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RESEARCH ARTICLE

A MULTILEVEL MODEL FOR MEASURING FIT BETWEEN A FIRM'S COMPETITIVE STRATEGIES AND INFORMATION SYSTEMS CAPABILITIES[1]

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To compete in a highly dynamic marketplace, firms must frequently adapt and align their competitive strategies and information systems. The dominant literature on the strategic fit of a firm's information systems focuses primarily on high-level measures of the strategic fit of a firm's overall IS portfolio and the impact of fit on business performance. This paper addresses the need for a more fine-grained approach for assessing the specific areas of misfit between a firm's competitive strategies and IS capabilities. We describe the design and evaluation of a multilevel strategic fit (MSF) measurement model that enables researchers and practitioners to measure the strategic fit of a firm's information systems at both an overall and a detailed level. The steps in the model include identifying the relevant IS capabilities according to the type of system; measuring the current level of support for each capability using a capabilities instrument; identifying the ideal level of support for each capability using an adaptation of Conant et al.'s (1990) instrument to assess strategic archetype; and comparing the ideal and realized level of support for each capability. Evidence from a multiple case study analysis indicates that the fine-grained assessment of strategic fit can strengthen the validity, utility, and ease of corroboration of the strategic fit measurement outputs. The paper also demonstrates how an iterative design science research approach, with its emphasis on evaluating the utility of prototype artifacts, is well suited to developing field-tested and theoretically grounded measurement models and instruments that are accessible to practitioners. This focus on practical utility in turn provides researchers with results that can be more readily corroborated, thus improving the quality and usefulness of the research findings.

Keywords: Strategic alignment, information systems capabilities, configurational theory, strategic archetypes, design science, research methods

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Introduction

To compete in a highly dynamic marketplace, firms must frequently adapt and align their competitive strategies and information systems. Improving the strategic fit of a firm's information system has been a primary goal of IS executives for at least two decades (Luftman and Ben-Zvi 2010; Niederman et al. 1991). However, the IS planning process is hindered by a lack of empirically validated yet actionable process theories for measuring the fit between a firm's competitive strategies and IS capabilities (organizational capabilities enabled by a firm's IS).

Strategic planning for IS has evolved from a focus on IS functionality (e.g., Lucas 1981), to IS architecture (e.g., Allen and Boynton 1991), to IS strategic alignment (e.g., Henderson et al. 1996). Prior studies have established the benefits of improving the fit between a firm's competitive strategies and overall IS strategies or IS portfolios (e.g., Bergeron et al. 2004; Sabherwal and Chan 2001). This paper addresses the need for a more fine-grained model for diagnosing the individual IS capabilities that contribute to the overall fit or misfit between a firm's competitive strategies and IS capabilities.

The motivation for this paper arose out of difficulties we experienced trying to use existing high-level strategic fit of IS approaches to help practitioners assess and improve the strategic fit of their firm's specific IS, such as their supply chain management systems (SCMs).[2] Prior approaches (e.g., Henderson et al. 1996; Sabherwal and Chan 2001) tend to focus on fit between a firm's competitive strategies[3] and the capabilities of the firm's overall portfolio of information systems. When we attempted to use existing high-level strategic fit measurement approaches to identify areas of misfit of a firm's specific SCM, we had challenges obtaining results that could be corroborated by the users. For example, we could not use the approach of Sabherwal and Chan (2001) as it operationalizes a firm's competitive strategy using Venkatraman's (1989b) STROBE measure. The STROBE measure describes a firm's "analysis" capabilities, but does not distinguish between analysis of a firm's internal processes and analysis of a firm's external environment. For SCM in particular, providing support for internal analysis and external analysis are very different IS capabilities that need to be distinguished to produce an assessment of strategic fit.

After experiencing these difficulties, we elected to design and evaluate a new and more fine-grained measurement model. To do so, we used a design science research approach to explicate the requirements and theoretical principles for a new model for measuring the strategic fit of a firm's IS, which we refer to as the multilevel strategic fit (MSF) measurement model. A design science approach places emphasis on achieving clarity in the goals and underlying theoretical constructs for a new artifact and carefully evaluating how well the new artifact meets those goals.

Design science in IS research has been used most commonly for generating field-tested and theoretically grounded knowledge for creating software applications. However, this paper demonstrates how design science is also well-suited for developing methods for measuring complex multidimensional constructs such as the strategic fit of a firm's IS. To guide the design and evaluation of the MSF measurement model, we also construct and evaluate an example instance for measuring the strategic fit of a firm's SCM. The benefits of a fine-grained and actionable strategic fit measurement model are (1) researchers can receive readily validated results due to the ease with which the specific areas of misfit identified can be corroborated by IS managers or users, and (2) practitioners can receive specific guidance to improve the effectiveness of their firm's IS.

In the following sections, we begin by examining prior approaches in the research literature for measuring strategic fit. We then describe the design science research methodology used. Next, we outline the components of the MSF measurement model and demonstrate how it was applied to measure the strategic fit of a firm's SCM. The following section describes the findings of a multiple case study that was used to guide the design of the MSF measurement model and evaluate the reliability, validity, and utility of the example instance. We conclude with a discussion of implications for future research and practice.

Background

We begin the model development by describing our analysis of the existing strategic alignment measurement approaches

[2]SCMs are interorganizational information systems used to coordinate information within and between the participants of a supply chain. Firms often employ a portfolio of SCM, including legacy systems connected by electronic data interchange (EDI) and enterprise systems connected by web-based communications. This study focuses on SCM because (1) we had encountered many firms that appeared to have difficulty assessing how well their SCM fit their competitive strategies and (2) SCMs are increasingly important to the success of many firms, yet have received insufficient attention in the empirical IS literature (Subramani 2004).

[3]The competitive strategy constructs used in this paper actually apply to business unit competitive strategies rather than firm-level strategies (Doty et al. 1993). In cases where there are different strategies among the business units in a firm, it would be more accurate (though cumbersome) to refer to "a business unit's competitive strategies."

published in the most prominent IS journals, as well as IS journals that explicitly mention strategic alignment as part of their topics of interest. These journals included *MIS Quarterly, Information Systems Research, Journal of Management Information Systems, Journal of the Association for Information Systems, Information and Management, Information Systems Management, Information Systems Journal, European Journal of Information Sytems, Journal of Strategic Information Systems,* and *MIS Quarterly Executive*. We also examined all strategic alignment research approaches described in the article citations and performed a keyword search across all journals in Google Scholar. Some studies found were not applicable as they investigated social or behavioral factors influencing the process of aligning business strategies and IS strategies or IS organizations (e.g., Reich and Benbasat 2000), rather than investigating how to measure the outcome of the process of strategic alignment (we label this outcome "strategic fit"). Other studies suggested how strategic fit could be conceptualized, but did not suggest how it could be measured. We found four existing approaches that could be used to measure the strategic fit of a firm's IS (see Appendix A). These approaches can be seen in Avison et al. (2004), Chan et al. (1997), Oh and Pinsonneault (2007), and Sabherwal and Chan (2001). We also found several other papers (not listed here) that essentially replicated one of these four approaches.

Prior approaches can be classified into one of three types. We define a Type A assessment as a determination of the match between each of a firm's realized and intended IS capabilities. Following the approach of Henderson et al.'s (1996) strategic alignment model, a firm's intended IS capabilities are based on the firm's intended competitive strategies. For example, if a firm stated that their intended competitive strategies included a focus on operational efficiency and long-term planning, a Type A assessment would examine the realized level of support the firm's IS provide for these capabilities. However, measurement difficulties arise because a firm's actual patterns of strategic behavior (their realized or emergent strategies) are often different from their stated or intended strategies (Clarke 2001; Conant et al. 1990; Mintzberg 1978). Perhaps because of these difficulties, few Type A assessments are found in the empirical IS literature, although Avison et al. is one example.

A Type B assessment, which we define as a single calculated value of the overall level of fit between a firm's competitive strategies and IS capabilities, is more commonly found in empirical IS research. While various methods have been suggested to calculate an overall measure of strategic fit of a firm's IS (e.g., Chan et al. 1997; Oh and Pinsonneault 2007; Sabherwal and Chan 2001), their common focus has been to determine the overall level of strategic fit in order to explain or predict the relationship between fit and other variables such as business performance.

Finally, we define a Type C assessment as a determination of the match between each of a firm's realized and theoretically ideal IS capabilities individually. A firm's theoretically ideal IS capabilities can be derived from prior studies of realized competitive strategy archetypes (Sabherwal and Chan 2001). In comparison with a Type A assessment, a Type C assessment requires two additional steps to identify the firm's realized competitive strategies and derive the firm's theoretically ideal IS capabilities. However, there is stronger theoretical and empirical support for basing a strategic fit assessment on a firm's realized rather than its intended competitive strategies (Conant et al. 1990; Doty et al. 1993; Mintzberg 1978).

Comparing the Type B and C assessments, the Type C detailed assessment is suitable for prescribing which IS capabilities a firm should improve in order to increase their overall strategic fit, while the Type B assessment is more suitable for comparing the overall strategic fit of a firm's IS against other firms or for explaining and predicting the relationship between overall strategic fit and other variables. Furthermore, since a Type C assessment would reveal the degree of fit for each individual IS capability, it could be more readily corroborated than a Type B assessment, as one could check for evidence that the realized IS capabilities did or did not match the levels that would be theoretically ideal according to the firm's realized competitive strategies.

A few prior studies that used a Type B assessment also contained elements of a Type C assessment of a firm's overall IS portfolio (e.g., Sabherwal and Chan 2001). However, no prior studies were found that examined how a Type C assessment could be performed on a firm's specific types of IS (such as their SCM). The existing studies we found focused primarily on examining the relationship between a firm's business performance and overall level of strategic fit and did not suggest how the assessments could be checked for corroboration or how they could be used in practice for improving the strategic fit of a firm's IS.

A strategic fit measurement model that could provide a Type B assessment of the overall level of strategic fit as well as a fine-grained Type C assessment of the specific areas of misfit is needed in order to assist managers with deploying information systems that more fully support their firm's competitive strategies. Such fine-grained assessments are also needed to enable researchers to check whether their strategic fit measurement approach can be corroborated with detailed

evidence, thus improving the quality of the findings. Finally, a strategic fit measurement model needs to be developed using appropriate research techniques to ensure the assessments are grounded in both theory and evidence (Benbasat and Zmud 1999; Rosemann and Vessey 2008; Straub and Ang 2008).

To summarize, there is a need for a more fine-grained strategic fit of IS measurement model that, in addition to being developed using appropriate research methods, must be

(1) *Theoretically grounded:* The measurement approach must be justified using convincing theoretical arguments. For example, a theoretically sound measurement model would acknowledge the difference between a firm's intended and realized competitive strategies (Mintzberg 1978).

(2) *Readily corroborated:* A researcher should be able to ensure measurement outputs are reliable and valid by checking for corroboration with other evidence, such as interviews with managers or users of the information system. For example, if an assessment indicates the overall strategic fit is poor (which may be hard to verify objectively), the assessment should also be able to identify the specific IS capabilities that contribute to poor fit.

(3) *Actionable:* The measurement approach must have descriptive and prescriptive utility for identifying the IS capabilities a firm needs to improve in order to increase their strategic fit. For example, an assessment should indicate the current fit and any corrective actions needed, such as the need to improve the flexibility of a firm's IS in order to be aligned with a competitive strategy focused on organizational agility.

None of the prior studies found met all of these requirements, as their focus had largely been on establishing the explanatory or predictive utility of a high-level assessment of the strategic fit of a firm's overall portfolio of IS. In the remainder of the paper, we examine the premise that combining these overall strategic fit assessments with fine-grained measures into a multilevel measurement model strengthens the validity and utility of the measurement outputs.

Methodology

In contrast to traditional research approaches that are used for exploring or confirming hypotheses (e.g., Bagozzi et al. 1991), this study follows a design science research approach (Gregor and Jones 2007; Hevner et al. 2004) because our primary goal is to develop a new artifact. In this paper, the artifact, which we refer to as the MSF measurement model, is an approach for measuring the strategic fit of a firm's IS. To guide the design and evaluation of the model, we construct and evaluate an example instance for measuring the strategic fit of a firm's SCM. If we had followed a more traditional research approach, we might have hypothesized various strategic fit constructs and relationships and developed a statistically tested survey instrument to examine these relationships. In contrast, the design science research approach focuses on clarifying the goals of a research artifact (a construct, method, model, or instantiation) and on building and carefully evaluating the utility of the artifacts, and to a lesser degree, their reliability and validity (Hevner et al. 2004; Venable 2006).

Following Baskerville et al. (2009), the design science research approach used involves specifying the problem and goals of a solution, a search for a satisfactory design (a model for measuring the strategic fit of a firm's specific types of IS), and construction of a satisfactory example (how the model was used to measure the strategic fit of a firm's SCM specifically). Both design and implementation are justified using prior theory and new case study evidence. Due to the complexity of strategic fit assessments, a prototyping approach consisting of three iterations of design and evaluation was needed to fully specify the solution requirements prior to constructing and evaluating the prototypes (Baskerville et al. 2009; Nunamaker et al. 1990). This paper describes the final iteration of the research process.[4]

To ensure the MSF measurement model is grounded in theory and empirical evidence, it is developed using exploratory research methods for developing theories or managerial guidelines from case study evidence (Eisenhardt 1989). In this paper, the theory developed from the case studies consists of actionable propositions related to the design of a measurement model and hence is more akin to a process theory (Markus and Robey 1998) or a "theory for design and action" (Gregor 2006, p. 611), rather than a causal theory.

The MSF measurement model was evaluated in its context using rich qualitative evidence to refine the model and examine its utility, reliability, and content validity. Evidence

[4]The gathering and analysis of case study data began in April 2002. A preliminary model was presented at two international research conferences in December 2002 and January 2003 to gather feedback. The data collection concluded in January 2004, while the data analysis and further development of the model continued through 2007.

from five firms[5] was used to evaluate the MSF measurement model. Using a range of informants from multiple cases ensures the evidence covers a range of competitive strategy types, IS implementations, and participant experiences (see the case descriptions in Appendix B). A purposive theory-driven sampling strategy was used to ensure all aspects of the underlying theories were included in the evidence gathered from informants (Eisenhardt 1989) and to facilitate comparisons as well as theoretical and literal replication (Yin 2003). For comparison purposes, the selection criteria required cases to be manufacturers with revenues over US$100 million that had used SCM for over five years, and that exhibited a range of competitive strategies and IS capabilities.

Apart from Case A, the cases studied were all electronics manufacturers located in Canada. This continuity facilitated comparison and theoretical replication among similar firms, while reducing extraneous phenomena and cross-industry differences (Dess et al. 1990; Weill and Olson 1989; Yin 2003). The inclusion of Case A (an integrated energy production and distribution company in Canada) enabled comparison and contrast with a different industry and a supply chain that is more internally integrated.

At least three informants were interviewed from each case including two senior managers and one external consultant. All had direct experience working with the case's SCM. Informants were required to have had at least five years' experience in the industry in order to be able to assess their case relative to competitors. In addition, the managers were required to have worked in the company for a minimum of three years in at least two different business units to ensure they had a broad perspective on the firm's activities.

We analyzed interview transcripts and archival documents from the case study informants and compared these findings with responses to the questionnaire-based outputs of the MSF model described later. By checking for corroboration between the MSF measurement outputs and the interview and archival evidence, we were able to evaluate the reliability, validity, and utility of the MSF measurement outputs (see the "Evaluation" section below). In analyzing this data, we assessed the corroboration of results and probed contradictions using follow-up interviews in person or by e-mail (as per Eisenhardt 1989; Yin 2003). Any contradictions led to a further search for theoretically and empirically sound measurement techniques and instruments.

[5]Analysis of Case A revealed the retail business unit (Case A2) exhibited markedly distinct competitive strategy patterns compared to the corporate business unit (Case A1) even though both were from the same firm and both shared a centralized SCM used throughout the firm. Thus, we differentiate Case A2 from Case A1.

The case study interviews probed the same concepts as the MSF model questionnaires, but used open-ended questions to collect further evidence to investigate, triangulate, and strengthen the findings from the questionnaires. We conducted interviews at least one week after the questionnaires so that discussions with the researcher could not bias the questionnaire responses. Triangulating the questionnaire findings with rich contextual data was especially important due to the newness of the constructs and measures to this area of research (Jick 1983; Sawyer 2001). To increase the consistency, efficiency, and flexibility of data collection, semi-structured interviews were used in an ethnographic technique known as a "grand tour" (McCracken 1990). Participants were interviewed several times over the course of the study to assess the consistency of their responses. A further benefit of the repeated interviews was "to allow the participants to become more comfortable with the researcher, and hence more frank and open" (Walsham and Waema 1994, p. 157).

We gathered interview transcripts and archival documents from the cases over a 20-month period and coded and analyzed them using QSR's NVivo software. The analyses were compared between cases, respondents, and methods to further refine the MSF measurement model (Eisenhardt 1989), check for corroboration of measures and respondents (Sawyer 2001), and evaluate the content validity and internal consistency reliability of the resulting strategic fit assessments (Straub et al. 2004).

Case study analysis relies on the interpretations of theoretically sensitized researchers. We mitigated the potential for bias by using rigorous data collection and analysis methodologies. Multiple researchers and case study participants reviewed the evidence and findings to check for inaccuracies or researcher bias. This increased the validity of the findings while contributing different perspectives on the constructs. We evaluated alternative questionnaire items adapted from previously validated studies to determine which instruments had the strongest reliability and validity for use in this study. Research objectivity was also ensured through triangulation of multiple data sources, constant comparisons and pattern matching between the theories and data, and through searching for rival explanations (Eisenhardt 1989; Jick 1983; Sawyer 2001; Strauss and Corbin 1998; Yin 2003).

Objectivity was ensured through "member checking"—having the informants review the case analyses and highlight any inaccuracies to ensure the findings followed from the evidence. Objectivity was also enhanced through frequent comparisons and pattern matching between theory and data. Content validity was established through the use of previously validated measures, triangulation of multiple data sources,

theoretical sensitivity of the researchers to the cases, and extensive pilot testing of alternative measures using case respondents and a panel of three expert practitioners. Reliability was strengthened through the application of a formal case study protocol, maintaining a database of evidence and findings, and comparing results from multiple respondents (Eisenhardt 1989; Strauss and Corbin 1998; Yin 2003).

The Multilevel Strategic Fit Measurement Model

In this section, we provide an overview of the MSF measurement model and describe each step in the model, including the theoretical justification for the step followed by an example of how the step was applied to measure the strategic fit of the SCM at each of the case studies (see Table 1). The details of the application serve as illustration and proof-of-concept for the model (Gregor and Jones 2007; Peffers et al. 2008) and are later used in the "Evaluation" section to assess the validity, reliability, and utility of the model.

Step 1: Identify the IS Capabilities Set to be Measured According to the Type of IS

Description: The set of IS capabilities constructs that are relevant for assessing the strategic fit of a specific type of IS can be identified from new or existing research that uses intensive research methods such as case studies or grounded theory.

Application: To identify the relevant IS capabilities for SCM, we initially used existing questionnaire items from prior studies of generic IS capabilities (e.g., Sabherwal and Chan 2001; Venkatraman and Ramanujam 1987). However, when checking for corroborating evidence in Step 7, we found these existing measures were not specific enough for SCM. We then performed a grounded theory analysis of interviews with SCM experts to identify the set of IS capabilities that are particularly relevant to SCM and that would balance the conflicting goals of being mutually exclusive, collectively exhaustive, yet parsimonious. As reported in McLaren et al. (2004a), the relevant IS capabilities for SCM include operational efficiency, operational flexibility, planning, internal analysis, and external analysis.

Step 2: Measure the Firm's Realized Level of Support for Each IS Capability

Description: Once the relevant "IS Capabilities Set" is identified in Step 1, a "Realized IS Capabilities Instrument" can be developed to measure the realized level of support the firm's IS provides for each capability. It is important to assess a firm's realized level of support for each capability rather than the intended capabilities because frequent reconfiguration and adaptation of the IS may result in the realized capabilities being different than those in the intended design (Markus and Robey 1998; Truex et al. 1999).

As Hambrick (1983) notes, a firm's capabilities can only be characterized relative to the firm's competitors. A relative measure can be achieved either by using absolute scales and normalizing the values across industries (e.g., Sabherwal and Chan 2001) or by instructing respondents to answer relative to the typical level for their industry (e.g., Snow and Hrebiniak 1980). The latter approach is preferable because the measurement outputs are useful to respondents without requiring the collection of data from other competitors to normalize the results. Measuring the perceived relative level of support for a capability also allows for comparison with the ideal levels, which are classified in relative terms (i.e., high, medium, or low). However, the researchers must first ensure the respondents have a reasonable understanding of their own industry and the typical level of support for each IS capability.

Application: A questionnaire containing two Likert-type items from previously validated studies for each of the five SCM capabilities was pilot tested using Cases A, B, and C. The questionnaire responses were compared with evidence from the case study reports to ensure it was possible to corroborate the relative level of support for a capability identified using the questionnaire against evidence from the case study documents. The final version of the "Realized SCM Capabilities Instrument" (Appendix C3) was administered to two senior managers for each case and the responses were averaged across each case to measure the realized level of support the case's SCM provided for the SCM capability. For example, for Case A1, the questionnaire yielded a five-point rating of the relative level of support the case's SCM provided for each capability in the profile: {Operational Efficiency, Operational Flexibility, Planning, Internal Analysis, and External Analysis}. For respondent A1-1, the realized capabilities profile for their firm's IS was {4, 2, 3.5, 3.5, 2.5} with an inter-item range of {0, 0, 1, 1, 1}. Normalizing the five-point Likert-type scale to a three-point scale of low, medium, and high (for comparison with the theoretically ideal ratings) gave a realized capabilities profile of {High, Low, Medium, Medium, Low}. The realized capabilities ratings were averaged with those from a second senior manager from Case A1. The two sets of responses had a low inter-rater range {0, 0, 0, 0.5, 0.5}.

Table 1. Steps in Multilevel Strategic Fit Measurement Model

Step	Application Details
(1) Identify the **IS capabilities set** to be measured according to the type of IS	Identified a relevant yet parsimonious set of IS capabilities for measuring the strategic fit of a firm's SCM that included operational efficiency, operational flexibility, planning, internal analysis, and external analysis (McLaren et al. 2004a).
(2) Measure the firm's current level of support for each IS capability using a **realized IS capabilities instrument**	Measured the realized level of support each case's SCM provided for each SCM capability using a purpose-built "Realized SCM Capabilities Assessment Instrument," which contained Likert-type items adapted from existing survey measures (see Appendix C3).
(3) Identify the firm's realized competitive strategy archetype using a **realized competitive strategies** instrument	Identified each case's Miles and Snow (1978) archetype (defender, analyzer, prospector, or reactor as outlined in Table 2) using an 11-dimension "Realized Competitive Strategy Instrument" adapted from Conant et al. (1990) (see Appendix C1).
(4) Determine the **theoretically ideal level of support** for each IS capability according to the firm's competitive strategy archetype	Determined the theoretically ideal level of support a firm's SCM should provide (low, medium, or high) for each SCM capability according to whether the firm was a defender, analyzer, or prospector.* The ideal levels were derived from an analysis of prior research (see Table 4).
(5) Calculate the **overall (Type B) strategic fit** of the firm's IS as the overall deviation between the firm's ideal and realized level of support for each IS capability	Calculated the overall strategic fit of each case's SCM as the Euclidean distance of the misfits between the realized and theoretically ideal level of support for each SCM Capability (see Table 5).
(6) Calculate the **detailed (Type C) strategic fit** of the firm's IS as the difference between the firm's ideal and realized level of support for each IS capability	Calculated the detailed strategic fit of each case's SCM by comparing the realized and theoretically ideal level of support for each SCM Capability individually (see Table 6).
(7) **Check for corroboration** of the overall and detailed assessment of strategic fit of the firm's IS using interviews and archival documents	Checked that the overall assessment of the strategic fit of each case's SCM from Step 5 was corroborated by examining the evidence from the interview transcripts, archival documents, and the respondents' subjective rating of the overall level of fit (see Table 7). Also checked that the individual capabilities that had the greatest and least strategic fit from the detailed assessment of strategic fit in Step 6 were corroborated by interview evidence from the case participants.

*Since reactors do not exhibit consistent strategic patterns, they are usually omitted from empirical studies. Thus, it is not possible to derive the theoretically ideal IS capabilities for a reactor from the existing literature.

Step 3: Identify the Firm's Realized Competitive Strategy Archetype

Description: In this step, the firm's realized rather than intended competitive strategies are identified using an adaptation of Conant et al.'s (1990) questionnaire instrument. To justify this step, let us first examine the most widely acknowledged model of strategic alignment in IS research and practice, that is, the strategic alignment model (SAM) described in Henderson et al. (1996) and extended in several subsequent papers (Luftman 1996; Papp 2001). The SAM model conceptualizes strategy using the rational *strategy as organizational design* perspective—for example, Porter's (1985) cost versus differentiation strategies—rather than the *strategy as realized or emergent patterns of activities* perspective (e.g., Mintzberg 1978). One reason for the popularity of the rational view may be that it is often operationalized using just two dimensions (i.e., market scope and strategic competency in Porter's 1985 generic strategies). In contrast, operationalizing a firm's realized strategic patterns provides a more holistic analysis, but requires use of a much larger number of constructs (e.g., Miles and Snow's 11-dimension competitive strategy profiles).

As both competitive strategy and IS capabilities are multi-dimensional constructs, operationalizing the fit between the two would require investigating a very large number of contingency relationships unless a configurational approach[6] is used (Sabherwal and Chan 2001). Configurational theories

[6]Configurational theories examine the impact of groupings of variables on a dependent variable, such as business performance. In contrast to contingency theories (which assume performance is contingent on a few variables), configurational theories assume there are multiple conditions and paths that may lead to the same equifinal state of performance (Doty et al. 1993). In configurational theories, business performance is governed not by having more or less of a variable, but by the fit of each of the system components (firm and environment variables) with each other.

have been established that indicate how the multiple dimensions of a firm's realized competitive strategies tend to cluster around a limited number of commonly occurring configurations or archetypes (Meyer et al. 1993; Miles et al. 1978; Miller 1986). Chan et al. (1997) found that a configurational approach to analysis of strategic fit of a firm's IS strategies was a better predictor of business performance than a simpler contingency approach. The configurational approach can "offer richer insights by focusing on parsimonious and relatively homogenous groups rather than diverse concepts" (Sabherwal and Chan 2001, p. 20). In short, configurational theories can reduce the complexity of measuring fit between at firm's multidimensional competitive strategy and IS capabilities profiles, while providing a more holistic analysis than contingency theories.

Miles and Snow (1978) studied realized competitive strategy patterns in numerous firms and identified four stable and recurring configurations of competitive strategy patterns (see also Miles et al. 1978). Their defender, prospector, analyzer, and reactor archetypes are widely used for operationalizing configurations of realized competitive strategies. Several strategy and IS studies have established the empirical support and predictive utility of the archetypes (Croteau and Bergeron 2001; Doty et al. 1993; Hambrick 1983; Sabherwal and Chan 2001; Zahra and Pierce 1990). Each archetype displays unique patterns of responses to 11 dimensions of competitive strategy: product–market breadth, market leadership, market surveillance, growth, process goals, competency breadth, adaptability, administrative focus, planning, organizational structure, and control. The descriptions of the archetypes are multifaceted but, at a high level, the archetypes exhibit competitive strategy patterns focusing on operational efficiency, innovation, risk minimization, and quick response, respectively (see Table 2).

Miles and Snow's (1978) original paragraph-type measure of competitive strategy archetype (see Appendix C2) can be problematic as it does not fully operationalize all 11 dimensions of their typology (Conant et al. 1990; Segev 1987). Therefore, Conant et al. developed a questionnaire instrument to measure all 11 dimensions of a firm's competitive strategies and determine the Miles and Snow competitive strategy archetype to which the firm most closely corresponds (see Appendix C1). Although the Conant et al. measure has largely been overlooked in the IS literature, it does overcome the major limitation of Miles and Snow's paragraph-type measure.[7] In Conant et al., the 11-item measure had a mean reliability coefficient of .69, which parallels Nunally's (1978) guideline of .70. The Conant et al. measure has been further validated in numerous studies (e.g., DeSarbo et al. 2006; Woodside et al. 1999) and used in over 100 journal articles.

Application: We identified Case A1's competitive strategy patterns and Miles and Snow archetype using an 11-dimension "Realized Competitive Strategy Instrument" (see Appendix C1) adapted from Conant et al. The responses identified the archetype the case most closely resembled for each of the 11 dimensions of competitive strategy. The overall archetype the case most resembled was then identified from the archetype response that was selected most often. If there were a tie between reactor and other archetypes, the case would be classified as a reactor (due to inconsistent strategy). In the case of a tie between the other archetypes, the case would be classified as an analyzer (hybrid strategy).

For Case A1, two senior managers in the business unit completed the realized competitive strategy questionnaire. The results indicated that each case exhibited defender-like patterns in seven of the dimensions. The next most frequent response was analyzer-like patterns in two and four dimensions respectively. This indicated the case was very similar to the idealized defender archetype, although there were some minor analyzer tendencies in a few dimensions.

Table 3 summarizes the competitive strategy archetype each case most closely resembled. The second column indicates the archetype that was derived using the questionnaire measures adapted from Conant et al.'s 11-dimension measure. The third column shows the archetype that was derived using a qualitative analysis of interview transcripts and archival documents. There was agreement in each case's competitive strategy archetype between each questionnaire response and the analysis of qualitative evidence. A panel of three expert practitioners with prior knowledge of the cases also agreed with the classification of the competitive strategy archetypes. This corroboration indicates the questionnaire had good content validity and internal consistency reliability (Paré 2004; Straub et al. 2004; Trochim 2000).

[7]For example, a respondent in our case studies had assumed the competitive strategies followed by her fast-moving business unit would correspond with Miles and Snow's prospector archetype according to the brief description in their paragraph-type measure. However, the questionnaire measure adapted from Conant et al. revealed her business unit actually followed competitive strategies corresponding to a defender archetype, which she later confirmed once she examined the detailed questionnaire responses and learned more about the differences between the archetypes. This highlights the danger of making high-level assumptions about a case's competitive strategies, as well as the danger of confusing intended and emergent competitive strategies.

Table 2. Competitive Strategy Archetypes (Adapted from McLaren et al. 2004b)

Competitive Strategy Archetype	Typical Competitive Strategy Patterns (after Miles and Snow 1978)
Defender (operational efficiency)	• High-quality standardized products and processes • Low prices achieved with economies of scale • Mechanistic organizational structure • High fixed-asset intensity • Highly cost-efficient but relatively few core technologies
Prospector (innovation)	• High research and development and market intelligence investments • Lower level of controls and operational efficiency • Organic organizational structure • Low fixed asset intensity • Flexible technologies, processes, and skills
Analyzer (minimize risk with proven opportunities)	• Maintains core products and adopts proven innovations • Large matrix organizational structure • Mix of processes and technologies for efficiency and flexibility
Reactor (quick response to market demands)	• Lack of consistent or coordinated responses to competitive environment • Rapid, opportunistic responses to immediate market demands • Project-oriented processes and organizational structure • Negligible long-term planning

Table 3. Competitive Strategy Archetype from Questionnaires and Interviews

Case	Archetype from Questionnaires	Archetype from Qualitative Analysis	Example Evidence from Qualitative Analysis
A1	Defender	Defender	Focus on cost controls, risk management, quality, market dominance, long-term relationships and contracts
A2	Analyzer	Analyzer	Focus on sales, risk management, adopting proven technologies, competitive intelligence, market scanning
B	Defender	Defender	Focus on cost controls, quality, economies of scale, long-term relationships and contracts
C	Prospector	Prospector	Focus on technology innovation, customized products, market share growth
D	Prospector	Prospector	Focus on innovation, inter-firm collaboration, market share growth, market scanning, time-to-market
E	Prospector	Prospector	Focus on research, innovation, collaboration, breadth of products, customer relationships

Step 4: Determine the Theoretically Ideal Level of Support for Each IS Capability

Description: McLaren et al. (2004b) demonstrate how an analysis of prior studies can be used to determine the theoretically ideal level of support a firm's IS portfolio should provide for various IS capabilities, according to the firm's Miles and Snow competitive strategy archetype. For example, studies by Camillus and Lederer (1985) and Sabherwal and Chan (2001) suggest that prospectors should have information systems that have a relatively high level of support for operational flexibility.

Application: We analyzed previous empirical studies to determine the theoretically ideal SCM capabilities for each Miles and Snow competitive strategy type as reported in McLaren et al. (2004b). An expert panel of three experienced supply chain consultants was used to confirm the face validity of the theoretically ideal IS capabilities profiles for each strategic type. Table 4 outlines the ideal SCM capabilities profiles and briefly explains how they were derived.

Thus, for Case A1, which was most like a defender, Table 4 suggests their SCM should ideally provide a relative level of support for operational efficiency, operational flexibility, planning, internal analysis, and external analysis that is {High, Low, High, High, Low}.

Table 4. Justification of the Ideal Level of Support for each SCM Capability (Adapted from McLaren et al. 2004b)

SCM Capability and Ideal Level of Support	Justification from Prior Studies
Operational Efficiency Defenders – High Prospectors – Low Analyzers – Medium	• Defenders invest heavily in cost and technological efficiency while prospectors have inherent inefficiency. Analyzers require efficiency for their mature product lines but not to the level of defenders overall (Miles et al. 1978). Supported by empirical studies (Conant et al. 1990; Doty et al. 1993; Miles and Snow 1978). • Segev (1989) arrived at same ratings with expert panel. • Camillus and Lederer (1985) and Sabherwal and Chan (2001) suggest defenders should have IS that support efficiency although the latter study of 226 firms failed to find empirical support for the proposition. • In a study of 76 firms, Simons (1987) finds prospectors should have a relatively low focus on operational efficiencies and cost controls although support for defenders focusing on operational efficiency was not found.
Operational Flexibility Defenders– Low Prospectors – High Analyzers – Medium	• Defenders less focused on responding to shifts in market environment while prospectors require large degree of technological and operational flexibility. Analyzers require flexibility for their immature product lines but not to the level of prospectors overall (Miles et al. 1978). Supported by empirical studies (Conant et al. 1990; Doty et al. 1993; Miles and Snow 1978). • Camillus and Lederer (1985) suggested prospectors should have IS that support flexibility; empirically supported by Sabherwal and Chan (2001). • Simons (1987) finds prospectors required more flexible accounting IS while defenders required more stable accounting IS.
Planning Defenders – High Prospectors – Medium Analyzers – Medium	• Defenders require intensive planning to meet cost and efficiency goals while decreasing risks, while analyzers plan heavily for their stable products but less so for their innovative products. For prospectors, planning is less intensive and for shorter terms, but has broader coverage across potential products and markets (Miles et al. 1978). Supported by several empirical studies (Conant et al. 1990; Doty et al. 1993; Miles and Snow 1978). • Sabherwal and Chan (2001) arrived at same ratings for an equivalent construct they termed "futurity." They noted that prospectors should be rated medium rather than low as they do some sophisticated shorter-term planning (Shortell and Zajac 1990).
Internal Analysis Defenders– High Prospectors – Low Analyzers – High	• Defenders invest heavily in internal monitoring and controls for efficiency, while analyzers invest heavily in internal analysis to coordinate complex matrix administrative structures. Prospectors have low levels of internal controls, formalization, and routinization and hence require lower levels of internal analysis (Miles et al. 1978). Supported by several empirical studies (Conant et al. 1990; Doty et al. 1993; Miles and Snow 1978). • Segev's (1989) study arrived at same ratings for internal analysis.
External Analysis Defenders – Low Prospectors – High Analyzers – High	• Prospectors invest heavily in scanning the environment for potential opportunities while defenders tend to ignore external changes. Analyzers must frequently monitor the marketplace to adopt successful innovations (Miles et al. 1978). Supported by several empirical studies (Conant et al. 1990; Doty et al. 1993; Miles and Snow 1978). • Segev's (1989) study arrives at same ratings for external analysis. • Simons (1987) finds prospectors ideally scanned competitor activities more aggressively than defenders and used more external forecasting.

Step 5: Calculate the Overall Strategic Fit of the Firm's IS

Description: The purpose of an overall (Type B) assessment of the strategic fit of a firm's information system is to calculate a single overall measure for comparison with the strategic fit of the IS at other firms or business units. In general, strategic fit can be operationalized using several approaches (Venkatraman 1989a): (1) fit as matching variables; (2) fit as mediating, moderating, or covarying variables; (3) fit as gestalt; or (4) fit as profile deviation. The fit as matching variables approach used in Step 6 identifies the fit between the realized and ideal values for each capability, but does not yield a single value of overall strategic fit needed for Step 7 so that fit can be correlated with other variables or compared across multiple firms.

Measuring fit as mediating, moderating, or covarying variables has been compared in several studies that investigate how the interaction between business strategy and IT strategy

variables impact business performance (e.g., Chan et al. 1997; Croteau and Bergeron 2001; Oh and Pinsonneault 2007). Bergeron et al. (2004) assessed the four-way fit between business and IT strategies and structures and demonstrated how the fit as gestalts approach can provide a more multi-dimensional assessment using cluster analyses of a larger number of variables. However, as with the fit as moderating, mediating, or covarying variables, the output of the gestalts approach is more suited to testing the relationship between fit and performance than providing actionable guidance on how to measure and improve fit. In contrast, operationalizing fit as profile deviation meets the goals of being readily corroborated and actionable as practitioners can interpret it as the overall gap between the ideal and realized profiles and decompose it into the individual gaps between each ideal and realized capability, as is done for Step 6.

Modeling misfits as the deviation between two profiles implies that the greater the collective misfit is, the poorer the overall strategic fit of that firm's IS. A challenge in using the profile deviation approach is the lack of consensus on how to determine an overall measure of fit (Venkatraman 1989a). Typically, the Euclidean distance between the ideal and observed profiles is calculated to determine the disparity between the two profiles as the simple calculation does not require creation of covariance matrices or lengthy multivariate clustering techniques (Bergeron et al. 2001; Van de Ven and Drazin 1985). Although the Euclidean distance calculation is perhaps not as sophisticated as statistical clustering techniques (such as Mahalanobis distance), the Euclidean distance can be readily calculated from the gap analysis and does not require a large data set, which would be needed for calculating covariance matrices in a clustering technique. Therefore, Euclidean distance appeared to be the most promising method of calculating the overall strategic fit such that the outputs still met the goals of being actionable and readily corroborated with evidence As detailed in the "Evaluation" section, the overall assessment of strategic fit calculated using the Euclidean distance for the case studies was well corroborated by other evidence from interviews and archival documents.

Application: First, the theoretically ideal level of support for each SCM capability for Case A1 was converted to the same scale as the realized and ideal capabilities (i.e., 1 = very low, 2 = low, 3 = medium, 4 = high, 5 = very high). Next, the Euclidean distance between the ideal and realized capabilities profiles was calculated to determine an overall measure of strategic fit of Case A1's SCM. Thus, for Case A1, the overall level of strategic fit of the case's SCM was

$$[(4 - 4)^2 + (2 - 2)^2 + (4 - 3.5)^2 + (4 - 3.5)^2 + (2 - 2.5)^2]^{1/2} = 0.87$$

The Euclidean distance calculated for the other respondent was very similar at 0.94. A value of zero for the overall level of fit would indicate perfect fit. The overall value of strategic fit is relative and only has meaning in comparison to other firms or business units (see Table 5).

Step 6: Calculate the Detailed Strategic Fit of the Firm's IS

Description: Following Venkatraman's (1989a) "fit as matching" approach, a detailed (Type C) assessment of the strategic fit of a firm's IS can be calculated as the difference between the firm's ideal and realized level of support for each IS capability.

Application: A detailed (Type C) assessment of strategic fit of the SCM at Case A1 was determined by comparing the match between the realized and theoretically ideal levels of support for each capability using the five-point scale (i.e., 1 = very low, 2 = low, 3 = medium, 4 = high, 5 = very high). For example, Table 6 highlights the misfits between the realized and theoretically ideal SCM capabilities using the responses from the first senior manager respondent for each case (the inter-rater ranges were examined and the different responses had a negligible impact on the scale ratings). From Table 6, Case A1's SCM provided the theoretically ideal level of support for operational efficiency and operational flexibility. However, support for planning and internal analysis was less than ideal, and support for external analysis was slightly greater than ideal.

Step 7: Check for Corroboration of the Assessment of Strategic Fit of the Firm's IS

Description: Measuring the strategic fit of a firm's IS at both an overall and a detailed level provides a fine-grained assessment of strategic fit that can be readily corroborated using evidence from interviews and archival documents. As described in the strategic alignment literature (e.g., Bergeron et al. 2001; Venkatraman 1989a), the profile deviation approach used implies that if a firm's IS provides a level of support for each IS capability that is equal to the theoretically ideal level, then there is a perfect fit between the capabilities of the IS and the firm's competitive strategies. If a firm's IS provides a level of support below the ideal level, the resulting misfit can be interpreted as the IS providing inadequate support for that organizational capability. Similarly, if the realized level of support for a capability is above the ideal level, the misfit is interpreted as a waste of scarce resources. In either case of too little or too much support, a resource-based view of the

Table 5. Deviation of SCM Capabilities from Theoretically Ideal Levels

Case	Absolute Deviation of Realized Level of Support for a IS Capability from the Theoretically Ideal Level of Support for the Capability (where 0.0 indicates perfect fit between realized and ideal levels)					Euclidean Distance Between Realized and Ideal Profiles
	Operational Efficiency	Operational Flexibility	Planning	Internal Analysis	External Analysis	
A1	4 – 4.0 = 0.0	2 – 2.0 = 0.0	4 – 3.5 = 0.5	4 – 3.5 = 0.5	2 – 2.5 = -0.5	0.9
A2	3 – 4.0 = -1.0	3 – 2.0 = 1.0	3 – 3.5 = -0.5	4 – 3.5 = 0.5	4 – 2.5 = 1.5	2.2
B	4 – 2.0 = 2.0	2 – 2.0 = 0.0	4 – 2.5 = 1.5	4 – 3.0 = 1.0	2 – 2.0 = 0.0	2.7
C	2 – 2.5 = -0.5	4 – 2.5 = 1.5	3 – 3.0 = 0.0	2 – 2.5 = -0.5	4 – 2.5 = 1.5	2.2
D	2 – 2.0 = 0.0	4 – 3.5 = 0.5	3 – 2.3 = 0.7	2 – 2.0 = 0.0	4 – 3.0 = 1.0	1.3
E	2 – 3.0 = -1.0	4 – 3.5 = 0.5	3 – 3.3 = -0.3	2 – 3.0 = -1.0	4 – 2.5 = 1.5	2.1

The realized and ideal levels use a five-point scale where 1 = very low, 2 = low, 3 = medium, 4 = high, 5 = very high.

Table 6. Match between Ideal and Realized Level of Capability from Questionnaires

Case	Competitive Strategy Type	Theoretically "Ideal" : Realized Level of Support for Capability				
		Operational Efficiency	Operational Flexibility	Planning	Internal Analysis	External Analysis
A1	Defender	H:H	L:L	**H:M**	**H:M**	L:L
A2	Analyzer	M:H*	**M:L**	M:M	**H:M**	**H:L**
B	Defender	**H:L**	L:L	**H:M**	**H:M**	L:L
C	Prospector	L:L	**H:M**	M:M	L:L	**H:M**
D	Prospector	L:L	**H:M**	**M:L**	L:L	**H:M**
E	Prospector	L:M*	**H:M**	M:M	L:M*	**H:M**

Note: Bolded values highlight capabilities that are lower than the theoretically ideal level and starred (*) values indicate capabilities that were higher than the theoretically ideal level for a case's strategic type.

firm would expect misfits to negatively impact organizational performance (Bergeron et al. 2001; Doty et al. 1993; Venkatraman 1989a).

Application: The overall assessment of the strategic fit of Case A1's SCM from Step 5 indicated the SCM had a relatively high overall level of fit with Case A1's competitive strategy. This finding was corroborated by the case participants and with evidence from the interview transcripts, archival documents, and a questionnaire item as described in the "Evaluation" section. Furthermore, the more detailed strategic fit assessment from Step 6 was even more readily corroborated by case study evidence as we could analyze the interviews and archival documents separately to determine which capabilities appeared to be satisfactory and which capabilities appeared to be inadequate for supporting the case's competitive strategies. As discussed in the following section, the results of the detailed and overall assessments of strategic fit of the SCM for each case were reviewed by the case study participants, compared with qualitative evidence, and found to be reliable, valid, and useful.

Evaluation

Evaluating new IS artifacts involves answering the question "How well does it work?" (March and Smith 1995). In the following section, we examine the reliability, validity, and utility of the MSF measurement model by analyzing the multiple case study that was used to inform the model's design and evaluate the example instance in a real world context. For each case, we followed and evaluated each step of the MSF measurement model (Table 1). Two senior managers from each case completed the realized competitive strategies and realized SCM capabilities questionnaires, which yielded both an overall and a detailed assessment of the strategic fit of the case's SCM. We begin with an evaluation

of the output of the model (the strategic fit assessments). Next, we evaluate the utility of the model and the quality of the research process used.

Evaluation of the Model Output

We evaluated the reliability of the MSF model by comparing outputs from the final version of the model with all the evidence gathered from the case studies. First, summary reports of the qualitative analysis of interview transcripts and archival documents were prepared for each case for later comparison with the questionnaire-based results of the MSF model. These reports identified the capabilities that appeared to need improvement to increase the strategic fit of each case's SCM, according to the analysis of interviews and archival documents (see Appendix D).

Next, we followed the steps of the MSF measurement model described in the previous section (see Table 1). Each of the identified misfits where the realized level of support for an IS capability was below the theoretically ideal level (the bolded items in Table 6) corresponded to deficiencies that were identified in analysis of interview transcripts and archival documents. For example, qualitative evidence from Case A2 strongly matched the findings from the questionnaires that the SCM did not provide an adequate level of support for operational flexibility, internal analysis, and, in particular, external analysis (compare Appendix D with Table 6, which shows a misfit between a low realized level of support for external analysis and a high ideal level for Analyzers). With respect to external analysis, the qualitative evidence included reports of users being frustrated with the inability to perform market scanning and competitive analyses, as well as evidence of *ad hoc* systems being developed to address the gap.

Where misfits were the result of the realized level of support for an IS capability being above the theoretically ideal level (the starred items in Table 6), there was no mention in the interview transcripts or archival documents of this being of concern. Thus, the qualitative evidence did not contradict the identification of a case of "over fit" using the MSF model, but it also did not contradict the assumption in congruence theory that too much of something may be a waste of managerial resources (Bergeron et al. 2001; Doty et al. 1993; Venkatraman 1989a).

The realized competitive strategies questionnaire given to each case respondent also included a Likert-type item to assess the perceived level of strategic fit of the case's SCM (see Appendix C3). In Table 7, we compare the perceived level of strategic fit with the calculated overall level of strategic fit and the evidence from the qualitative analyses. For comparison purposes, the calculated values of strategic fit were given a rating relative to each other, where high is less than 1, medium is 1–2, and low is greater than 2.

Table 7 highlights the close correspondence between the qualitative evidence, the perceived strategic fit, and the modified Euclidean distance calculation using "Strategic Fit as Deviation below Ideal." The only discrepancy was for Case E, where the Euclidean distance calculation of overall strategic fit was somewhat larger than would be expected for a case with an otherwise medium level of fit (according to the qualitative evidence and questionnaire item). Interestingly, if we recalculate strategic fit as the Euclidean distance after ignoring any deviations where the realized level was greater than ideal, this discrepancy disappears (see last the column in Table 7). However, further research is needed before we can advocate adjustments to methods for calculating overall strategic fit using Euclidean distance.

To examine the validity and utility of the resulting strategic fit assessments, each assessment was reviewed by the case study participants (a technique known as member checking) based on semi-structured interviews. Each of the interviews indicated the MSF measurement model and resulting strategic fit assessments appeared to be valid—in other words, to have strong face validity (Trochim 2000). For example,

> **A1-1:** *I think it's very valid. The framework that you supply is very easy to understand across a firm both in the business and in the IT world. You've spoken to both business and IT within the corporation who have been able to relate to what you have put together—knowing that we've also contributed to it. And you've walked me through the results of the research and it correlates with what I would think the outcome would be.*

> **D-1:** *Yes, it's quite accurate. We certainly do external analysis, but [we don't] have a specific group that formally does it in a very organized way. I think that as compared to [our competitors, we are] less structured or organized in the way that we evaluate externally—like what businesses they get into….And I don't think [we have] as methodical a system for doing that as [our competitors].*

Evaluation of the Model Utility

We argue that the MSF model has utility for researchers in that it provides them with a holistic, multilevel assessment of

Table 7. Overall Strategic Fit of the SCM at Each Case Study

Case	QUALITATIVE MEASURES		QUANTITATIVE MEASURES		
	Strategic Fit from Analysis of Interviews	Sample Qualitative Evidence	Average Perceived Level of Strategic Fit from Questionnaire*	Strategic Fit from Euclidean Distance Calculation† (Step 5)	Strategic Fit from Euclidean Distance Ignoring Greater than Ideal Misfits†
A1	High	• *"[The IS are] enabling us to reduce costs which is one of the main drivers for us. So it fits quite well with our strategic needs."*	High (4.0 out of 5)	High (0.9)	High (0.7)
A2	Low	• Requests for better systems for doing market scanning and competitive analysis. • Some frustration with poorly integrated custom developed applications.	Low-Medium (2.5 out of 5)	Low (2.2)	Medium (1.9)
B	Low	• Ongoing projects to integrate multiple ERP and APS systems and develop more collaborative planning capabilities. • Frustration with heavy usage of standalone spreadsheets and databases.	Low-Medium (2.5 out of 5)	Low (2.7)	Low (2.7)
C	Low	• *"The [IS] is a bit of a hindrance when you consider all the time taken to set up new customers."* • *"We really need a more flexible system in place."*	Low (2.0 out of 5)	Low (2.2)	Low (2.1)
D	Medium	• *"I think they're pretty good."* • *"I think it's pretty efficient."* • *I'm sure our contract manufacturers have everything totally integrated. But we don't need it as much."*	Medium (3.0 out of 5)	Medium (1.3)	Medium (1.3)
E	Medium	• *"The systems meet the minimum needs … improvements would save time and money."* • *"These systems are great at gathering the information but there is very little intelligent use of the information gathered."*	Medium (3.0 out of 5)	Low (2.1)	Medium (1.6)

*From a questionnaire item that measured the perceived strategic fit of the firm's IS capabilities, where 1 = very low and 5 = very high (see Appendix C3).

†High is less than 1, medium is 1–2, and low is greater than2

the strategic fit of a firm's IS. The outputs of both the overall and detailed assessment of strategic fit of a firm's IS can be readily validated by determining whether the specific areas of misfit identified are corroborated by interview and archival evidence. In contrast to existing approaches, the benefit to researchers is not only a more fine-grained assessment of the strategic fit of a firm's IS, but also one that can be readily checked prior to using the overall assessment of strategic fit in explanatory and predictive studies to examine the relationship between fit and other variables such as business performance.

We found the MSF model easy to apply once it has been instantiated for a specific type of IS, such as for SCM in our example application. Managers could use and understand the outputs of the model with only minimal education on the concept of realized competitive strategy archetypes. Application of the model only becomes more time-consuming and difficult when it is first applied to a new type of IS. For example, in Step 1 we used a grounded theory-type study to identify the relevant capabilities to measure for SCM, since no suitable prior studies were found. Repeated use of the model to measure SCM does not require performing this step again. Similarly, the check for corroborating evidence in Step 7 initially requires intensive research methods to have definitive confidence in the reliability and validity of the model, but once this is done, Step 7 does not need to be repeated to the same degree of detail.

We also evaluated the utility of the MSF model for practitioners by examining feedback on the measurement process and its outputs from the case study participants. Each participant appeared to find the MSF model and resultant strategic fit assessments useful for examining and understanding his or her case's competitive strategies and IS capabilities, as well as the fit between the two. There were no negative comments about the MSF model, even the most indifferent respondent (B-1) implied it was an improvement on prior approaches.

> **B-1:** *The suggested courses of action and areas of exploration could be valuable either for action or at least for discussion—to argue or prove why or why not.*

In general, the respondents indicated the MSF model yielded very interesting results.

> **A1-1:** *The outcome of [our retail and corporate business units having] two different [competitive strategy] types was a very interesting way of looking at things and looking at why [our retail] business is different and why it has different needs. Because the retail business [Case A2] has always said "we just need this" [even though these needs are not] necessarily aligned with the operational efficiency that the defender archetype [of Case A1] demands.*

> **E-2:** *I think it's very useful. I think the underlying philosophy of a company determines how it organizes itself and where it allocates its resources.*

The participants seemed especially interested in the ability to analyze and describe their competitive strategies using Miles and Snow's (1978) defender, prospector, and analyzer archetypes and the underlying dimensions of competitive strategy. The MSF model also appeared to be useful in helping to ensure that firms' IS are aligned with their competitive strategies, especially in large firms that may have numerous IS initiatives underway that are not likely to be in alignment

> **A1-1:** *I would stress that, especially in large firms, that a framework such as yours is useful because—say in our case, we've got…over 600 IT professionals that are spread across the organization supporting all different types of business units within the company….And I think your framework helps to ensure that we're all marching in the same direction….You do need to do that detailed functional requirement work, but continue to go from the detail to the big picture, using your framework to ensure that, at a corporate level, we're all aligned.*

In general, the MSF model and resultant strategic fit assessments had strong face validity as seen in the participants' comments attesting to its ability to reflect their situation accurately. The outputs also appeared to have strong reliability as seen in the corroboration of findings from multiple sources of data. In each case, the MSF model was judged to be valuable for generating strategic fit assessments that helped to confirm or clarify the strategic fit of the firms' IS capabilities. In addition, the MSF model was also seen to be valuable for enabling the communication of the firms' competitive strategies and the resultant IS capabilities that would support those strategies.

> **A1-1:** *I think it confirms a lot of what I and a number of my colleagues have been thinking. But it puts it in a nice framework to be able to have the IT people [and] business people down to the lowest level of corporation understand the link [between strategy and IS] and understand what it is that we're trying to achieve.*

Evaluation of Research

The preceding demonstration and evaluation of the outputs of the MSF model indicate it has met our requirements of being theoretically grounded, readily corroborated, and actionable. Hevner et al. (2004) expand upon these requirements in describing seven guidelines for conducting and evaluating design science research in IS. Guideline 1 is to ensure that the construction of the design artifact is justified using prior theory and the evaluation is conducted with appropriate research methods. Following Van Aken (2004), the design of the model steps described in the preceding section include a careful justification of each step using prior theory and evidence from the case studies. Guideline 2 is to ensure the research contributions are clear, verifiable, new, and interesting. The demonstration and evaluation of the MSF model and example instance indicates the approach can give a fine-grained analysis of the strategic fit of a firm's IS, which is readily actionable and corroborated with evidence compared to existing approaches.

Hevner et al.'s Guideline 3 is to create an innovative IS artifact in the form of a construct, model, method, or instantiation. The MSF model is innovative as it is the first to provide a holistic multilevel assessment of the strategic fit of a firm's IS such that the outputs are not only accessible for practitioners, but also more fine-grained and readily corroborated with evidence. Guideline 4 is to provide a solution to an important and relevant business problem. We argue that

the ongoing problem of measuring and improving strategic fit of IS requires a "theory for design and action" (Gregor 2006, p. 611) for guiding the assessments, not only at the level of overall strategic fit, but also at a detailed level that can diagnose specific areas of misfit where a firm can target their IS investments. Guideline 5 is to use a well-executed evaluation to demonstrate the efficacy, quality, and utility of the design artifacts. An analysis of evidence from interviews, questionnaires, and archival documents was used with six case studies in order to assess the reliability, validity, and utility of the constructed measurement model artifact.

Guideline 6 is to use an iterative search for an effective solution to the problem. This study used ongoing comparisons between emerging constructs, questionnaire items, and case study evidence to develop a reliable, valid, and useful measurement model and example instance. Guideline 7 is to communicate the results effectively to technology-oriented and management-oriented audiences. Throughout the case studies and research workshops, participant feedback indicated the MSF model is accessible to both researchers and practitioners and can produce outputs that are useful for guiding the analysis and communication of the strategic fit of a firm's information system.

Contributions to Theory

We argue that the MSF measurement model is an important contribution as a theory for design and action. First, the model clarifies and extends prior theoretical conceptualizations by providing a fine-grained yet holistic conceptualization of the fit between a firm's realized competitive strategies and IS capabilities. In contrast, prior studies typically conceptualize the strategic fit of a firm's IS at the level of overall IS strategies or IS portfolios (see Appendix A) and therefore limit the ease with which resultant fit measurements can be corroborated or used to identify specific areas of misfit. The MSF model also clarifies the importance of distinguishing between a firm's intended strategies (i.e., a Type A assessment of fit) and the firm's realized strategies and capabilities (i.e., a Type B or C assessment of fit). Furthermore, the MSF model demonstrates the utility of using configurational theory and the profile deviation approach for conceptualizing the fit between two multidimensional constructs. It also highlights how the Conant et al. (1990) measure, which has not been widely utilized in the IS literature, can overcome the limitations of Miles and Snow's (1978) paragraph-style instrument by fully operationalizing all 11 dimensions of the typology. Appendix E provides a further discussion of the design knowledge developed in the construction and evaluation of the MSF measurement model.

This paper makes a further contribution to knowledge on SCM. Despite being critically important to the success of many firms, SCMs have received insufficient attention in the empirical IS literature due, in part, to the complexity of their functionality (Subramani 2004). By developing clearer ways of conceptualizing SCM based on the organizational capabilities they enable, the research presented helps clarify the unique attributes of SCM and furthers our understanding of these complex information systems.

Finally, Lastly, this research makes an important contribution to research methodology by demonstrating the utility of a design science research approach for developing an empirically and theoretically grounded measurement process. The detailed explanation of research methods, prior theories, expository examples, and case study evaluations provide an example of how to confront the challenges of presenting design work for a process or method. We demonstrate how a design science research approach can be useful not only for the design of IS applications, but also for the design of measurement processes and instruments that provide theoretically grounded outputs that are readily corroborated, and are more actionable by both researchers and practitioners. Drawing upon extant design science research methodology (e.g., Baskerville et al. 2009; Gregor and Jones 2007; Hevner et al. 2004), the approach is well suited for addressing calls for IS research to balance the dual requirements of rigor and relevance (Benbasat and Zmud 1999; Straub and Ang 2008). This paper demonstrates how intensive research methods such as multiple case studies, combined with an iterative design-evaluation research approach, can be used to develop measurement instruments that are more intensively pilot tested using triangulation with multiple sources of evidence. A more traditional approach would be to adapt measurement instruments from prior studies and subject them to a relatively short pilot test and a more lengthy analysis of the statistical conclusion validity. That approach is only suitable if the validity of the theories and instruments are already well established (Boudreau et al. 2001). In contrast, the example instruments developed using the MSF measurement model can not only provide a reasonable demonstration of reliability and content validity, but also have good descriptive and prescriptive utility by providing outputs that are readily corroborated and actionable. Such intensively developed instruments are well suited for further explanatory and predictive research, which can then be used to examine the instruments' predictive utility and statistical conclusion validity.

Implications for Practice

From a practical standpoint, the MSF measurement model enables instruments to be developed that can identify the IS capabilities that a firm would need to address in order to improve the fit between the firm's competitive strategies and IS capabilities. We have demonstrated how the MSF model is applied in practice by using the model to measure the strategic fit of SCM across several case studies.

A significant benefit of using the MSF measurement model outlined in Table 1 is that practitioners can gain a better understanding of the chain of thinking for measuring strategic fit that includes determining their firm's realized (rather than intended) competitive strategies, identifying the ideal IS capabilities for those strategies, determining the overall strategic fit of their firm's IS, and finally analyzing and improving the individual misfits where their realized IS capabilities are not ideal. An MSF assessment also helps a firm to avoid wasting scarce resources on other IS capabilities that are already at or above ideal levels. Similarly, when firms are evaluating new or existing information systems, they can use the MSF model to assess how well the capabilities of their IS fits their competitive strategies. This can help decision makers reduce the risk and uncertainty in IS planning while maximizing the return on investment for IS implementations.

Furthermore, a researcher or practitioner could use the overall assessment of strategic fit to benchmark the firm or business unit against other firms or business units. For example, the overall strategic fit of the SCM at Case A1 was better than that at Case A2, which highlights a greater problem with the fit of the SCM for Case A2. The overall assessment (Step 5) could be used to identify the business unit(s) that had the lowest fit, while the detailed assessment (Step 6) could identify which capabilities had the lowest fit.

The case studies also reveal additional findings that have implications for practice. For example, Cases A1 and A2 demonstrate how two business units in a firm may exhibit very different competitive strategy patterns, even though the firm may intend to align each business unit with a single corporate competitive strategy. Case A's centralized IS infrastructure clearly fits the defender-type competitive strategies of the corporate business unit (Case A1) much more than the analyzer-type competitive strategies of the retail business unit (Case A2). This shows how important it is for the firm to detect differences in realized competitive strategies if it wishes to implement a single information system that meets the requirements for multiple business units. For example, information systems designed to be shared by Case A1 and Case A2 would need to provide at least the minimum level of support for each IS capability required for both defenders and analyzers. For SCM, this would include a high level of support for four of the five SCM capabilities with a medium level of support for operational flexibility. This situation highlights the problem of implementing IS to meet the needs of organizations with diverse or inconsistent competitive strategies—a topic worthy of further study.

Limitations and Future Research

We formally evaluated the MSF measurement model by using it to generate an example instance for measuring the strategic fit of a firm's SCM. SCMs were well suited for testing the efficacy of the MSF measurement model because, with their complex functionality, it is often difficult to determine how well a firm's SCM fits their competitive strategies (Reddy and Reddy 2001). We expect that since most other types of IS have a narrower range of functionality (for example, customer relationship management), it should be comparatively straightforward to analyze them using the MSF measurement model as the IS capabilities they support could readily be established.

We also note the MSF model requires respondents to rate the capabilities provided by their firm's IS relative to their industry norms to control for cross-industry differences (Dess 1990). Some respondents might have unrealistic perceptions, especially if they do not have sufficient experience. However, in our case study evaluations, we found agreement among the case respondents with regard to their perceptions of their firm's relative SCM capabilities as long as the managers had at least three months' experience in their current positions and five years' experience in their industries. A more lengthy process would involve normalizing each firm's scores across its industry as demonstrated in Sabherwal and Chan (2001). An added benefit of normalization is that it would provide benchmarking data for assessing the strategic fit of a firm relative to its competitors.

For the overall assessment of strategic fit of a firm's IS, the profile deviation approach to determining strategic fit by calculating the distance between theoretically ideal and reported configurations has strengths and weaknesses. As Van de Ven and Drazin (1985) and Sabherwal and Chan report, a profile deviation approach enables a more holistic rather than reductionist analysis of the relationship between multidimensional constructs. Such a systems perspective would be infeasible if a study were to focus on any of the many interacting relationships and factors individually (Venkatraman 1989a). However, future studies should

explore replacing the Euclidean distance calculation with a more complicated statistical clustering technique, such as calculating the Mahalanobis distance between the realized and ideal profiles as this would adjust for intercorrelations between the fit variables (Hair et al. 1998). However, the Euclidean distance calculation can be readily calculated from the gap analysis performed for a detailed (Type C) strategic fit assessment, while the Mahalanobis distance requires the additional calculation of a covariance matrix. An even stronger statistical approach would be to analyze the effect of the individual components of misfit using multivariate analyses (Edwards 1992), but again, such lengthy statistical analyses would be to the detriment of the goal of producing measurement outputs that are readily corroborated with evidence.

The Euclidean distance calculation of overall strategic fit used in this paper readily provides a useful overall assessment of the strategic fit of the IS at a case for comparison with other business units or other firms. Future research can use this ability to compare fit between firms in benchmarking studies and to clarify the relationship between fit and outcomes such as business performance or user satisfaction. The conditions under which the strategic fit of a firm's IS is associated with improved business performance could then be examined, which in turn would lead to stronger explanatory and predictive theories.

Further tests of the practical utility of the MSF model could be undertaken by examining the acceptance of the model in the marketplace of managerial ideas. As defined by Kasanen et al. (1993), a weak market test examines whether any managers have decided to use the model in actual decision making. A semi-strong market test examines whether the model is widely adopted by firms. A strong market test examines whether firms using the model outperform others. The MSF model has already passed the weak market test as it has been used by decision makers to gain a better understanding of their firm's realized competitive strategies as well as the fit with their firm's SCM capabilities. We further believe the model is sufficiently robust and flexible so that future studies can continue to evaluate, refine, and disseminate the MSF model so that it sees wider adoption in the marketplace.

Reflecting on our experience in this study, we have found the design science research approach valuable for producing measurement models that require intensive pilot testing due to immature or conflicting prior theory. Due to the relative newness of the theory base in the IS discipline, at times we may be quick to apply theories and research instruments developed in other studies to solve research problems in completely different contexts. The design science research approach, with its careful attention to evaluation of theories and instruments, encourages researchers to more clearly define the research problem space and solution space before confirmatory studies proceed. This coupling of carefully designed research artifacts with rigorous hypothesis testing research has great potential to produce stronger IS theories that are valuable to both researchers and practitioners within and beyond the IS discipline.

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RESEARCH ARTICLE

A MULTILEVEL MODEL FOR MEASURING FIT BETWEEN A FIRM'S COMPETITIVE STRATEGIES AND INFORMATION SYSTEMS CAPABILITIES

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Appendix A

Prior Approaches for Measuring the Strategic Fit of a Firm's Information Systems

Authors	Competitive Strategy Measures	Information Systems Measures	Strategic Fit of IS Measures	Insights for Measuring Strategic Fit of IS	Utility for Measuring Strategic Fit of IS
Chan et al. (1997)	• Respondents rate how well they agree to statements from Venkatraman's (1989b) 6-dimension business strategic orientation (STROBE) measure of aggressiveness, analysis, defensiveness, futurity, proactiveness, risk aversion (e.g., "We sacrifice short-term profitability to gain market share").	• Measures apply to firm's IS portfolio, not specific IS • Respondents rate how well their firm's IS support each of the 8 STROBE dimensions (e.g., "The systems help us monitor changes in our market share").	• Fit modeled as match between STROBE items and IS support for each STROBE dimension. • Results suggest IS support for STROBE dimensions moderated impact of STROBE items on business performance.	• Supports measuring fit using multidimensional configurations rather than contingency relationships. • Advocates modeling strategies as realized patterns of activity rather than intended plans.	• STROBE measures suitable for measuring fit of firm's IS portfolio, but not adapted for specific IS. • Requires 40 to 60 questions to operationalize STROBE and IS support for STROBE constructs. • Does not examine prescriptive utility of approach for measuring and improving fit.

Authors	Competitive Strategy Measures	Information Systems Measures	Strategic Fit of IS Measures	Insights for Measuring Strategic Fit of IS	Utility for Measuring Strategic Fit of IS
Sabherwal & Chan (2001)	• Responses to Venkatraman's (1989b) 6-dimension STROBE measure are used to assign a firm to one of Miles et al.'s (1978) Defender, Prospector, or Analyzer strategic archetypes. A review of literature is used to support the mapping of STROBE responses to the strategic archetype.	• Measures apply to firm's IS portfolio, not specific IS. • Respondents rate how well their firm's IS support four strategic attributes of IS (monitoring and controlling operations, market surveillance, strategic decision-making, and interorganizational coordination).	• Fit modeled as profile deviation between theoretically ideal IS profile for the firm's strategic archetype and respondent's ratings of support provided by the firm's IS for each of the four strategic attributes of the IS. • Results suggest strategic fit of IS influenced business performance for prospectors and analyzers, but not defenders.	• Supports measuring strategic fit using profile deviation approach to measure misalignment between ideal and realized support provided by a firm's IS. • Advocates analyzing previous literature to determine theoretically ideal IS attributes for a given Miles and Snow (1978) competitive strategy type.	• Attributes of a firm's IS strategies were used to assess fit of firm's IS portfolio, but did not focus on specific types of IS. • STROBE measure apparently more valid than Miles et al.'s (1978) paragraph-style measure, but does not operationalize all dimensions of Miles and Snow archetypes.[1] • Does not examine prescriptive utility of the approach for measuring and improving fit.
Avison et al. (2004)	• Intended strategies are inferred from documentation of business scope, distinctive competencies, and business governance (after Henderson and Venkatraman 1992).	• Intended and realized IS strategies are inferred from documentation of existing and proposed IS (after Henderson et al. 1996; Luftman 1996; Papp 2001).	• Fit modeled using strategic alignment model (SAM) proposed by Henderson et al. (1996) and extended by Luftman (1996) and Papp (2001). • Fit measured qualitatively as match between information systems and competitive strategies.	• Positions strategic fit of IS as a subset of a broader strategic alignment model containing business and IS strategies, structures, and processes, each of which can be the focal point for initiating alignment.	• Illustrates how SAM could be used to assess strategic fit of IS. Little guidance on determining competitive strategies or IS capabilities. • Provides an illustrative example of how to apply SAM to assess fit. Does not examine prescriptive utility directly.
Oh & Pinsonneault (2007)	• Respondents rate the relative importance of 34 strategic actions (after Miller and Chen 1996), which are used to determine how strongly the firm follows three generic strategies: revenue growth, quality improvement, and cost reduction.	• Measures apply to firm's IS portfolio, not specific IS. • Respondents indicate how many different types of IS are used at their firm from a list of 32 types of IS (e.g., order management). The percentage of potential IS that are used at the firm is used to infer how strongly the firm's IS portfolio supports revenue growth, quality improvement, and cost reduction strategies.	• Fit modeled as match between importance of business strategy actions (revenue growth, quality improvement, and cost reduction) and percentage of potential IS for supporting each strategy that are used at the firm. • Results suggest usage of cost reduction IS moderated impact of fit on business performance in area of cost reduction.	• Indicates that relationship between strategic fit of IS and business performance is nonlinear and requires careful attention to measures, contingency theories, and inter-relationships between variables.	• IS usage measures suitable for determining the composition of a firm's portfolio of IS and how well it supports the three generic strategies. • Does not examine prescriptive utility of the approach for measuring and improving fit.

[1]Miles et al.'s (1978) strategic archetype construct contains 11-dimensions (product–market breadth, market leadership, market surveillance, growth, process goals, competency breadth, adaptability, administrative focus, planning, organizational structure, and control) which are not fully operationalized in the paragraph-style measure originally proposed to measure the Miles and Snow archetype (Conant et al. 1990; Segev 1987).

Authors	Competitive Strategy Measures	Information Systems Measures	Strategic Fit of IS Measures	Insights for Measuring Strategic Fit of IS	Utility for Measuring Strategic Fit of IS
This study	• Miles and Snow (1978) archetype determined using responses to Conant et al.'s (1989) 11-dimension questionnaire.	• Generic IS capabilities adapted to measure capabilities of SCM. • Respondents rate how well their firm's IS support five SCM capabilities (operational efficiency, operational flexibility, planning, internal analysis, and external analysis).	• Fit modeled as profile deviation between theoretically ideal SCM capabilities profile for the firm's strategic archetype and respondent's ratings of support provided by firm's SCM for each of five SCM capabilities. • Results suggest outputs have strong face validity for assessing strategic fit as multiple levels.	• Describes the theoretical and empirical justification for a more fine-grained model for measuring the strategic fit of a firm's IS so that the outputs that are more actionable and readily corroborated.	• Strong theoretical and empirical support for measures used to operationalize strategic fit for SCM. • Utility and content validity of measurement model demonstrated through an iterative prototyping approach using an analysis of multiple case study interviews, questionnaires, and archival documents.

Appendix B

Summary of Case Descriptions

Case A produces and distributes energy products primarily in Canada. Throughout the firm, a centralized EDI-enabled ERP application is used for supply chain management, financial analysis, and procurement. For the corporate business unit represented by Case A1, the SCMs are primarily used for internal supply chain transactions, planning, and analyses, with some usage for external procurement transactions and analyses. For the retail business unit represented by Case A2, the SCMs are used more for external market scanning, product pricing analyses, and managing relationships and transactions with retail dealers and logistics providers.

Case B is a global contract manufacturer of electronic devices and components. Case B fulfils the various manufacturing, design, and supply chain management requirements that its clients desire to outsource. Although Case B tends to have long-term relationships and contracts with its large clients, there are typically several other global contract manufacturers that compete for the same clients. The SCMs used by Case B have advanced capabilities for coordinating and optimizing the supply chain. However, the diversity of product lines, geographic dispersion of the facilities, and frequency of mergers and acquisitions has resulted in Case B having a large number of different SCMs, which are not always well integrated.

Case C designs and manufactures integrated circuits (electronics chips) for use in electronics products that are manufactured by other firms. The relatively small size of the company Case C and the limited breadth of products has made it easier for them to deploy a fairly simple, integrated, and centralized SCM portfolio. Although there is interest in collaborative supply chain capabilities, the relatively low-volume, high-margin transactions have not required Case C to invest heavily in supply chain collaboration systems to date.

Case D is involved in the sales, service, manufacturing, and distribution of innovative high-end equipment for long-haul telecommunication networks. Case D outsources much of the product manufacturing to contract manufacturers including Case B and hence utilizes SCM primarily for order management and finance, rather than manufacturing and distribution. A centralized SCM is used throughout the firm to manage purchasing and to aggregate demand for supplied parts from the different business units of the firm.

Case E sells, services, manufacturers, and distributes equipment for long haul telecommunication networks. Case E outsources product manufacturing to contract manufacturers including Case B. However, the proportion of manufacturing outsourced by Case E is less than Case D. Although Case E's SCMs are used primarily for order management and finance, manufacturing and distribution functionality is used more extensively than at Case D. In addition, Case E generally has a larger product and geographic range than Case D and has operated the business for a much longer period. Case E uses a variety of SCM including several different ERP systems, which are partially integrated with an enterprise-wide advanced planning and scheduling SCM. Separate order management, finance, and product life cycle management information systems are used to manage order fulfillment, product development, customer service, and market intelligence. There is some process integration with customers and suppliers; however, the information exchanged is limited mostly to capturing customer requirements and aggregating purchase orders.

Appendix C

Questionnaire Items Used in the Measurement of Strategic Fit of SCM

C1. Multi-Item Scale for Identification of Realized Competitive Strategies

The following measure is adapted from Conant et al. (1990). Test-retest reliability of Conant et al.'s original scale items 1 to 11 and the overall instrument are:

1	2	3	4	5	6	7	8	9	10	11	Intrument
.63	.73	.72	.62	.82	.75	.67	.70	.66	.73	.56	0.74

The letters in italics and brackets identify the response characteristic of a (D) = defender, (P) = prospector, (A) = analyzer, and (R) = reactor. These letters and the item titles are for description and analysis purposes only and were removed from the questions given to respondents. The 11 scale items comprising the instrument correspond to the 11 competitive strategy dimensions in the Miles and Snow (1978) typology. The order presented was 1,5,8,7,4,2,10,3,9,11,6 to decrease the risk of hypothesis guessing and reduce risk of recency effects for related items.

1. *Entrepreneurial: Product–Market Focus*
   In comparison to our competitors, the products and services that we provide to our customers are best characterized as
   (a) More innovative; continually changing; and broader in scope. *(P)*
   (b) Fairly stable in certain markets while innovative in other markets. *(A)*
   (c) Well focused; relatively stable; and consistently defined throughout the marketplace. *(D)*
   (d) In a state of transition, and largely based on responding to opportunities or threats from the marketplace or environment. *(R)*

2. *Entrepreneurial: Market Leadership*
   In contrast to our competitors, my organization has an image in the marketplace as one which
   (a) Offers fewer, selective products and services that are high in quality. *(D)*
   (b) Adopts new ideas and innovations, but only after careful analysis. *(A)*
   (c) Reacts to opportunities or threats in the marketplace to maintain or enhance our position. *(R)*
   (d) Has a reputation for being innovative and creative. *(P)*

3. *Entrepreneurial: Market Surveillance*
   The amount of time my organization spends on monitoring changes and trends in the marketplace can best be described as
   (a) Lengthy: We are continuously monitoring the marketplace. *(P)*
   (b) Minimal: We really do not spend much time monitoring the marketplace. *(D)*
   (c) Average: We spend a reasonable amount of time monitoring the marketplace. *(A)*
   (d) Sporadic: We sometimes spend a great deal of time and at other times spend little time monitoring the marketplace. *(R)*

4. *Entrepreneurial: Market Growth*
   In comparison to our competitors, the increase or losses in demand that we have experienced are due most probably to
   (a) Our practice of concentrating on more fully developing those markets that we currently serve. *(D)*
   (b) Our practice of responding to the immediate needs of the marketplace. *(R)*
   (c) Our practice of aggressively entering into new markets with new types of product and service offerings. *(P)*
   (d) Our practice of assertively penetrating more deeply into markets we currently serve, while offering new products and services only after a very careful review of their potential. *(A)*

5. *Engineering: Process Goals*
   One of the most important goals in this organization in comparison to our competitors is our dedication and commitment to
   (a) Keep costs under control. *(D)*
   (b) Analyze our costs and revenues carefully to keep costs under control and to selectively generate new products and services or enter new markets. *(A)*
   (c) Insure that the people, resources, and equipment required to develop new products and services and new markets are available and accessible. *(P)*
   (d) Make sure that we guard against critical threats by taking whatever action is necessary. *(R)*

6. *Engineering: Competency Breadth*
   In contrast to our competitors, the competencies (skills) that our managerial employees possess can best be characterized as
   (a) Analytical: their skills enable them to both identify trends and then develop new product or service offerings or markets. *(A)*
   (b) Specialized: their skills are concentrated into one, or a few, specific areas. *(D)*
   (c) Broad and entrepreneurial: their skills are diverse, flexible, and enable change to be created. *(P)*
   (d) Fluid: their skills are related to the near-term demands of the marketplace. *(R)*

7. *Engineering: Infrastructure Adaptability*
   The one thing that protects my organization from competitive failure is that we
   (a) Are able to carefully analyze emerging trends and adopt only those that have proven potential. *(A)*
   (b) Are able to do a limited number of things exceptionally well. *(D)*
   (c) Are able to respond to trends as they arise even though they may possess only moderate potential. *(R)*
   (d) Are able to consistently develop new products and services and new markets. *(P)*

8. *Administrative: Administrative Focus*
   More so than many of our competitors, our management staff tends to concentrate on
   (a) Maintaining a secure financial position through cost and quality control measures. *(D)*
   (b) Analyzing opportunities in the marketplace and selecting only those opportunities with proven potential, while protecting a secure financial position. *(A)*
   (c) Activities or business functions which most need attention given the opportunities or problems we currently confront. *(R)*
   (d) Developing new products and services and expanding into new markets or market segments. *(P)*

9. *Administrative: Planning*
   In contrast to many of our competitors, my organization prepares for the future by
   (a) Identifying the best possible solutions to those problems or challenges that require immediate attention. *(R)*
   (b) Identifying trends and opportunities in the marketplace which can result in the creation of product or service offerings which are new to the marketplace or which reach new markets.*(P)*
   (c) Identifying those problems that, if solved, will maintain and then improve our current product and service offerings and market position. *(D)*
   (d) Identifying those trends in the industry that other firms have proven possess long-term potential while also solving problems related to our current product and service offerings and our current customers needs. *(A)*

10. *Administrative: Organizational Structure*
    In comparison to our competitors, the structure of my organization is
    (a) Functional in nature (i.e., organized by department — marketing, accounting, personnel, etc.). *(D)*
    (b) Product- or market-oriented (for example, business units are organized by product or market and handle functions like marketing and accounting internally). *(P)*
    (c) Primarily functional (departmental) in nature; however, a product- or market-oriented structure does exist in newer or larger product or service offering areas. *(A)*
    (d) Continually changing to enable us to meet opportunities and solve problems as they arise. *(R)*

11. *Administrative: Control*
    Unlike many of our competitors, the procedures my organization uses to evaluate our performance are best described as
    (a) Decentralized and participatory encouraging many organizational members to be involved. *(P)*
    (b) Heavily oriented toward those reporting requirements which demand immediate attention. *(R)*
    (c) Highly centralized and primarily the responsibility of senior management. *(D)*
    (d) Centralized in more established service areas and more participatory in newer product or service areas. *(A)*

C2. Paragraph-Style Scale for Identification of Realized Competitive Strategies

This measure is from Miles and Snow (1978) and is used as a supplementary measure to the preceding 11-item scale developed by Conant et al. (1990). To reduce hypothesis guessing and biasing the responses with the Miles and Snow competitive strategy type names, the archetype names were removed and the order of presentation was changed.

Prospector: A firm with this type of strategy typically operates within a broad product-market domain that undergoes periodic redefinition. The organization values being "first in" in new product and market areas even if some of these efforts prove not to be highly profitable. The organization responds rapidly to early signals concerning areas of productivity, and these responses often leads to a new round of competitive actions. However, a firm with this type of strategy may not maintain market strength in all of the areas it enters.

Reactor: A firm with this type of strategy does not appear to have a consistent product-market orientation. The organization is usually not as aggressive in maintaining established products and markets as some of its competitors, nor is it willing to take as many risks as other competitors. Rather, the organization responds in those areas where it is forced to by environmental pressures.

Defender: A firm with this type of strategy attempts to locate and maintain a secure niche in a relatively stable product or service area. The organization tends to offer a more limited range of products or services than its competitors, and it tries to protect its domain by offering higher quality, superior service, lower prices, and so forth. Often a firm with this type of strategy is not at the forefront of developments in the industry; it tends to ignore industry changes that have no direct influence on current areas of operations and concentrates instead on doing the best job possible in a limited area.

Analyzer: A firm with this type of strategy attempts to maintain a stable, limited line of products or services, while at the same time moving out quickly to follow a carefully selected set of the more promising new developments in the industry. The organization is seldom "first in" with new products or services. However, by carefully monitoring the actions of major competitors in areas compatible with its stable product–market base, the organization can frequently be "second in" with a more cost-efficient product or service.

C3. Realized SCM Capabilities Assessment Instrument

Since an instrument for measuring these constructs did not already exist, this study combined items from preexisting and previously validated measures as shown in the notes following the items. A Likert-type scale was used where 1 = to a much lesser degree, 3 = to the same degree, and 5 = to a much greater degree.

Evidence of Support for	"My overall perception is that compared to our competitors', our supply chain management information systems…"
Operational Efficiency	1. improve the efficiency of our day-to-day business operations.[1] 2. provide timely information for cost control.[2]
Operational Flexibility	3. provide the flexibility to adapt to unanticipated changes.[3] 4. make it easy to switch to another supplier or customer to supply or purchase the same product or service.[4]
Planning	5. facilitate *long-term* strategic business planning.[1] 6. provide us with the data we need to support our day-to-day decision-making.[1]
Internal Analysis	7. enable us to develop detailed analyses of our present business situation.[1] 8. provide reliable information on the organization's financial situation.[2]
External Analysis	9. assist us in setting our prices *or value proposition* relative to the competition.[1] 10. provide information on competitive products and services.[2]

Notes:
[1]Adapted from Sabherwal and Chan (2001); the words in italics were added for clarity.
[2]Adapted from Zviran (1990).
[3]Adapted from Venkatraman and Ramanujam (1987).
[4]Adapted from Bensaou (1997).

An additional Likert-type questionnaire item measured the perceived strategic fit of the firm's IS capabilities (where 1 = very low and 5 = very high). This questionnaire item was used to provide a parsimonious measure for triangulation with the qualitative evidence and the MSF model's calculated (Euclidean Distance) level of strategic fit for the case studies.

11. "I feel that the degree to which the capabilities of our supply chain management information system support our business needs is...."

Appendix D

Excerpts of Reports Prepared from Quantitative Analyses

Summary reports were prepared for each case based on the qualitative analysis of interview transcripts and archival documents. The analyses identified the capabilities that appeared to need improvement to increase the overall strategic fit of each case's SCM. The following excerpts from the reports highlight some of the findings and recommendations for each case.

In general, **Case A**'s information systems appear to have adequate support for the capabilities required for the defender-type competitive strategy of the corporate business unit (Case A1). However, for the retail business unit (Case A2), the level of support for operational flexibility and external analysis capabilities appear to be insufficient for their analyzer-type competitive strategy. Thus, while Case A's centralized IS infrastructure fits well with the corporate business unit, it has a poor strategic fit for the retail business unit. This highlights the need for IS planners to ensure various business units in a firm share the same competitive strategies before implementing a homogenous IS infrastructure across the firm.

Case B's IS appears to provide the theoretically ideal level of support required for operational flexibility and external analysis. However, the strategic fit of Case B's IS can be improved by increasing the level of support for operational efficiency, planning, and internal analysis capabilities. It appears that Case B's IS is poorly suited to a defender-type strategy. This may be because Case B inherited many of its systems from the parent company it was spun off from and from several companies it has acquired.

Case C can improve the strategic fit of its IS by focusing on increasing the level of support they provide for operational flexibility and external analysis capabilities. Case C's IS consists primarily of a commercial ERP package that was implemented to improve operational efficiency and internal information sharing rather than operational flexibility or external analysis. However, the lack of strategic fit with Case C's prospector-like competitive strategies may be the primary reason why Case C's users have been unsatisfied with the performance of their organizational IS and have had to rely heavily on the use of less automated information systems such as standalone spreadsheets and databases.

For **Case D**, the lack of fit in external analysis capabilities is expected to hinder their prospector-like competitive strategy. Indeed, Case D's parent firm recently suffered large inventory write-offs due in part to an inability to coordinate supply and demand information with its supply chain partners. The firm is currently making large investments in collaborative SCM to address the shortcomings of their external analysis capabilities.

For **Case E**, the level of support for internal analysis met the theoretically ideal level. However, support for operational flexibility and external analysis capabilities appeared to be insufficient. A respondent noted that although Case E's IS was adequate when economic conditions were very favorable, the need for improving the ability to integrate and analyze information becomes more apparent during the recent economic downturn. This suggests strategic fit may be more important in lean economic times than in periods of robust profitability. Case E's SCM consisted primarily of packaged and custom-built ERP and APS software that traditionally have not been designed for the external analysis or operational flexibility capabilities required by Case E's prospector-type strategy. We expect Case E's lagging operational performance can be greatly improved by implementing IS that better fit their competitive strategies (Cragg et al. 2002; Henderson et al. 1996).

Appendix E

Design Knowledge for the Multilevel Strategic Fit Measurement Model

In order to generate the design knowledge for a new measurement model, the design science research approach cycled through the following steps: clarifying the purpose and scope of the design, identifying the theoretical basis or justificatory knowledge for the design as well as the underlying theoretical constructs, determining the principles of form and function of successive prototypes, and developing testable propositions and evaluating each prototype (Gregor and Jones 2007). These six core components of the design knowledge for the MSF measurement model are shown in the columns in Table E1. The purpose and scope explains why strategic fit is measured the way it is. The constructs describe how the strategic fit of a firm's IS is conceptualized in the MSF model. The justificatory knowledge is the theoretical basis for the components of the model and is described in the section called the "MSF Measurement Model." The principles of form and function of the MSF model are the steps used to obtain the assessments of strategic fit at any of the three levels (see Table E1). Artifact mutability outlines the extent to which the measurement instruments generated using the MSF measurement model can be changed. For example, the relevant set of IS capabilities to be analyzed can readily be changed according to the type of IS. Finally, the testable propositions are statements that can be tested to ensure the MSF model fulfills its intended purpose.

Table E1. Core Components of the Design Knowledge for a Multilevel Strategic Fit Measurement Model	
Purpose and Scope	Assess how well a firm's realized IS capabilities support the firm's realized competitive strategies.
Constructs	Strategic fit is conceptualized as the match between a firm's realized IS capabilities and theoretically ideal IS capabilities.
Justificatory Knowledge (Theoretical Basis for Design)	A firm's realized IS capabilities may differ from intended designs due to constant readjustments to design and implementation (Markus and Robey 1998; Truex et al. 1999). A firm's competitive strategies emerge from the interplay between intended and realized strategies (Mintzberg 1978). Configurational theories can reduce the complexity of measuring fit between two multidimensional profiles, while providing a more holistic analysis than contingency theories (Doty et al. 1993). Prior research can be used to prescribe theoretically ideal levels of a variable such as IS capabilities according to the firm's competitive strategy type (Venkatraman 1989a). A profile deviation approach is useful for both researchers and practitioners for assessing the overall fit between two multidimensional constructs such as a firm's realized and ideal IS capabilities profiles (Venkatraman 1989a).
Principles of Form and Function	Step (1) Identify the set of IS capabilities to be measured according to the type of IS. Step (2) Measure the firm's realized level of support for each IS capability. Step (3) Identify the firm's realized competitive strategy archetype. Step (4) Determine the theoretically ideal level of support for each IS capability according to the firm's competitive strategy archetype. Step (5) Calculate the overall (Type B) strategic fit of the firm's IS as the overall deviation between the firm's ideal and realized level of support for each IS capability. Step (6) Calculate the detailed (Type C) strategic fit of the firm's IS as the difference between the firm's ideal and realized level of support for each IS capability . Step (7) Check for corroboration of the overall and detailed assessment of strategic fit of the firm's IS using interviews and archival documents
Artifact Mutability (how it handles changes)	The relevant set of IS capabilities to be analyzed can readily be changed according to the type of IS and the needs of the firm. A firm's realized competitive strategies could be described in more precise terms than Miles and Snow's (1978) generic strategic archetypes. For example, a firm could be described as having a specific mix of strategic archetypes or patterns. The theoretically ideal IS capabilities prescribed for a given realized strategy type could be expanded if more research is done on other types of IS or other types of strategic patterns. The method of calculating overall fit could be refined with further study. For example, different weights could be assigned to each capability depending on its relative impact on performance.
Testable Propositions	The overall assessment of strategic fit of a firm's IS (Step 5) has utility for explaining or predicting relationship between strategic fit and organizational performance. The detailed overall assessment of strategic fit of a firm's IS (Step 6) has utility for describing and prescribing the IS capabilities that a firm needs to improve to support the firm's realized competitive strategies.

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