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Performance Metric Portfolios: A Framework Grounded in Operations Strategy

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Abstract

The widespread adoption of supply chain management principles suggests that managers recognize the importance of evaluating operational decisions holistically. However, it is often difficult to link specific operational practices to strategic level outcomes and in turn to corporate financial results. This presents problems for both managers and academic researchers attempting to justify the often high cost of operational improvement initiatives in terms of objective accounting metrics.

This study provides evidence that it *is* possible to demonstrate linkages between carefully chosen portfolios of tactical, strategic, and financial metrics. Survey data from 118 manufacturers are used to evaluate hypotheses linking multi-level metrics of performance across three well-established strategic foci. We present theoretically-grounded portfolios of metrics drawn from the literature and from the Supply Chain Council's supply-chain operations reference (SCOR) model and related design and customer chain models. Our analysis suggests that metric portfolios in which tactical metrics are designed to match strategic-level metrics, based on alignment with a specific strategic focus, provide clearer mechanisms for understanding performance linkages.

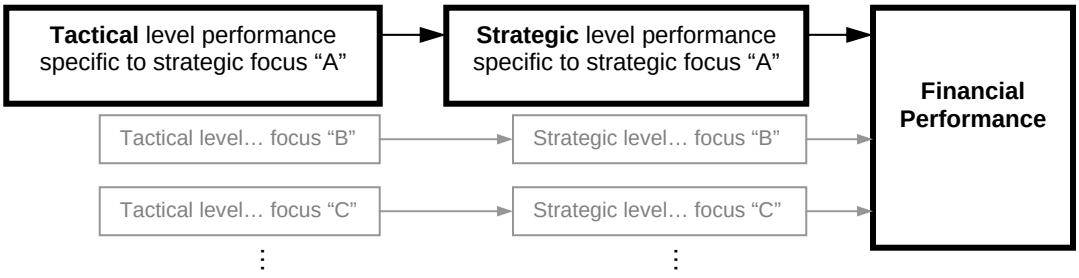
Keywords: operations strategy, performance measurement systems, metrics, empirical research

1. Introduction

In order to ensure growth and competitive sustainability, firms need to repeatedly demonstrate their ability to provide unique offerings preferable at some level to those made available by their competitors. Measures of financial performance, such as rate of return or profitability, typically provide some of the highest-level indicators of this ability. Unfortunately, due to the high-level nature of these measures, the linkage between financial performance, actual internal strategy, and operational practice aimed at supporting that strategy remains difficult to discern. The ambiguity of these connections has serious repercussions for managers at various levels attempting to remain focused on the key operational performance issues and associated practices that ultimately drive firm competitiveness (Dixon, Nanni, and Vollman 1990).

Fortunately, existing research is not without insights into reducing this ambiguity. Strategic fit theory, for example, has been used to suggest that the selection of metrics should be idiosyncratic to strategic focus (Khurana, Lin, Rosenzweig, and Roth 1998; Melnyk, Stewart, and Swink 2004) in the hope that performance along such operational practices will enable performance at the strategic level. Melnyk et al. (2004, 211) assert: "A metric is a verifiable measure, stated in either quantitative or qualitative terms and defined with respect to a reference point. Ideally, metrics are consistent with how the operation delivers value to its customers as stated in meaningful terms." If strategic focus is key to defining the competitive orientation of firms and the mechanisms by which financial benefits can be generated, then at the tactical level a concentration on metrics for activities that directly support (i.e., lead to strategic-level performance along) such a focus should be essential. The general conceptual framework adopted in this study, for which we provide theoretical support in the next section, follows this very line of logic and is presented in general form in Figure 1. In it we incorporate notions generalized from previous multi-level frameworks (Dean and Snell 1996; Khurana et al. 1998; Koufteros, Vonderembse, and Doll 2002; Mallick and Schroeder 2005; Slater, Olson, and Reddy 1997; Kaplan and Norton 1992).

Figure 1 General Conceptual Framework Guiding this Study



Regardless of such insights, to date there remains a tendency for studies to pursue a rather one-dimensional view of tactical- and strategic-level performance linkages that often do not explicitly take strategic focus into consideration (Lohman, Fortuin, and Wouters 2004; Epstein and Westbrook 2001). We attempt to address this gap in the literature by constructing and evaluating linkages within metric portfolios idiosyncratic to three well-established strategic foci in the literature: *Operational Excellence*, *Customer Intimacy*, and *Product Leadership* (Kaplan and Norton 2000; Treacy and Wiersema 1993); see section 2.2 for an extended discussion. By metric portfolios, we mean sets of metrics designed to concisely and meaningfully describe the state of an enterprise. Useful portfolios that allow for policy-performance transparency and causal inference span multiple levels of management and contain both tactical and strategic performance metrics. Using data collected from 118 manufacturers, our analysis suggests that metric portfolios in which tactical metrics are designed to match strategic-level metrics, based on alignment with a specific strategic focus, provide clearer mechanisms for understanding performance linkages.

In the next section, we outline the literature on which we build our arguments for the role of strategic focus in metric portfolio construction and our hypotheses regarding these portfolios. In section 3 we

describe the process through which we develop representative items that compose our test metric portfolios. Section 3 also discusses the data collection associated with these portfolios of metrics. The analysis and results of our hypotheses tests are then provided in section 4, followed by a discussion of the research implications, limitations, and potential areas for future study.

2. Theoretical Development

2.1. Systems Approach to Performance Measurement

According to Melnyk et al. (2004, p. 209), "…metrics and performance measurement are critical elements in translating an organization's mission, or strategy, into reality." Since no single operational activity, or associated performance metric, sufficiently describes the breadth of activities that support a firm's strategy, diversified accounting systems have been proposed to assist managers in capturing a clearer picture of firm performance. Generally speaking, a performance measurement system should provide a limited range of critical performance metrics that sufficiently represent the key attributes of the organization's ongoing strategy-supporting operations (Evans 2004; Kaplan and Norton 1993, 1996, 2000; Khurana et al. 1998). Financial and operational metrics are used for benchmarking against both past performance levels and for comparison against the performance of other organizations with which the firm either competes or deals with in a partnered or complementary role. The rationale behind relying on a limited, rather than open, list of key performance metrics is to help ensure focused decision-making across managerial levels. Too many metrics can lend to uncertainty, cognitive overloads, local biases, misaligned decisions and ultimately poor strategic execution; not something a firm would like to convey to its various stakeholders (Melnyk et al. 2004).

But the question remains: *How can a firm develop the right portfolio of performance metrics to bolster its strategy and thus ultimately generate financial benefits*? Theoretically, the answer should be largely based on what exactly the strategy of the firm entails (Khurana et al. 1998; Lohman et al. 2004; Melnyk et al. 2004; Neely, Gregory, and Platts 1995; White 1996a). For firms with vastly different strategies, even within the same marketplace, the appropriate set of key performance metrics may be vastly different as well (Slater et al. 1997). Following Hambrick and Fredrickson (2001), we define strategy as an externally-oriented concept of how the firm will achieve its objectives. By externally-oriented, we mean those capabilities visible to the customer, such as the ability to offer a low price. Specifically, competitive capabilities define *what* broad-based, heterogeneous factors are critical to business success…Since competitive capabilities represent the ability of the total firm to meet customer requirements, they are often highly perceptible to customers (Roth and Jackson, 1995, 1721-1722). Zhang, Vonderembse, and Lim (2003) assert that externally-focused, competitive capabilities can be viewed as linkages between corporate strategy and the functional strategies of the firm. Clearly, the use of longer-term, externally-focused, strategic-level metrics enables the firm to measure how successful they are in achieving the desired positioning in the marketplace (Kaplan and Norton 2000; Khurana et al. 1998).

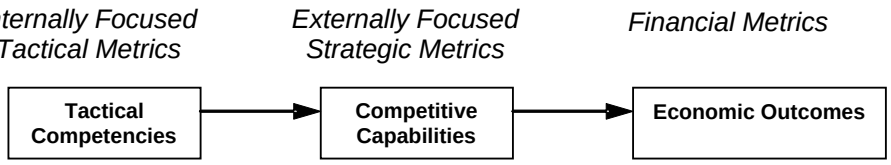
Internally-oriented competencies, in turn, support these customer-facing capabilities (see Figure 2). There are many different views of "competency" in the extant literature. For clarity, this research draws on Roth and Jackson's definition (1995, 1722):

> [C]ompetencies refer to more localized production expertise, such as the bundle of people skills, system integration, or specific production technologies that can be linked to a specific point in the value chain or to specific strategic design choices that create competitive capabilities…competencies designate how specific competitive capabilities are acquired and leveraged.

It is through the implementation of these more internally-oriented competencies that organizations achieve strength on externally-oriented capabilities (Heskett, Jones, Loveman, Sasser, and Schlesinger 1994; Kaplan and Norton 2000; Khurana et al. 1998; Koufteros et al. 2002; Neely et al. 1995; Roth and Jackson 1995; Upton 1994). For example, manufacturers that develop a product mix flexibility capability often do so by means of internal competencies including machine, labor, and routing flexibilities (Zhang et al. 2003). From an operations strategy perspective, then, internal competencies are more

tactical/operational in nature than external capabilities, as they typically reflect the shorter-term aspects of manufacturing (Gunasekaran, Patel, and Tirtiroglu 2001; Hill 1989; Koufteros et al. 2002; Wacker 1996).

Figure 2 Theoretical Foundation for Multi-Level Performance Linkages



Adapted from Koufteros, Vonderembse & Doll (2002)

Finally, when congruent with the organization's goals and objectives and implemented effectively, operational initiatives like statistical process control (SPC) foster operational competencies such as conformance to design specifications (see Figure 2; Ferdows and De Meyer 1990; Khurana et al. 1998; Kim and Arnold 1996). In this case, short- to medium-term metrics capture how well the operational initiatives cultivate internal, operations competencies. Tactical/operational metrics such as these are often used to diagnose variations in performance against plan.

This division of performance metrics into two levels of meaningful consideration—strategic and tactical/operational—is further justified by literature on operations management (OM) decision level categorization (Parente 1998). For example, Malhotra, Steele, and Grover (1994) support the distinction between strategic and tactical planning levels through the results of an extensive Delphi study; long-term positioning and design decisions (e.g., capacity planning, facility location, etc.) are characterized as strategic issues, while short- to medium-term operating decisions needed to manage the organization (e.g., master production scheduling, inventory control, etc.) are classified as tactical issues. Further, in a typology of manufacturing performance metrics, White (1996a) categorizes metrics based on the data source: internal sources of data are attained within the organization (e.g., conformance to design specifications) while external sources reflect data captured from customers (conformance to customers' needs), suppliers, etc. For these reasons, we focus only on the distinction between 'strategic' and 'tactical/operational ('tactical/operational' term hereafter 'tactical') measurement considerations.

2.2. Strategic Focus

As a result of the key role that strategy plays in driving the allocation of resources and thus the foundations of performance at both strategic and tactical levels, the general strategic focus or positioning of organizations should be incorporated in the construction, testing, and application of metric portfolios if such portfolios are in fact intended to guide a wide range of organizations towards financial gains (Khurana et al. 1998). The predominant role that any single strategic dimension plays in characterizing the objectives of a firm can be used to categorize firms as falling predominantly into a particular strategic group among other firms with similarly oriented objectives.

In the management literature, for example, Miles and Snow (1978) propose three viable strategic types: *Defenders*, *Prospectors*, and *Analyzers*. While Defenders attempt to position themselves in the marketplace by offering a relatively narrow set of products at low prices, Prospectors focus on product innovation and market development; the strategic positioning of Analyzers lies somewhere in between Defenders and Prospectors. Such strategic orientations of organizations in the management literature laid the foundation for various taxonomies of manufacturing strategies.

Using cluster analysis, Miller and Roth (1994) identify three generic manufacturing strategies—*Caretakers*, *Innovators*, and *Marketeers*—which share many commonalities with Miles and Snow's (1978) strategic types as well as with Porter's (1985) generic strategies; see Table 1. Similar to Defenders and the Cost Leadership strategy, Caretakers distinguish themselves by competing on price, but members of this cluster also tend to emphasize delivery reliability, conformance quality, and delivery speed. Like Prospectors, Innovators seek to make rapid changes in design and to quickly introduce high performance products to the marketplace. Finally, Marketeers are known for their ability to offer broad product lines

that target niche markets, along with a focus on after-sales service. Frohlich and Dixon (2001) replicate Miller and Roth's (1994) analysis using two more recent global samples of manufacturers, and conclude that while the Caretaker and Innovator strategies seem to be generally robust over time, a viable/defensible Marketeer strategy may no longer exist in practice.

Table 1 Overview of Strategic Groups Literature

Study	**Strategic Groups**		
Miles and Snow (1978)	Defenders	Analyzers	Prospectors
Porter (1985)	Cost Leadership	Differentiation	Focus
Miller and Roth (1994)	Caretakers	Marketeers	Innovators
Frohlich and Dixon (2001)	Caretakers	Designers	Innovators
Kathuria (2000)	Efficient/Speedy Conformers	Do All	----------
Treacy and Wiersema (1993)	Operational Excellence	Customer Intimacy	Product Leadership

Treacy and Wiersema (1993) prescribe a typology that captures features of the various strategic groups contained in both the management and manufacturing strategy literatures. In particular, Treacy and Wiersema (1993) suggest that market leaders provide customer value by means of *Operational Excellence* (e.g., McDonald's), *Product Leadership* (e.g., Intel), and/or *Customer Intimacy* (e.g., Lowe's). While Treacy and Wiersema's (1993) three paths to market leadership generally map to Miles and Snow's (1978) and Porter's (1985) typologies, the authors assert that their strategic foci are based on a more expanded concept of customer value, aspects of which are contained in the manufacturing strategy clusters described above. For this reason, our subsequent discussion and analysis is based on Treacy and Wiersema's (1993) typology.

Treacy and Wiersema's (1993) first path to market leadership, Operational Excellence, captures the extent to which the organization leverages standardization in providing cost-effective, fast and reliable fulfillment of order requirements (Slater et al. 1997; Treacy and Wiersema 1993). In this strategy, cost savings are typically accrued by means of operational efficiencies and process improvements (Kaplan and Norton 2000).

A strategic focus of Product Leadership embodies the organization's ability to rapidly develop and deploy innovative products and services that exceed existing performance boundaries (Slater et al. 1997; Treacy and Wiersema 1993). Product leaders seek to quickly identify and commercialize emerging opportunities, as well as rapidly assess customer response, and as a result, their "business and management processes have to be engineered for speed" (Treacy and Wiersema 1993, p. 89).

Finally, the Customer Intimacy path to market leadership implies that the organization recognizes and accommodates customer preferences in order to build strong, lasting relationships. Treacy and Wiersema (1993, p. 84) assert that a Customer Intimacy strategy emphasizes "…segmenting and targeting markets precisely and then tailoring offerings to match exactly the demands of those niches… companies that excel in customer intimacy combine detailed customer knowledge with operational flexibility so that they can respond quickly to almost any need."

Although the preceding literature implies that an organization's strategic focus is categorized as biased toward one particular strategy more so than others, firms are likely to be characterized by efforts along multiple dimensions simultaneously (Frohlich and Dixon 2001; Kathuria 2000; Slater et al. 1997). According to Kaplan and Norton (2000, p. 172), "Companies strive to excel in one of the three areas [Operational Excellence, Product Leadership, Customer Intimacy] while maintaining threshold standards in the other two." A firm's logical consideration of a portfolio of performance metrics spanning multiple strategies is thus justified. Regardless, in order to develop parsimonious prescriptions for metric portfolios that can be supported empirically, it is helpful to use a categorical approach to describing the *predominant* strategic focus of individual organizations.

2.3. Performance Metric Frameworks

The literature offers various conceptual performance metric frameworks designed to identify and measure causal relationships among specific operational initiatives, the strategic focus of the organization, and the desired economic outcomes (Epstein and Westbrook 2001; Kaplan and Norton 1996, 2000). In this section, we review several well-established performance metric frameworks. Building on this discussion (and sections 2.1 and 2.2), we offer a series of hypotheses that relate strategic focus, portfolios of aligned tactical and strategic metrics, and financial metrics of performance.

One of the more established performance metrics frameworks is the balanced scorecard concept (Kaplan and Norton 1992), which has its roots in the activity-based costing literature (see, for example, Cooper and Kaplan 1988). The balanced scorecard provides a general framework for linking a variety of lower-level, operational metrics to corporate financial results (Kaplan and Norton 1992). Although balanced scorecards were initially introduced as a performance management tool to complement traditional financial metrics, much of the recent literature is devoted to their use in defining and driving the realization of strategic objectives (Kaplan and Norton 1996, 2001, 2004; Ittner and Larcker 2003; Ittner, Larcker, and Meyer 2003; Slater et al. 1997).

According to Kaplan and Norton (1993), Slater et al. (1997), and Khurana et al. (1998), different strategies and environmental conditions necessitate different performance measurement systems. Khurana et al. (1998), for example, offer empirical evidence that the composition of a performance measurement system varies depending on the firm's strategic focus. From a strategic fit perspective, strategic-level metrics enable the firm to measure how successful they are in achieving its long-run objectives (Epstein and Westbrook 2001; Ittner and Larcker 2003; Ittner et al. 2003; Kaplan and Norton 2000; Kathuria 2000; Melynk et al. 2004; Richardson, Taylor, and Gordon 1985; Venkatraman 1989). Along these lines, Slater et al. (1997, p. 40) conclude that, "Business units with a performance measurement focus that complements their market strategies are generally perceived to be superior performers by senior management." Therefore, organizations exhibiting characteristics that operationalize a particular strategic focus are expected to demonstrate stronger links with its associated strategic metrics:

H1a: *Performance on Operational Excellence strategic metrics is stronger for organizations with an Operational Excellence focus.*

H1b: *Performance on Customer Intimacy strategic metrics is stronger for organizations with a Customer Intimacy focus.*

H1c: *Performance on Product Leadership strategic metrics is stronger for organizations with a Product Leadership focus.*

Balanced scorecards also "link a company's long-term strategy with its short-term actions" (Kaplan and Norton 1996, p. 75); this is exactly the goal of OM researchers evaluating the effectiveness of operations initiatives. Similarly, Heskett et al.'s (1994) service-profit chain (S-PC) provides an alternative causal chain of actions and associated metrics, but it is specifically applicable to service organizations. The S-PC links internally-oriented, tactical metrics such as internal service quality to employee satisfaction and productivity, which in turn influences the value of the provided service (external service value/competitive capabilities). The amount of value provided to the customer drives customer satisfaction, which in turn influences customer loyalty and ultimately leads to revenue growth and profitability.

Building on the balanced scorecard as well as the S-PC model, Epstein and Westbrook (2001) construct what they call the action-profit linkage (APL) model. This performance metric framework establishes links between specific company actions, which are driven by corporate strategy, and the delivered product/service; the delivered product/service, in turn, influences customer perceptions and ultimately economic outcomes such as profitability.

In the practitioner literature, the Supply-Chain Council (SCC)—a global, not-for-profit organization that develops and promotes state-of-the-art supply chain management practices—offers a *Supply Chain Operations Reference* (SCOR) model characterized by three levels of detailed performance metrics (http://www.supply-chain.org). Level one metrics measure how successful the organization is in achieving their desired marketplace positioning in terms of customer-facing (e.g., reliability, responsiveness, flexibility) and internal-facing (e.g. cost, assets) performance attributes. At level two, metrics are decomposed into more detail in terms of SCC-derived process categories (e.g., planning, execution, etc.). Finally, level three metrics embody detailed process element information pertaining to each level-two category, and are generally used to diagnose variations in performance against plan.

Taken together, these various performance measurement frameworks provide a means for communicating how lower-level, tactical activities and their associated performance metrics relate to higher-level, strategic goals and metrics, thereby enabling the organization to achieve a greater consistency of vision or roadmap (Epstein and Westbrook 2001; Heskett et al. 1994; Kaplan and Norton 1996, 2000; Koufteros et al. 2002; Melynk et al. 2004; Neely et al. 1995; Upton 1994). This suggests a hierarchical, causal composition of performance measurement. For example, a decrease in the average amount of time it takes to complete a quote for a customer, a tactical metric of performance, is likely to result in more satisfied customers, a strategic metric (Epstein and Westbrook 2001; Kaplan and Norton 2000). Such alignment of metrics ensures that the activities conducted at the tactical level are consistent with the objectives set at the strategic level (Khurana et al. 1998; Melynk et al. 2004; Venkatraman 1989). Thus, drawing from strategic fit theory, we expect a stronger relationship between tactical and strategic metrics that are aligned. More formally:

H2a: *Compared with alternate tactical metrics, tactical metrics of Operational Excellence are more strongly associated with strategic metrics of Operational Excellence.*

H2b: *Compared with alternate tactical metrics, tactical metrics of Customer Intimacy are more strongly associated with strategic metrics of Customer Intimacy.*

H2c: *Compared with alternate tactical metrics, tactical metrics of Product Leadership are more strongly associated with strategic metrics of Product Leadership.*

But how do tactical and strategic metrics influence financial performance, i.e., can we theoretically and empirically show that these metrics matter (see, for example, Ittner and Larcker 1998, 2003; White 1996b)? Kaplan and Norton (1992, p. 79) conclude that, "Periodic financial statements remind executives that improved quality, response time, productivity, or new products benefit the company only when they are translated into improved sales and market share, reduced operating expenses, or higher asset turnover...The challenge is to learn how to make such explicit linkages between operations and finance."

As described in section 2.1, tactical metrics capture how well operational initiatives cultivate internally-oriented competencies, which, in turn, assist in competitive capability building. According to Hill (1989), it is the externally-focused capabilities, operationalized here by means of strategic-level metrics, that have the potential to provide the organization with a marketplace advantage, i.e., to "qualify for and/or win orders." Since the precise nature of operational initiatives and competencies and their effects may not win customers directly, we posit that strength on tactical-level metrics may only *indirectly* influence the bottom line (Epstein and Westbrook 2001; Upton 1994; Wacker 1996; Zhang et al. 2003). That is, we take a mediation perspective of fit in which the portfolio of strategic metrics may act as a key intervening variable between the corresponding tactical metrics and financial performance (Venkatraman 1989). Importantly, the mediation perspective enables the researcher to "recognize the differences in the various stages of a system of relationships" (Venkatraman 1989, p. 429). As such, we offer the following hypotheses:

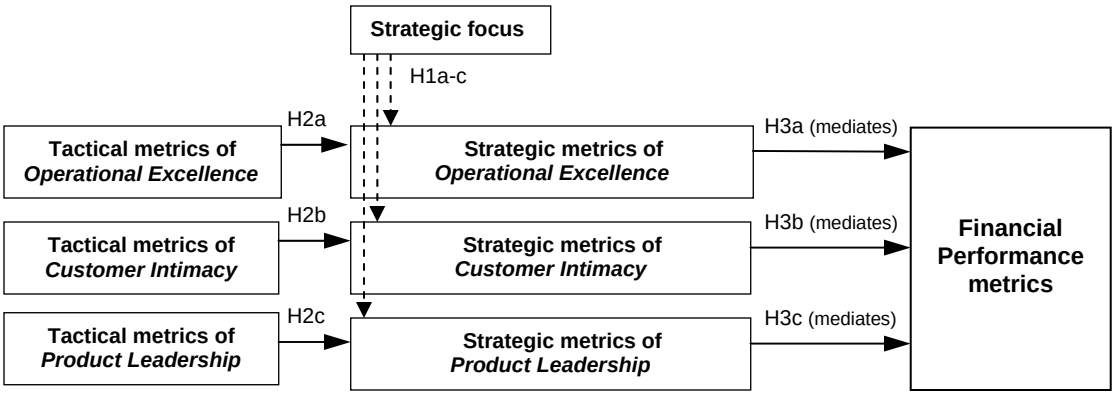
H3a: *Strategic metrics of Operational Excellence mediate the relationship between tactical metrics of Operational Excellence and financial performance.*

H3b: *Strategic metrics of Customer Intimacy mediate the relationship between tactical metrics of Customer Intimacy and financial performance.*

H3c: *Strategic metrics of Product Leadership mediate the relationship between tactical metrics of Product Leadership and financial performance.*

To summarize, our research model and corresponding hypotheses are provided in Figure 3 below.

Figure 3 Specific Research Model and Hypotheses Tested



3. Research Design and Methodology

3.1. Performance Metric Portfolio Development

Given our theoretical development, we delineate performance metrics along two dimensions crucial to multilevel performance linkage (and ultimately to metric portfolio selection). The first of these dimensions distinguishes strategic-level from tactical-level performance metrics, since it is our conjecture that strategic-level performance mediates linkages between tactical-level and financial performance metrics. The second dimension delineates the overall strategic focus of specific metrics, operationalized by the three prototypical strategic foci of Operational Excellence, Customer Intimacy, and Product Leadership. The joint consideration of these two metric dimensions forms the basis of the 2x3 classification matrix presented in Table 2.

In the spirit of practical metric portfolio development, we followed Slater et al.'s (1997) rule of thumb to draw out 7-12 key performance indicators for each of the three strategic foci previously alluded to in the literature (Operational Excellence, Product Leadership and Customer Intimacy; see section 2.2 for extended discussion).

To ensure suitability to practice, we drew heavily on existing metric compilations, and particularly those provided to us by senior executive members of the SCC and commonly appearing in the academic literature (see associated exemplar sources in Appendix A). While the SCOR model metrics were instrumental in this effort with regards to the consideration of items relating to Operational Excellence, the SCC was also in the process of developing Customer- and Design-Chain metric libraries at the time of our study. We drew on these in turn in our consideration of representative items for our Customer Intimacy and Product Leadership metric categories. To ensure relative and absolute representations of tactical performance, we included both Likert-type and continuous objective items in our performance metric portfolios. To ensure content validity across the set of items ultimately selected for use in our field study, we followed Churchill's (1979) framework, drawing on existing literature in OM studies in which concepts similar to those outlined by the SCC metric libraries have been studied.

Table 2. Concept Definition Matrix for Performance Metric Classification

Focus →	*Operational Excellence*	*Customer Intimacy*	*Product Leadership*
Level ↓	**… leverage standardization in providing cost-effective, fast and reliable fulfillment of order requirements.**	**… recognize and accommodate customer preferences in order to build strong, lasting relationships.**	**…rapidly develop and deploy innovative products and services that exceed existing performance boundaries.**
Strategic	**Long-term, externally focused metrics of how the market perceives the firm's ability to…**	**SO** *Strategic metrics of Operational Excellence*	**SC** *Strategic metrics of Customer Intimacy*	**SP** *Strategic metrics of Product Leadership*
Tactical	**Short- to medium-term business process metrics relating to the internal activities that may enable the firm to…**	**TO** *Tactical metrics of Operational Excellence*	**TC** *Tactical metrics of Customer Intimacy*	**TP** *Tactical metrics of Product Leadership*

Measure purification followed a multi-phase manual sorting procedure common to other contemporary studies (cf., Stratman and Roth 2002; Menor and Roth 2003; Moore and Benbasat 1991). However, while these recent works aim to provide face validation for reflective measures of distinct constructs, our primary interest in using this technique was more generalized. For tactical-level metrics our intent, similar to that of metric systems in practice (e.g., the SCC metric libraries), was to ensure that the items related to specific strategic foci were correctly interpreted by practitioners. While we sought a set of tactical-level metrics that captured a variety of operational activities, we had no preconception that such activities might represent a single theoretical construct. In contrast, at the strategic-level, our objective was to group metrics into multi-item scales targeted at specific strategic foci. The full Q-sort process used to purify item selection and construction involved two independent iterations of ten expert practitioners or "judges." The final set of items for the tactical metric indices and the strategic metric scales selected for use in our study, along with representative references, is provided in Appendix A.

3.2. Field Study

To formally test our hypotheses regarding metric linkages and the alignment of strategic orientation to performance, we developed a web-based survey that incorporated the items developed above. The target population for our survey consisted of U.S. affiliated, senior manufacturing managers from the SCC and APICS (American Production and Inventory Control Society; http://www.apics.org) membership lists for which we had current phone and e-mail contact information (759 managers in total). Similar to the SCC, APICS is comprised of operations and supply chain professionals interested in advancing the body of knowledge in operations management. An overview of the organizations represented by this set suggests a slight bias toward larger organizations when compared to the U.S. manufacturing industry as a whole.

Full-study data collection began in February 2005, with initial introductory phone calls to these managers in which they were briefed on the motivation and orientation of our study and subsequently asked whether they would be willing to complete our survey. A total of 163 managers (21.5% of the target population) confirmed that they would be willing to respond to such a survey. Based on comparisons of those confirmations with our original set, no apparent deviations from industry representation or other firm demographics appeared to distinguish this subset from our original population, thus alleviating concerns over response bias. These verbal confirmations were followed up by e-mails that included a brief description of the study, the web-based survey URL, and a unique ID and password for accessing the web-based survey. Two rounds of follow-up phone calls to these managers

over the next several months yielded a 15.5% response rate (n = 118), which is consistent with other survey-based research (see, for example, Narasimhan, Jayaram, and Carter 2001; Sroufe 2003; Tsikriktsis, Lanzolla, and Frohlich 2004).

Our unit of analysis is the manufacturing business unit (MBU) impacted by the primary business strategy of the firm, and all survey items were answered with respect to this MBU. In our sample, the majority of respondents identified the MBU as the enterprise (56%), followed by the division/group level (24%), the business unit level within a division/group (17%), and finally, the plant level (3%). Responding organizations employed a median of 14,000 employees and reported a median of $3 billion in annual sales. The median profit margin was 8.2% (average 9.7%).

Comparisons of responding and non-responding MBUs with respect to size (sales and number of employees) as well as industry membership (four-digit SIC codes) showed no statistical differences, indicating that the responses are representative of the sample frame. We performed two additional checks for non-response bias. First, we compared incomplete surveys to complete surveys, and second, we compared late respondents (completed survey after the second follow-up) with early respondents (completed survey after the initial email contact). No systematic differences were identified in either check, suggesting an absence of response bias.

3.3. Identifying Strategic Foci

Similar to prior operations strategy studies (see, for example, Frohlich and Dixon 2001; Khurana et al. 1998; and Miller and Roth 1994), we use cluster analysis to classify the responding organizations into strategic foci. In keeping with theory, we clustered the MBUs using five taxons derived from their dependence on information from (1) internal production planners and supervisors; (2) consumers and individual corporate clients; and (3) new product designers and engineers (Hambrick 1983; Miles and Snow 1978), as well as on the importance of each of the following systems in realizing business goals: (4) customer resource management (CRM) systems; and (5) computer aided design and/or manufacturing (CAD/CAM) systems (Boyer, Leong and Ward 1996; Duray, Ward, Milligan and Berry 2000; Miller and Roth, 1994; Sabherwal and Chan 2001); see Appendix A. Consistent with the Operational Excellence strategic focus, which is characterized by a top management team dominated by production and cost-control specialists, we expect one cluster to be distinguished by a heavy reliance on information sourced from internal production planners and supervisors. In contrast, MBUs emphasizing Customer Intimacy are likely to place more weight on consumer information, so a second cluster should emerge that is differentiated by means of the *consumers and individual corporate clients* and *CRM systems* taxons. Theory also suggests a third cluster—Product Leadership—in which decision-making is typically shaped by product development executives and from information obtained by means of CAD/CAM systems (Miller and Roth 1994).

Following Hair, Anderson, Tatham, and Black (1995), we conducted a two-step cluster analysis using the (1) ACECLUS and (2) FASTCLUS procedures in SAS 8.1; utilizing these procedures in tandem has been found to increase the validity of the cluster solution. In the first step, the ACECLUS procedure "preprocesses" the data for input into the FASTCLUS analysis, as the clusters formed during FASTCLUS can be influenced by the order in which the data is read (SAS Institute, Inc. 1989). Hence, the results of the ACECLUS procedure serve as a starting point for the second step, i.e., the FASTCLUS cluster analysis. According to Johnson (1998, p. 369), the FASTCLUS nonhierarchical clustering technique "…can find good clusters with only two or three passes over the data."

Based on theory, the FASTCLUS clustering algorithm was constrained to a 3-cluster solution. However, 2- and 4-cluster solutions were also examined. The final 3-cluster solution was both theoretically and statistically superior to any other. With the exception of *CRM systems*, the taxon variables used to define the clusters were significantly different from one another across all clusters (see Table 3). Given the cluster means of these taxons, it is possible to assign the clusters to the strategic foci of Operational Excellence, Customer Intimacy, and Product Leadership.

Table 3. Cluster Means and Standard Deviations

Taxons	*Operational Excellence (n = 39)*	*Customer Intimacy (n = 32)*	*Product Leadership (n = 47)*	*F-Statistic*	*p-value*
Production Planners	4.36 (.71)	1.94 (.80)	4.00 (.83)	95.96	0.0001
Consumers	3.08 (1.11)	4.44 (.76)	3.91 (.90)	19.09	0.0001
Product Designers	2.38 (.99)	3.34 (1.21)	3.94 (.96)	23.69	0.0001
CRM Systems	2.72 (1.00)	2.66 (1.10)	3.13 (1.15)	2.31	0.1037
CAD/CAM Systems	1.69 (.69)	2.09 (1.17)	3.87 (.77)	75.47	0.0001

*Notes: 1. Standard deviations in parentheses.
2. All Duncan pairwise tests significant at $p < .05$ except for CRM taxon.

To ensure that the clusters were correctly classified, we utilized discriminant analysis (PROC DISCRIM in SAS 8.1). This method performs cross-validation by means of a jackknife procedure, which calculates the percentage of observations correctly classified into the Operational Excellence, Customer Intimacy, and Product Leadership clusters using the linear discriminant function. Although no standard misclassification cut-off value exists, a 95 percent or higher success rate (percentage of observations correctly classified) is preferred. As shown in Table 4, the 98 percent classification rate (1 - .02 = .98 ~ 98%) further validates our 3-cluster solution.

Finally, Hair et al. (1995) advocates establishing some form of predictive validity for the cluster solution. Past research has shown the organization's strategic focus to vary based on the percentage of sales accorded to various stages of the product lifecycle (see, for example, Miller and Roth 1994; Sabherwal and Chan 2001), so we asked survey respondents to indicate the *percentage of MBU sales attributed to each stage (introductory, growth, maturity, decline) in the product lifecycle*. Similar to Miller and Roth's (1994) Caretakers, our operationally excellent MBUs derive the highest percentage of sales from the maturity stage of the product lifecycle ($p \leq .05$). As expected, Customer Intimacy cluster MBUs have a significantly higher percentage of sales from products in the growth stage than Operational Excellence cluster organizations ($p \leq .05$). Also relative to operationally excellent MBUs, the Product Leadership cluster—like Miller and Roth's (1994) Innovators—derives a higher percentage of sales from products in the introductory stage of the product lifecycle ($p \leq .05$).

Table 4. Cluster Classification Summary

To / From Cluster:	*1 Operational Excellence (n = 39)*	*2 Customer Intimacy (n = 32)*	*3 Product Leadership (n = 47)*	*Total*
1	37 (94.87%)	1 (2.56%)	1 (2.56%)	39 (100%)
2	0 (0%)	32 (100%)	0 (0%)	32 (100%)
3	0 (0%)	0 (0%)	47 (100%)	47 (100%)
Error Rates from:				
Cross-validation	0.05	0.00	0.00	0.02
Posterior Probabilities	0.33	0.27	0.40	

3.4. Measures

3.4.1. Strategic Metric Scales

The strategic metrics associated with the three strategic foci are modeled as latent variables reflected by multiple items. We used the confirmatory factor analysis (CFA) functionality in the PROC CALIS routine of SAS 8.1 to assess scale unidimensionality (Anderson and Gerbing 1991). A measurement model was specified for each strategic metric scale that linked each of the measurement items to the latent variable. Table 5 lists the fit indices for each of our measurement scales. All strategic metric scales exhibit fit indices of .90 or greater, indicating that they meet the criteria for unidimensionality (Bollen 1989; Hatcher 1994). Table 5 also lists Cronbach's Alpha (α) reliability values for each scale. Following Stratman and Roth (2002) and Hatcher (1994), discriminant validity was assessed using a series of chi-square difference tests between nested CFA models for all three construct pairs. All of the chi-square differences are significant at $p \leq .05$, indicating that the strategic metric scales represent distinct constructs. Since the scales exhibit good reliabilities and therefore relatively little measurement error, we used a simple average of the scale items to form a single composite scale variable for each strategy.

Table 5. Strategic Metric Scale Unidimensionality and Reliability Analyses

Proc Calis Measurement Model Results from Confirmatory Factor Analyses of Strategic Metric Scales

Strategic Metric Scale	Items	GFI	NNFI	CFI	RMR	RMSEA	Cronbach α
Operational Excellence	5	.99	1.03	1.00	.03	.00	.68
Customer Intimacy	8	.95	.97	.98	.07	.04	.75
Product Leadership	5	.98	.98	.99	.03	.06	.82

3.4.2. Tactical Metrics Items and Indices

The tactical metrics used in this study are posited to act individually rather than as elements of a multi-item scale reflecting a latent variable. We assess the effects of these individual items on the strategic metric scales to evaluate H2. However, in order to increase the power of the statistical tests of the mediation hypotheses (H3a, H3b, and H3c), three composite indices were created using the tactical metric items that are theoretically aligned with each of the three strategic foci. These three tactical indices were constructed by summing the tactical metric item z-scores of each set.

Note that two of the tactical metric items—*average time required to complete a quote for a typical customer* and *average number of changes per product design*—showed excessive skewness and kurtosis in their original form. Given this lack of univariate normality, the two variables were transformed by taking the natural log; all results are presented using these two transformed variables.

3.4.3. Financial Performance Metrics

Respondents were asked to report their MBU's performance in terms of (1) profit level before taxes; and (2) pre-tax return on assets (ROA); see Appendix A (Khurana et al. 1998). Descriptive statistics (means, standard deviations, and Spearman correlations) pertaining to these financial performance metrics, along with the strategic metric scales and tactical metric items, are provided in Appendix B.

Given the difficulty associated with obtaining self-reported financial-related information (Dillman 2000; Vickery, Droge and Markland 1993), some missing data is observed for our financial performance metrics (profit level $n = 64$; ROA $n = 40$). As such, we attempt to provide criterion-related validity for these metrics using a subset of our sample and the COMPUSTAT database. Specifically, the available data relating to these questions were validated for those *publicly traded* MBUs categorized at the *enterprise level* by correlating the values with the corresponding metrics from the COMPUSTAT database. The profit level ($n = 40$; $p \leq .01$) and ROA ($n = 26$; $p \leq .10$) metrics correlated positively and significantly with the corresponding COMPUSTAT data, thereby providing some criterion-related validity for our financial performance metrics.

3.4.4. Control Variables

We control for industrial sector membership and organization size in our tests of hypotheses 3a, 3b, and 3c, as past research suggests these two factors may influence financial performance (see, for example,

Evans, 2004). For parsimony, the MBUs were classified into three broad industrial sectors based on their two-digit SIC codes. Organizations with SIC codes of 24, 26, 28, 30, 32, or 33 were classified as members of the processing industrial sector. Those with SIC codes of 25, 34, 35, or 36 were classified as manufacturing industrial sector members, and those with SIC codes of 37 or 38 were classified as high-tech industrial sector members. Following prior literature, number of employees was used as a proxy for organization size; see Appendix A.

4. Analysis and Results

4.1. Influence of Strategic Alignment on Strategic Metric Scales

Hypotheses 1a, 1b and 1c could be tested using independent ANOVAs, however, these tests may be biased due to the correlations between the three strategic metric scales (Hair et al. 1995). MANOVA provides a means of testing the impact of the MBU's strategic cluster on all three strategic metric scales simultaneously. The null hypothesis for the one-way MANOVA is that there is no difference among the three strategic clusters when they are compared simultaneously using the strategic metric scales of Operational Excellence, Customer Intimacy, and Product Leadership. This null hypothesis is rejected at ($p \leq .05$) with a Wilk's lambda of 0.87 (corresponding F statistic = 2.57). Having established a significant multivariate effect for a MBU's strategic cluster, it is now appropriate to examine the effect of strategic cluster membership on the individual strategic metric scales.

The mean values of the three strategic metric scales, by strategic cluster, are presented in Table 6. Looking down the column for the strategic metric scale of Operational Excellence leads us to reject H1a, as there is no significant difference ($p \leq .10$) between cluster groups (univariate ANOVA F-statistic = 1.52). Alternatively, the mean for the strategic metric scale of Customer Intimacy in the Customer Intimacy cluster is significantly ($p \leq .05$) higher than the mean in the Operational Excellence cluster (univariate ANOVA F-statistic = 6.27), although there is no significant difference from the mean in the Product Leadership cluster. This provides partial support for H1b. Furthermore, the mean for the strategic metric scale of Product Leadership in the Product Leadership cluster is significantly ($p \leq .10$) higher than the mean in the Operational Excellence cluster (univariate ANOVA F-statistic = 2.90), although there is no difference from the mean in the Customer Intimacy cluster. This provides partial support for H1c.

Table 6. Difference of Means of Strategic Metric Scales by Strategic Group Cluster

		Strategic Metric Scale of Operational Excellence		Strategic Metric Scale of Customer Intimacy		Strategic Metric Scale of Product Leadership	
Strategic Group Cluster	n	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Operational Excellence	35	3.41 a	0.75	3.29 a **	0.65	3.20 a *	0.93
Customer Intimacy	31	3.39 a	0.63	**3.69 b ****	0.47	3.59 a,b	0.64
Product Leadership	44	3.63 a	0.67	3.70 b **	0.56	**3.60 b ***	0.81

Notes: Within a column, means with different letters are significantly different from each other according to Scheffe's test;
** p < .05; * p < .10; bolded numbers represent support for our hypotheses.

4.2. Influence of Tactical Metric Items on Strategic Metric Scales

We use ordinary least squares regression to test hypothesis 2. Strategic-level metric scales related to each of the three strategic foci are regressed on their corresponding tactical metric items (see Table 7). Some support is provided for hypothesis H2a, with two of the three of the Operational Excellence tactical metric items having a positive and significant ($p \leq .10$) effect on the Operational Excellence strategic metric scale. The empirical results offer support for H2b, as the Customer Intimacy tactical metric items are all significantly ($p \leq .10$) associated with the corresponding strategic metric scale in the expected direction. Hypothesis H2c is strongly supported with the two Product Leadership tactical metric items significantly ($p \leq .01$) affecting the Product Leadership strategic metric scale. Note that while a large number of design changes might not be desirable from a strictly operational perspective, the observed positive relationship between the *average number of changes per product design* metric item and the

Product Leadership strategic metric scale is indicative of a capability to iterate quickly toward a successful, leading-edge product design.

Table 7. Regressions of Strategic Metric Scales on Matched Tactical Metric Items

	DV: **Strategic metric scale of Operational Excellence**	
Tactical metric items of Operational Excellence	Coeff	Pr<t
Intercept	1.75	0.00
Our production costs are low compared to competitors	**0.20**	**0.01**
The percentage of orders delivered by the original request date	0.01	0.11
Annual inventory turns for primary products	**0.11**	**0.10**
R^2 =	0.18	(Adj = 0.14)
F-statistic (*p*-value)	4.93	(0.0037)
n =	71	

	DV: **Strategic metric scale of Customer Intimacy**	
Tactical metric items of Customer Intimacy	Coeff	Pr<t
Intercept	2.16	0.00
We make extensive use of customer data in daily operations	**0.15**	**0.02**
We promptly resolve customer complaints	**0.17**	**0.05**
We have procedures in place to provide superior after-sales service	**0.12**	**0.08**
The average time required to complete a quote for a typical customer	**-0.05**	**0.08**
R^2 =	0.37	(Adj = 0.33)
F-statistic (*p*-value)	9.19	(<.0001)
n =	67	

	DV: **Strategic metric scale of Product Leadership**	
Tactical metric items of Product Leadership	Coeff	Pr<t
Intercept	2.08	0.00
Our product design cycle time is short compared to competitors	**0.32**	**0.01**
The average number of changes per product design	**0.24**	**0.00**
R^2 =	0.31	(Adj = 0.28)
F-statistic (*p*-value)	10.47	(0.0002)
n =	49	

Additional support for the proposed relationships between the aligned tactical- and strategic-level metrics can be shown by regressing each of the three strategic metric scales on tactical metric items from the other strategic foci. Given the general notion regarding the need to make tradeoffs among tactical decisions (e.g., investments in particular operational initiatives), we suspect MBUs pursuing tactical performance not critical to their overall strategic position do so at the expense of other mechanisms that perhaps more directly promote their strategy. Because of the potential for such tradeoffs, while some tactics may be necessary to the pursuit of a variety of distinct strategies, we should, at a minimum, anticipate weaker links between performance on certain tactical metric items and performance along "alternatively focused" strategies. Indeed, as anticipated by this line of logic, none of the Operational Excellence tactical metric items exhibit a significant association with the Customer Intimacy or Product Leadership strategic metric scales, providing further support for H2a (see Table 8).

Table 8. Regressions of Strategic Metric Scales on Unmatched Tactical Metric Items

	DV: **Strategic metric scale of Customer Intimacy**		DV: **Strategic metric scale of Product Leadership**	
Tactical metric items of Operational Excellence	Coeff	Pr<t	Coeff	Pr<t
Intercept	3.41	0.00	4.03	0.00
Our production costs are low compared to competitors	0.07	0.29	0.04	0.63
The percentage of orders delivered by the original request date	0.00	0.89	0.00	0.62
Annual inventory turns for primary products	0.00	0.99	-0.10	0.18
R^2 =	0.02	(Adj = -0.03)	0.03	(Adj = -0.01)
F-statistic (*p*-value)	0.39	(0.7613)	0.68	(0.5703)
n=	71		71	

	DV: **Strategic metric scale of Product Leadership**		DV: **Strategic metric scale of Operational Excellence**	
Tactical metric items of Customer Intimacy	Coeff	Pr<t	Coeff	Pr<t
Intercept	2.39	0.00	1.86	0.00
We make extensive use of customer data in daily operations	-0.08	0.43	**0.13**	**0.10**
We promptly resolve customer complaints	0.08	0.53	**0.29**	**0.00**
We have procedures in place to provide superior after-sales service	**0.25**	**0.02**	0.07	0.39
The average time required to complete a quote for a typical customer	0.03	0.50	-0.05	0.20
R^2 =	0.14	(Adj = 0.08)	0.34	(Adj = 0.30)
F-statistic (*p*-value)	2.49	(0.0526)	7.97	(< .0001)
n=	65		67	

	DV: **Strategic metric scale of Operational Excellence**		DV: **Strategic metric scale of Customer Intimacy**	
Tactical metric items of Product Leadership	Coeff	Pr<t	Coeff	Pr<t
Intercept	3.41	0.00	2.82	0.00
Our product design cycle time is short compared to competitors	0.02	0.85	**0.17**	**0.07**
The average number of changes per product design	-0.05	0.57	0.10	0.13
R^2 =	0.01	(Adj = -0.04)	0.12	(Adj = 0.08)
F-statistic (*p*-value)	0.18	(0.8390)	3.16	(0.0517)
n=	49		49	

The picture is less clear for the Customer Intimacy tactical metric items. Table 8 shows that several of these tactical metric items have a significant impact ($p \leq .10$) on the Operational Excellence or Product Leadership strategic metric scales. In addition, one tactical metric item of Product Leadership is significantly ($p \leq .10$) associated with the Customer Intimacy strategic metric scale, though there is no association between tactical metric items of Product Leadership and the Operational Excellence strategic metric scale. Overall, the results shown in Table 8 provide further support for hypotheses H2a, H2b, and H2c.

4.3 Mediation of Strategic Metrics

The third set of hypotheses—H3a, H3b, and H3c—posit that strategic metrics mediates the influence of tactical metrics on financial performance. In other words, strategic metrics may represent the generative mechanism through which tactical metrics influence financial performance. Following Baron and Kenny (1986), we estimate a series of regressions to test these hypotheses: first, each strategic metric scale is regressed on its corresponding tactical metric index (Table 9); second, each financial performance variable (profit level or pre-tax ROA) is regressed on each tactical metric index (Table 10); and third, each financial performance variable is regressed on each tactical metric index *and* its corresponding strategic metric scale (Table 10). Note that the control variables are included in the regressions in which financial performance is the dependent variable (Table 10); the manufacturing industrial sector membership variable is not *explicitly* included in these regressions because this categorization is designated as the comparison or "reference" group.

For a mediation hypothesis to hold, the tactical metric indices in the first and second steps of the Baron and Kenny (1986) regressions and the corresponding strategic metrics scale in the third step must

all have a positive and significant effect on their respective dependent variables. Partial mediation, in which the tactical metric indices exhibit both direct and indirect effects on financial performance, is demonstrated if the effect of the tactical metric index in the third step is less than its effect in the second step. Alternatively, for perfect/full mediation, the tactical metric index will have no significant effect in the third step – i.e., only an indirect effect is observed (Baron and Kenny 1986).

The first step of the Baron and Kenny (1986) regressions for each strategic focus is shown in Table 9. Recall that the index of tactical items used as the independent variable in each of the three regressions is the sum of the z-scores of the relevant tactical metric items. Given the results presented in Table 7, it is not surprising that all regressions are positive and significant ($p \leq .01$).

Table 9. Regressions of Strategic Metric Scales on Corresponding Tactical Metric Indices

	DV: **Strategic metric scale of Operational Excellence**		DV: **Strategic metric scale of Customer Intimacy**		DV: **Strategic metric scale of Product Leadership**	
	Coeff	Pr<t	Coeff	Pr<t	Coeff	Pr<t
Intercept	3.52	< .0001	3.58	< .0001	3.48	< .0001
Operational Excellence tactical metric index	**0.18**	**< .0001**				
Customer Intimacy tactical metric index			**0.14**	**< .0001**		
Product Leadership tactical metric index					**0.30**	**< .0001**
R^2 (1^{st} step of Baron & Kenny) **=**	0.18 (Adj = 0.17)		0.31 (Adj = 0.30)		0.31 (Adj = 0.30)	
F-statistic (*p*-value)	14.81 (0.0003)		28.82 (< .0001)		21.37 (< .0001)	
n =	71		67		49	

Table 10 shows the results of the second and third steps of the Baron and Kenny (1986) regressions for each strategic focus. The second step, in which each dependent financial performance variable is regressed on each tactical metric index, establishes the direct effect of the tactical index on financial performance while controlling for organization size and industry. The effect of the Operational Excellence tactical metric index is significant ($p \leq .10$) on pre-tax ROA, and the effect of the Customer Intimacy tactical metric index is significant on profit level ($p \leq .10$).

The third and final step in our Baron and Kenny (1986) procedure is similar to the second, except that the strategic metric scale is now included in the models. Note that an examination of the variance inflation factor values and condition indices indicated that multicollinearity was not present to a significant degree among the step three regression variables (Hair et al. 1995).

The results indicate that the strategic metric scale of Operational Excellence has a significant effect ($p \leq .01$) on pre-tax ROA, while the effect of the tactical metric index in this regression is not significant. This demonstrates pure mediation and provides some support for hypothesis 3a. The Operational Excellence strategic metric scale also has a significant effect on profit level ($p \leq .10$), yet the mediation hypothesis is not supported for this dependent variable, as the tactical metric index was not significant in step 2. We found no support for hypotheses 3b or 3c. While no support is found for hypothesis 3b, the findings stand as potentially suggestive given the positive nature of the Customer Intimacy strategic metric scale on both profit and pre-tax ROA and the associated R^2 increase (albeit limited) on the inclusion of this scale.

Table 10. Regressions of Financial Performance Metrics on Tactical Metric Indices and Corresponding Strategic Metric Scales

	DV: **Profit Level**		DV: **Pre-Tax ROA**	
Operational Excellence	Coeff	Pr<t	Coeff	Pr<t
Intercept	4.05	< .0001	2.68	0.001
Employees (organization size)	**0.22**	**0.05**	0.13	0.48
Processing industrial sector membership	-0.10	0.87	-0.01	0.99
High-tech industrial sector membership	0.99	0.15	1.28	0.16
Operational Excellence tactical metric index	0.08	0.48	**0.29**	**0.09**
R^2 (2^{nd} step of Baron & Kenny) =	0.12	(Adj = 0.04)	0.16	(Adj = 0.04)
F-statistic (*p*-value)	1.57	(0.1971)	1.37	(0.2674)
n =	53		35	
Intercept	1.66	0.25	-4.74	0.03
Employees (organization size)	**0.27**	**0.02**	**0.38**	**0.03**
Processing industrial sector membership	-0.24	0.68	-0.77	0.33
High-tech industrial sector membership	0.90	0.18	1.23	0.11
Operational Excellence tactical metric index	-0.05	0.72	-0.07	0.66
Operational Excellence strategic metric scale	**0.64**	**0.09**	**1.90**	**0.001**
R^2 (3^{rd} step of Baron & Kenny) =	0.17	(Adj = 0.081)	0.43	(Adj = 0.33)
F-statistic (*p*-value)	1.92	(0.1085)	4.33	(0.0046)
n =	53		35	

	DV: **Profit Level**		DV: **Pre-Tax ROA**	
Customer Intimacy	Coeff	Pr<t	Coeff	Pr<t
Intercept	4.25	< .0001	2.52	0.001
Employees (organization size)	0.15	0.20	0.16	0.37
Processing industrial sector membership	-0.12	0.84	0.30	0.75
High-tech industrial sector membership	0.99	0.18	1.07	0.28
Customer Intimacy tactical metric index	**0.15**	**0.10**	0.15	0.27
R^2 (2^{nd} step of Baron & Kenny) =	0.12	(Adj = 0.04)	0.10	(Adj = -0.02)
F-statistic (*p*-value)	1.50	(0.2193)	0.81	(0.5284)
n =	50		36	
Intercept	2.84	0.08	0.64	0.80
Employees (organization size)	0.14	0.23	0.14	0.45
Processing industrial sector membership	-0.10	0.87	0.37	0.69
High-tech industrial sector membership	0.71	0.37	0.79	0.45
Customer Intimacy tactical metric index	0.08	0.45	0.06	0.73
Customer Intimacy strategic metric scale	0.41	0.35	0.55	0.44
R^2 (3^{rd} step of Baron & Kenny) =	0.14	(Adj = 0.04)	0.11	(Adj = -0.04)
F-statistic (*p*-value)	1.37	(0.2538)	0.77	(0.5822)
n =	50		36	

	DV: **Profit Level**		DV: **Pre-Tax ROA**	
Product Leadership	Coeff	Pr<t	Coeff	Pr<t
Intercept	4.33	< .0001	2.60	0.01
Employees (organization size)	0.14	0.25	0.12	0.58
Processing industrial sector membership	0.03	0.97	0.36	0.80
High-tech industrial sector membership	-0.44	0.63	0.07	0.95
Product Leadership tactical metric index	-0.05	0.76	-0.07	0.81
R^2 (2^{nd} step of Baron & Kenny) =	0.05	(Adj = -0.06)	0.03	(Adj = -0.15)
F-statistic (*p*-value)	0.44	(0.7810)	0.16	(0.9585)
n =	39		27	
Intercept	5.44	0.001	3.63	0.16
Employees (organization size)	0.18	0.17	0.15	0.51
Processing industrial sector membership	-0.08	0.92	0.26	0.86
High-tech industrial sector membership	-0.45	0.63	0.07	0.95
Product Leadership tactical metric index	0.02	0.91	-0.01	0.98
Product Leadership strategic metric scale	-0.35	0.41	-0.31	0.67
R^2 (3^{rd} step of Baron & Kenny) =	0.07	(Adj = -0.07)	0.04	(Adj = -0.19)
F-statistic (*p*-value)	0.48	(0.7857)	0.16	(0.9753)
n =	39		27	

5. Conclusions

5.1. Managerial and Theoretical Implications

Overall, our results provide some evidence for the importance of aligning tactical- and strategic-level metrics along a common strategic focus. Furthermore, the notion that tactical level performance leads to strategic outcomes that in turn lead to financial performance is partially supported. Looking first at the strategic metric scales of the sample MBUs by strategic cluster, it is apparent that strategic Operational Excellence performance is similar across cluster groups. This may indicate that the Operational Excellence metric represents order qualifying performance elements for manufacturers (Hill 1989). In contrast, consistent with the findings of Kathuria (2000), those MBUs following a Customer Intimacy strategy or Product Leadership strategy have significantly higher performance on the strategic metrics corresponding to their strategic goals.

Interestingly, there is no significant difference between the levels of strategic Customer Intimacy or Product Leadership performance for MBUs following either of these strategies (see Table 6). Note that one of the paradoxical elements to come out of the cluster analysis was that MBUs that relied the most on customers as inputs also reported low use of CRM systems (though this was the least significant differentiator among the cluster taxons). If 'clearer' clusters were generated, it may be that the impact of strategic-level Customer Intimacy metrics could be apparent for those MBUs that it matters most to (i.e., those positioning themselves along a Customer Intimacy strategic focus).

We find strong evidence for the alignment of tactical-level metrics with their corresponding strategic metrics. This finding is of particular importance to managers, as it is the tactical-level metrics that form the levers through which manufacturing operations are controlled. A focus on misaligned tactical metrics is unlikely to yield the desired strategic outcomes. Our results are less clear when assessing the linkage from tactical-level metrics, through strategic metrics, to financial performance. The notion that strategic outcomes mediate the influence of tactical metrics on financial performance is only partially supported for the portfolio of Operational Excellence metrics. Yet the results for the Customer Intimacy and Product Leadership portfolios are tantalizingly suggestive, if inadequate from a strict statistical perspective. Perhaps the modest support for our mediation hypotheses is a result of poor statistical power, as our sample suffered from missing data in the financial performance metrics, which reduced the effective sample size for many of these tests.

Another possible explanation for the relatively weak linkages to financial performance pertains to the many other factors influencing these metrics. For example, external market forces may overwhelm the effects of internal operational initiatives, which would reduce the strength of the hypothesized linkages. Similarly, a decision to pursue multiple strategies rather than focus firm resources on a dominant strategy may also reduce these linkage effects. Those respondents answering the survey with respect to an MBU other than the enterprise imply that their firms are pursuing more than one strategy. This may have the effect of attenuating the expected linkages to financial performance.

A particularly disappointing result of the mediation analysis came with regards to the Customer Intimacy links to financial performance. Although coefficient direction and R^2 contributions may be somewhat suggestive, strategic-level metrics of Customer Intimacy provided no significant predictive capabilities in this regard. Note that several Customer Intimacy tactical metric items appear to also provide predictive strength for the Operational Excellence strategic metric scale (see Table 8). Despite the theoretical and empirical methods used to create the three portfolios of performance metrics, some tactical metric items, while primarily impacting a particular strategic focus, may also have some general impact in any strategic environment. Prior studies have found that the less-defined, customer-oriented strategic focus occupies a fuzzy middle ground in a continuum anchored by an operational focus on one end and a product focus on the other (Frohlich and Dixon 2001; Khurana et al. 1998; Miles and Snow 1978; Miller and Roth 1994). If some of these tactical metric items are perhaps more indicative of Operational Excellence than of Customer Intimacy, then it would not be surprising to observe their significance in the financial performance regressions where the Operational Excellence strategic metric scale was also significant. To this extent, regardless of the scale validity checks and early fairly positive

results for H2b, either or both tactical and strategic sets of items for Customer Intimacy may need to be rethought.

Of course as intriguing as these suggestions may be, they remain somewhat limited at this point given the lack of consistent support across all three strategic foci studied. Regardless, if future work can provide similar findings in support of the notion that tactical metrics must be in-line with a chosen strategy in order for financial-based benefits to be realized, these ideas could pose a powerful wake-up call for firms using otherwise misaligned and potentially unjustified performance measurement systems.

From a process perspective, a general solution to ensuring alignment and resolving cases of misalignment in practice requires the coordinated efforts of multiple parties. If operations and business strategy managers have already jointly rationalized the competencies, capabilities, and strategic goals of an organization, ensuring an ideally aligned metric portfolio should start with the outlining of strategic performance objectives by these same strategic-level managers. Once established, operations managers can then be charged with developing a set of tactical performance metrics reflective of activities key to the support of these strategic metrics. While human resource management plays an essential role in the dissemination and reinforcement of the select metrics (the portfolio) organization-wide, operations and business strategy managers continue to play a key role in monitoring the performance of these metrics and re-rationalizing and adjusting the portfolio as needed.

5.2. Limitations and Areas for Future Research

One of the central limitations in any study investigating the appropriateness of specific metrics in capturing hypothetical relationships is inherent to the metric selection itself. While it was not our intent to prescribe a specific set of metric portfolios for use in practice, but rather to draw from theory and existing practice to demonstrate the measurability of portfolio superiority for specific strategic foci, our results are nevertheless constrained by the specific, yet representative, portfolio designs examined. Alternate portfolios, perhaps even based on alternate strategic foci (see, for example, Khurana et al. 1998), might be found to provide stronger support for the logical arguments of strategic alignment posed here. Given strong support from past literature for the three strategic foci used, we feel that our work presents an enlightening early step in the right direction, although we encourage future research to reconsider the appropriateness of our focus on Operational Excellence, Customer Intimacy, and Product Leadership.

Another limitation relates to our sample data. First, our relatively small sample is limited to observations from predominantly large manufacturers. As such, it would be inappropriate to draw any extended implications with respect to strategically-aligned metric portfolios in the service sector, for example, or among small firms in general, based directly off these results alone. A second data limitation involves the full reliance of the analysis on common sources for both our dependent and independent measures. Although secondary source objective data offers some validity for the self-reported financial metrics, and past researchers have noted the adequacy of such metrics (Narasimhan and Das 2001), our analysis could certainly be strengthened by evidence of predictive capabilities with respect to secondary source data. However, this type of analysis typically requires enterprise-level data, which is often not readily available.

As with all survey research using a single respondent per observation, the study is vulnerable to the effects of common method variance (CMV). When designing our survey, we took steps to minimize the effect of CMV by separating the tactical metrics and the strategic metrics into different sections, making it difficult for respondents to match up the different metrics. Harman's single-factor test (Harman 1967; Kathuria, 2000) was used to assess the possible influence of CMV. If CMV were an important influence on the results, one would expect to see strong evidence for a single factor, yet four factors were found with eigenvalues greater than 1. Furthermore, as demonstrated by our analysis of mismatched metrics (Table 8), an omnibus halo-effect characteristic of CMV does not seem to be an issue here.

Further, while the current study was designed specifically to assess the effectiveness of strategically-aligned metric portfolios, with particular reference to the use of such portfolios by organizations with matching strategic foci, it does not provide any insight into whether the current set of key metrics used by organizations to guide performance are similarly aligned. An interesting and valuable follow-up to this

work would therefore involve the surveying of a representative set of organizations pursuing discernable and distinct strategic foci and analyzing whether the key metrics used by such organizations (a) embody strategic alignment across both tactical- and strategic-level metrics, (b) match their own overarching strategic focus as an organization, (c) are predictive of financial performance, and (d) if such higher levels of alignment and strategic matching can actually be linked to greater performance relative to their competition. If this can be shown through empirical evidence, then a still greater case for strategically focused and aligned metric portfolio prescriptions can be made as such portfolios are refined.

A final related, valuable study would be to investigate whether organizations equipped with aligned or misaligned portfolios take specific tactical and strategic actions distinct from those of organizations with alternate strategic foci. As an extension to the theoretical arguments posed here, it is conceivable that those organizations whose metric portfolios are more aligned with their strategic foci would be more prone to take tactical actions that complement their overarching strategy. This in fact is an implied requisite for item (d) above, wherein alignment and strategic matching itself augments performance. The linkage between performance metric portfolio selection, management action, and competitiveness therefore represents a foundation for an incredibly rich area of future research.

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Appendix A Measurement Items used in the Analysis

Strategic Metrics	Representative References
Operational Excellence	
We pursue process standardization	Gunasekaran et al. 2001; Kaplan and Norton 2000; Wacker 1996
We are known in the marketplace for our conformance quality	Kaplan and Norton 1992; Miller and Roth 1994; Neely et al. 1995; Wacker 1996
We are known for our on-time delivery performance	Kaplan and Norton 1992, 2000; Miller and Roth 1994; Neely et al. 1995; Wacker 1996; White 1996a
We are known for our speedy deliveries	Gunasekaran et al. 2001; Kaplan and Norton 1992, 2000; Miller and Roth 1994; Wacker 1996
We continually pursue price reductions	Kaplan and Norton 1993, 2000; Kim and Arnold 1996; Miller and Roth 1994; Neely et al. 1995
Customer Intimacy	
We consistently surpass customer expectations	Epstein and Westbrook 2001; Heskett et al. 1994; Ittner and Larcker 1998; Khurana et al. 1998; Slater et al. 1997
We are more effective at attracting new customers than competitors	Ittner and Larcker 1998; Kaplan and Norton 1993
We encourage our sales force to maintain ties with our customers	Heskett et al. 1994; Kaplan and Norton 1992; Khurana et al. 1998
Relative to other firms in our industry, we are better able to accommodate customer preferences	Gunasekaran et al. 2001; Kaplan and Norton 1996, 2000; Kim and Arnold 1996; Slater et al. 1997; http://www.supply-chain.org (Customer-Chain)
We make extensive use of customer data when developing marketing plans	Heskett et al. 1994; Ittner and Larcker 2003
We provide customers a broad range of offerings to ensure their specific needs are filled	Gunasekaran et al. 2001; Heskett et al. 1994; Kim and Arnold 1996; Miller and Roth 1994; Upton 1994; Zhang et al. 2003
Relative to other firms in our industry, the annual number of solutions we propose to existing clients is high	Kaplan and Norton 1993; http://www.supply-chain.org (Customer-Chain)
We target niche markets	Heskett et al. 1994
Product Leadership	
We are known in the marketplace for the performance quality of our products	Kaplan and Norton 2000; Khurana et al. 1998; Kim and Arnold 1996; Miller and Roth 1994; Neely et al. 1995
Our products are known for their features and functions	Kaplan and Norton 2000; Khurana et al. 1998; Neely et al. 1995; Wacker 1996
Our design team keeps up with recent advances in the field	Garcia et al. 2003; http://www.supply-chain.org (Design-Chain)
The number of times our patents are cited by external parties is high	Albert et al. 1991; Nerkar 2003
We are always the first to deliver a new product/service to market	Kaplan and Norton 1992; Khurana et al. 1998; Slater et al. 1997; http://www.supply-chain.org (Design-Chain); Wacker 1996; White 1996a

Note: All strategic metric items are measured on a 5-point Likert scale ('1' *strongly disagree*; '5' *strongly agree*)

Tactical Metrics	Representative References
Operational Excellence	
Our production costs are low compared to competitors[1]	Kaplan and Norton 1992, 2000; Neely et al. 1995; Slater et al. 1997; White 1996a
What percentage of orders is delivered by the original request date?[2]	Gunasekaran et al. 2001; http://www.supply-chain.org (SCOR Model); White 1996a
What is the current annual inventory turns for your primary products?[3]	Gunasekaran et al. 2001; Kaplan and Norton 2000; Khurana et al. 1998; Slater et al. 1997; http://www.supply-chain.org (SCOR Model)
Customer Intimacy	
We make extensive use of customer data in daily operation decisions[1]	Gunasekaran et al. 2001; Heskett et al. 1994; Ittner and Larcker 2003; Kaplan and Norton 1992
We promptly resolve customer complaints[1]	Heskett et al. 1994; Khurana et al. 1998; Lohman et al. 2004; http://www.supply-chain.org (Customer-Chain)
We have procedures in place to provide superior after-sales service[1]	Gunasekaran et al. 2001; Kim and Arnold 1996; Miller and Roth 1994
What is the average time required to complete a quote for a typical customer?[2]	Gunasekaran et al. 2001; Neely et al. 1995; http://www.supply-chain.org (Customer-Chain)
Product Leadership	
Our product design cycle time is short compared to competitors[1]	Kaplan and Norton 1992; Neely et al. 1995; http://www.supply-chain.org (Design-Chain)
What is the average number of changes per product design?[2]	Neely et al. 1995; http://www.supply-chain.org (Design-Chain); White 1996a

[1] Item measured on a 5-point Likert scale ('1' *strongly disagree*; '5' *strongly agree*)

[2] Self-reported, objective measure of tactical performance

[3] Item measured on a 7-point scale ('1' *under 1 time per year*; '2' *1 time to 2 times per year*; '3' *over 2 times to 4 times per year*; '4' *over 4 times to 8 times per year*; '5' *over 8 times to 16 times per year*; '6' *over 16 times to 32 times per year*; '7' *over 32 times per year*)

Financial Performance Metrics

What was your profit level (before taxes) for the most recent fiscal year?[4]
What is your current pre-tax return on assets (ROA) [pre-tax new profit/total assets]?[5]

[4] Item measured on a 7-point scale ('1' *negative*; '2' *break even (no profit/no loss)*; '3' *under 5%*; '4' *5% to 10%*; '5' *over 10% to 15%*; '6' *over 15% to 20%*; '7' *over 20%*)

[5] Item measured on a 7-point scale ('1' *under 5%*; '2' *5% to 10%*; '3' *over 10% to 15%*; '4' *over 15% to 20%*; '5' *over 20% to 25%*; '6' *over 25% to 30%*; '7' *over 30%*)

Cluster Taxons

Please indicate your degree of dependence on the following parties as sources of information when making decisions that support the MBU's primary business strategy:

	Little Dependence				**Extreme Dependence**
Internal production planners and supervisors	1	2	3	4	5
Consumers and individual corporate clients	1	2	3	4	5
New product designers and engineers	1	2	3	4	5

Please indicate the degree of importance of the role played by each of the following systems in realizing the goals of the MBU's primary business strategy:

	Not Important				**Extremely Important**
Customer resource management (CRM) system	1	2	3	4	5
Computer aided design and/or manufacturing (CAD/CAM) systems	1	2	3	4	5

Organization Size

Approximately how many employees, in full time equivalents (FTEs), does your organization currently employ?[7]

[7] Item measured on a 7-point scale ('1' under 250; '2' 250 to 500; '3' over 500 to 1,000; '4' over 1,000 to 2,000; '5' over 2,000 to 4,000; '6' over 4,000 to 8,000; '7' over 8,000)

Appendix B Descriptive Statistics

	Key Variables in Analysis	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Our production costs are low compared to competitors	2.84 (1.07)													
2	The percentage of orders delivered by the original request date	83.31 (17.53)	0.01												
3	Annual inventory turns for primary products	4.18 (1.31)	0.14	0.04											
4	We make extensive use of customer data in daily operations	3.14 (0.99)	0.09	0.20 *	0.10										
5	We promptly resolve customer complaints	3.84 (0.90)	0.17 *	0.20 *	-0.08	0.47 ***									
6	We have procedures in place to provide superior after-sales service	3.50 (1.01)	0.03	0.01	-0.15	0.33 ***	0.46 ***								
7	The average time required to complete a quote for a typical customer	2.30 (2.16)	-0.22 *	-0.05	-0.22 *	0.13	-0.17	-0.18							
8	Our product design cycle time is short compared to competitors	2.78 (0.91)	0.16 *	0.04	0.11	0.15	0.07	0.05	0.07						
9	The average number of changes per product design	2.12 (1.25)	0.01	0.08	-0.17	0.20	0.15	0.11	0.15	0.11					
10	Operational Excellence strategic metric scale	3.49 (0.69)	0.31 ***	0.25 **	0.27 **	0.36 ***	0.38 ***	0.27 ***	-0.20	-0.01	-0.03				
11	Customer Intimacy strategic metric scale	3.57 (0.59)	0.08	0.08	0.01	0.36 ***	0.36 ***	0.40 ***	-0.26 **	0.19 **	0.20	0.29 ***			
12	Product Leadership strategic metric scale	3.47 (0.82)	-0.03	-0.01	-0.13	0.17 *	0.18 *	0.37 ***	0.06	0.31 ***	0.39 ***	0.12	0.41 ***		
13	Profit Level	4.81 (1.64)	0.32 ***	-0.01	-0.18	0.09	0.14	0.18	-0.09	0.26 **	-0.18	0.09	0.26 **	0.14	
14	Pre-tax ROA	3.25 (1.92)	0.37 **	0.06	0.17	0.09	0.18	0.20	-0.14	0.24	-0.25	0.47 ***	0.31 *	0.05	0.77 ***

Note: *** $p < .01$; ** $p < .05$; * $p < .10$