scales with larger range and number are more reliable. Consequently more attenuation should result from measurement error in a dichotomous scale, and therefore lower the effect size observed (Houston, Peter and Sawyer 1983). Therefore we hypothesize that: *H1: Samples using a dichotomous measure of innovation will exhibit smaller effect sizes than samples using continuous measures of innovation.*
Innovation Typology	Past research has reported that the impact of organizational variables on innovation can be different for product and process innovations (Damanpour 1991). Additionally, the objectives associated with product and process innovations are different. Product innovations are designed to meet an organization's external needs while the emphasis for process innovations is to incorporate new elements into the operations of an organization (Knight 1967; Utterback and Abernathy 1975). Additionally, past research has highlighted the different mechanisms present within the organization to facilitate radical and incremental innovations (He and Wong 2004). Radical innovations are often exploratory in nature, while incremental innovations tend to exploit the current knowledge base within the organization. Therefore, it is expected that the typology of innovation will bias the effect sizes observed for the antecedents and outcomes of innovation, however the direction of this bias is not known a priori. *H2a: There will be a significant difference in effect sizes between samples studying product innovations, process innovations, and a combination of both product and process innovations.* *H2b: There will be a significant difference in effect sizes between samples studying radical innovations, incremental innovations, and combination of both radical and incremental innovations.*
Temporal Design	In meta-analytical investigations, scholars often code for the temporal nature of studies investigating causal relationships (e.g. Hom et al 1992). It is probable that studies investigating innovation at one point in time versus over a period of time are likely to yield different correlations between innovation and its antecedents and outcomes. Therefore we predict that the temporal design of the samples will bias the effect sizes observed with regards to innovation. However, the direction of this distortion is unknown a priori. *H3: There will be a significant difference in effect sizes between samples investigating innovation with a cross-sectional design and samples investigating innovation with a longitudinal design.*
Research Context	
Industry Characteristics	Past research has demonstrated that manufacturing and service organizations differ with respect to innovation (Damanpour 1991). Due to the differences inherent between service providers and manufacturers, the impact of antecedents on innovation could be markedly different. Studies with pooled samples from both sectors face greater heterogeneity than studies focusing on only one sector. Therefore, studies that focus on only one industry will be better able to tease out the true impact of antecedents on innovation and the relationship between innovation and performance as compared with studies that examine innovation in both industries. Therefore it is hypothesized that: *H4: Samples investigating innovation within either a manufacturing or service context will yield different effect sizes than samples investigating innovation across both industries.*

Table 4: GLS Moderator Results

Moderator	Beta	Variance	z-value	Moderator	Beta	Variance	z-value
MEASURE OF INNOVATION				ANTECEDENTS (con't)			
Measure 1 (Frequency Count)	0.848	0.0001	89.81*	Diversification	-0.113	0.0001	-11.71*
Measure 2 (Dichotomous)	-0.692	0.0002	-43.96*	Education	0.988	0.0005	43.85*
Measure 3 (R&D Intensity)	0.341	0.0002	26.88*	Network	-1.003	0.0001	-102.58*
Measure 4 (Organizational Steps)	2.076	0.0001	172.78*	Professionalism	-0.587	0.0003	-36.25*
TYPOLOGY OF INNOVATION				Resource	-0.37	0.0001	-44.43*
Product	0.446	0.0001	53.77*	Size	0.529	0.0001	68.39*
Process	0.682	0.0002	52.41*	Tenure	-0.813	0.0004	-42.07*
Radical	0.558	0.0001	61.65*	Competitor Orientation	-0.25	0.0009	-8.21*
Incremental	-0.85	0.0005	-39.18*	Customer Orientation	-0.923	0.0009	-30.53*
RESEARCH DESIGN				Change	-1.498	0.0003	-86.67*
Cross-Sectional vs. Longitudinal	-0.069	0.0001	-7.55*	Centralization	-0.409	0.0003	-23.11*
INDUSTRY CHARACTERISTICS				Communication	-0.278	0.0002	-19.23*
Manufacturing	0.897	0.0001	83.51*	Complex	0.023	0.0003	1.34
Service	0.493	0.0002	34.24*	Formal	-0.174	0.0005	-8.15*
ANTECEDENTS				Team	-1.338	0.0004	-66.04*
Competition	-0.002	0.0001	-0.15	OUTCOMES			
Turbulence	-0.364	0.0002	-28.38*	Financial	-0.343	0.0001	-42.54*
Age	-0.167	0.0001	-15.1*	Efficiency	1.218	0.0003	66.07*
Champion	0.096	0.0002	6.48*	Subjective	0.114	0.0003	6.72*

*p<.001.

Decomposition of Variance

Variable	Unique Variance	Percent of Variance Explained[11]
Environmental	0.0046	2.9%
Resources	0.0756	47.8%
Motivation	0.0157	9.9%
Processes	0.0067	4.2%
Total	0.1587	100%

[11] The remaining variation was explained by pairs of predictor set variables.

Table 5: Overview of Model Testing Theoretical Relationships

Variables	Theoretical Relationship with Innovation
Turbulence	Environmental turbulence creates an environment that can be characterized by uncertainty. Turbulence provides a stimulus for organizations to innovate in order to safeguard against this uncertainty. Organizations are forced to search for environmental information and opportunities and capitalize upon these opportunities through innovation. Therefore we hypothesize that: *H1: There is a positive association between environmental turbulence and innovation.*
Age	Older organizations are often thought of as being a creature of norms and habits. Older organizations have established formal and informal relationships both internal and external to the organization. They have been found to be more rigid and less open to change (Rao and Drazin 2000). On the other hand, some scholars posit that younger firms are less willing to make changes that might disrupt their current means of conducting business. In addition, past research has found support for a positive relationship between age and innovation (Chandy and Tellis 2000). Older organizations have a well-defined resource base and have demonstrated high potential for survival, which allows organizations the flexibility to pursue innovation (Kimberly and Evanisko 1981). Given the competing logics behind the relationship, the following is proposed. However, the direction of this relationship is unknown a priori. *H2: There is a significant association between age and innovation.*
Champion	Champions use power and influence to gain the necessary resources and support in order for the innovation to occur. Champions help nurture the innovation from conceptualization to implementation and therefore foster innovation within an organization (Chandy and Tellis 1998; Markham and Griffin 1998). *H3: There is a positive association between innovation champion and innovation.*
Diversification	Organizations that have very diversified product offerings have to split their R&D resources among several different product lines. It is this scarcity of resources that can have a detrimental impact on innovation (Boeker 1997; Hoskisson et al 2002). On the other hand, because the organization offers so many different product lines, diversification creates a greater knowledge base within the firm to build upon. In addition, the promoting the dissemination of diverse ideas across the organization is likely to promote innovation (Day 1994; Hitt et al 1996). Given the competing logics behind the relationship, the following is proposed. However, the direction of this relationship is unknown a priori. *H4: There is a significant association between diversification and innovation.*
Resources	Resources provide organizations with the flexibility to pursue innovation (Meyer 1982). Not only do available resources provide the necessary inputs to innovation, but also reduce barriers and risks to the organization when implementing the innovation. Resources enable an organization to absorb the cost of the innovation and the possibility of failure (Rosner 1968; Burns 1989). On the other hand, too many resources may be an indication of management incompetence and organizational waste, which can detract from innovation (Bolton 1993; Boeker 1997). Given the competing logics behind the relationship, the following is proposed. However, the direction of this relationship is unknown a priori. *H5: There is a significant association between resource level and innovation.*
Size	Large organizations often have more a larger resource base to pull from than smaller organizations (Baldridge and Burham 1975; Chandy and Tellis 1998). Size also leads to greater levels of diversity within the organization, which can lead to a greater number of innovative ideas being developed. However, size can also be associated with organizational inertia and a failure to adapt to changing resource conditions (Bolton 1993; Boeker 1997). The greater the organization's size, the higher the level complexity present within the organization, which can lead to difficulty in processing information. Given the competing logics behind the relationship, the following is proposed. However, the direction of this relationship is unknown a priori. *H6: There is a significant association between size and innovation.*
Openness to Change	A favorable attitude towards change provides organizations with a culture supportive of innovation. A culture supportive of change provides organizations with not only the motivation necessary for innovation, but also provides access to increased levels of resources necessary for innovation to occur. Based on this argument, we hypothesize the following relationship: *H7: There is a positive association between openness to change and innovation.*

Centralization	Centralization is thought to discourage innovation by decreasing employee's awareness, commitment and involvement. Centralization does not allow for lower level individuals to participate in decision-making and therefore they do not feel involved with the process of innovation or the outcomes associated with the innovation. Centralization does not foster information transfer within the organization and past research has argued that it is this free exchange of ideas that fosters innovation (Khan and Manopichetwattana 1989). On the other hand, other scholars have found the opposite relationship to be true. The concentration of power within the organization is often necessary to overcome organizational opposition to change and in fact increases the likelihood of innovation success (Dewar and Dutton 1986). Given the competing logics behind the relationship, the following is proposed. However, the direction of this relationship is unknown a priori. *H8: There is a significant association between centralization and innovation.*
Formalization	Formalization limits organizational flexibility and stifles the creativity of employees because of the focus on rules and procedures within the organization. Formalization results in standardized behavior from employees (Robbins 1990), thereby inhibiting innovation. *H9: There is a negative association between formalization and innovation.*
Performance	Innovation provides organizations with a new method of conducting business ahead of competition and the potential to gain a competitive edge in the marketplace (Stephens et al 1999; Ahuja 2000). In addition, innovation provides organizations with a new means of meeting customer needs and this can lead to increased financial performance. On the other hand, innovation takes up substantial resources and can be very risky for the organization. If the innovation fails in the marketplace it is likely to decrease financial performance (Markham and Griffin 1998). Given the competing logics behind the relationship, the following is proposed. However, the direction of this relationship is unknown a priori. *H10: There is a significant association between innovation and performance.*

SEM Model Testing Results

	Path to Innovation			Path to Performance			Mediation Test	
Variable	*Model 1*[a]	*Model 2*[b]	*Model 3*[c]	*Model 1*	*Model 2*	*Model 3*	*Sobel*	*Goodman I*
Turbulence	0.10***	0.10***			0.05	0.05	1.67*	1.75*
Age	0.00	-0.02			-0.09**	-0.09**	0.02	0.03
Champion	0.32***	0.32***			0.01	0.01	2.17**	2.18**
Diversification	0.16***	0.15***			0.00	0.00	1.96**	2.00**
Resources	0.22***	0.22***			0.04	0.04	2.08**	2.11**
Size	0.23***	0.22***			0.09**	0.09**	2.09**	2.12**
Openness to Change	0.30***	0.29***			0.09*	0.08**	2.14**	2.17**
Centralization	0.06	0.05			0.06	0.06	1.09	1.19
Formalization	0.04	0.03			0.17***	0.17***	0.71	0.78
Innovation				0.16***	0.06	0.09***		

Model Fit	*Model 1*	*Model 2*	*Model 3*
Absolute Fit Indices			
χ^2	116.71	96.47	250.73
d.f.	37	28	37
χ^2/d.f.	3.15	3.45	6.78
RMSEA	0.050	0.051	0.078
SRMR	0.047	0.044	0.072
Incremental Fit Indices			
NNFI	0.81	0.79	0.50
CFI	0.87	0.89	0.67
GFI	0.98	0.98	0.95

[a] – where innovation is modeled as a key mediator between antecedents and performance; [b] – where innovation is modeled as a partial mediator; [c] – where innovation is modeled as another antecedent to performance

* p<0.10. **p<0.05. ***p<.01.

Figure 1: Summary of Meta-Analysis Results

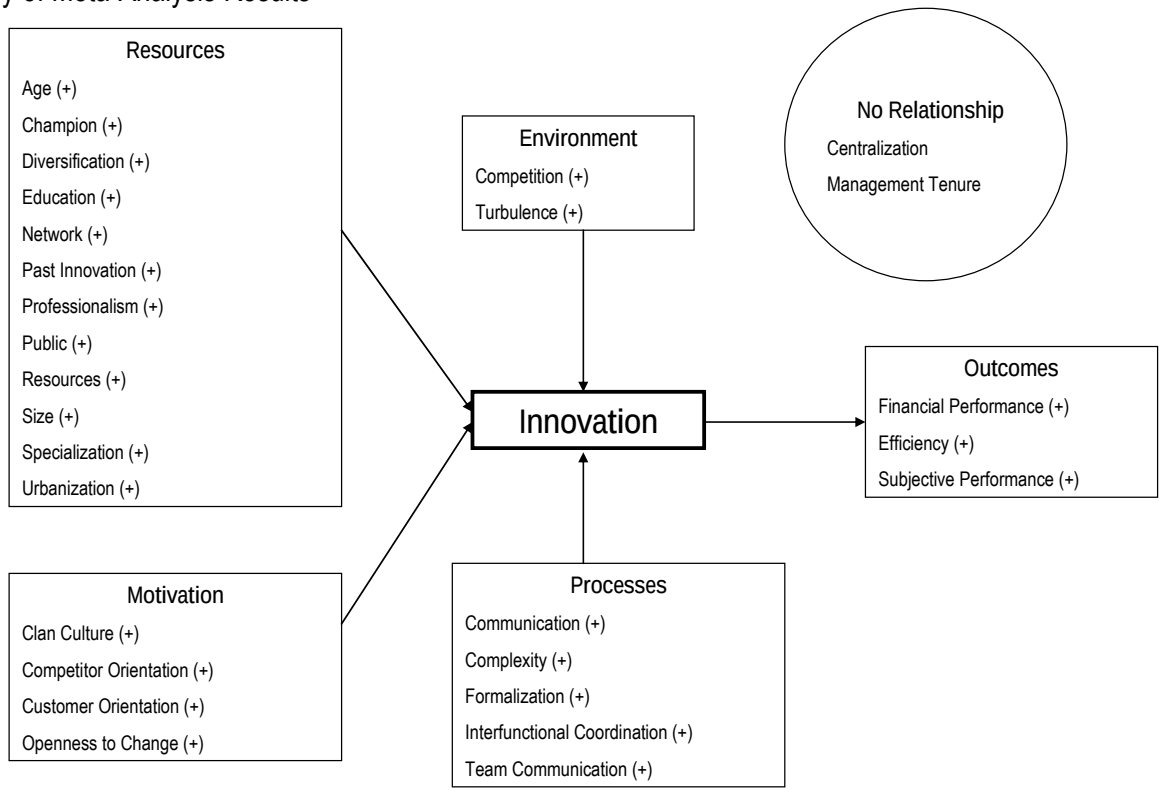

Figure 2: Conceptual Framework for Moderator Analysis