



# The effect of performance measurement systems on firm performance: A cross-sectional and a longitudinal study



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## ABSTRACT

Performance measurement (PM) systems have been popularized over the last 20 years and the operations management literature is replete with discussion of metrics and measurement systems. Yet, a comprehensive nomological network relating types of PM system uses to organizational capabilities and performance is lacking. Furthermore, there is scant empirical evidence attesting to the explanatory efficacy of PM systems as it relates to organizational performance. We view PM system uses through the lenses of the Resource Orchestration Theory (ROT) and explore specific relationships of underlying variables by relying on the Organizational Information Processing Theory (OIPT). Resting on the extant literature, we identify two types of uses which include Diagnostic Use (the review of critical performance variables in order to maintain, alter, or justify patterns in an organizational activity) and interactive use (a forward-looking activity exemplified by active and frequent involvement of top management envisioning new ways to orchestrate organizational resources for competitive advantage) and relate them along with their interaction (i.e., dynamic tension) to organizational capabilities. We further link capabilities to target performance, which subsequently impacts organizational performance (operationalized through both perceptual and objective financial performance measures). The nomological network is tested via a cross sectional study (386 Italian firms) while the efficacy of PM systems to explain organizational performance is examined by using longitudinal panel data approaches over a 10 year period. There is sufficient evidence to suggest that the use of PM systems leads to improved capabilities, which then impact performance. Contrary to the extant literature, however, we discovered that Diagnostic Use appears to be the most constructive explanatory variable for capabilities. On the other hand, in light of a longitudinal study, we also uncovered that Diagnostic Use experienced depreciating returns as far as objective financial measures are concerned. Also, when high levels of Diagnostic Use were coupled with low levels of Interactive Use, they produced the lowest levels of organizational capabilities. Conversely, high levels of both types of PM system use generated extraordinary high levels of capabilities. There is sufficient evidence to suggest that organizations cannot rely merely on Diagnostic Use of PM systems. We also learned that the effects of PM systems (measured via *adaptation*) fade unless high learning rates are applied. We offer detailed recommendations for future research which have theoretical as well as empirical implications.

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## 1. Introduction

The operations management literature has been a strong proponent of metrics and respective PM systems for quite some time. For instance, Bititci et al. (1997) offer a developmental guide to

construct integrated PM systems and Gunasekaran et al. (2004) proposed a framework for supply chain performance measurement. Melnyk et al. (2004) discuss metrics and performance measurement while Neely (1999; 2005) furnished a treatise on the evolution of performance measurement research in operations management. Later on, Gunasekaran and Kobu (2007) provided a literature review of performance measures and metrics in logistics and supply chain management. While the topic is popular, what is vividly missing from the literature is a judicious examination of how companies actually use PM systems to orchestrate their responses to

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organizational challenges and whether such uses do in fact enhance operational, strategic, and external stakeholder related capabilities and performance over time.

PM systems are integral to resource orchestration processes and over the last three decades many organizations have invested enormous amounts of capital, time, and effort developing and implementing such systems. Undoubtedly, one of the most popular paradigms is the *Balanced Scorecard*, first documented and articulated by Kaplan and Norton (1992). There are nevertheless numerous other measurement frameworks (Bititci and Turner, 2000) that have been proposed and implemented—e.g. the *Performance Measurement Matrix* (Keegan et al., 1989), the *Result and Determinants Model* (Fitzgerald et al., 1991), the *Performance Pyramid* (Lynch & Cross, 1992), and the *Performance Prism* (Neely et al., 2002). These formal performance systems are utilized as mechanisms that enable organizations to orchestrate their resources more effectively.

The Resource-Based Theory (RBT) has long argued that possessing valuable, rare, inimitable, and non-substitutable resources is vital to firm sustained advantage (Hitt et al., 2011; Wowak et al., 2013). But as Hansen et al. (2004, p. 1280) state “what a firm does with its resources is at least as important as which resources it possesses.” Sirmon et al. (2011) similarly note that while possession of resources is essential, the ability of a firm to “orchestrate” its resources is more fundamental as the firm bids to prosecute its strategic objectives. Orchestration of resources however is also subject to top management who mobilizes the vision to direct and use firm resources to achieve objectives (Chirico et al., 2011; Crook et al., 2008). Resource Orchestration Theory (ROT) is an emerging theoretical stream of work which rests on the conceptual work of Sirmon et al. (2007) and Helfat et al. (2007). Hitt et al. (2011) argue that “Resource orchestration is concerned with the actions leaders take to facilitate efforts to effectively manage the firm’s resources” (p. 64). Such actions include for instance the structuring of the firm’s resource portfolio, bundling resources into capabilities, and leveraging the capabilities to create value to customers (Hitt et al., 2011; Sirmon and Hitt, 2003; Sirmon et al., 2007). According to Hitt et al. (2011) and Holcomb et al. (2009), while each action and its particular nuances are vital, the synchronization of actions can contribute positively towards performance.

To manage each action and to synchronize the orchestration of resources, leaders rely on mechanisms such as PM systems which yield information regarding the functioning of their resource portfolio and bundle of capabilities (Hitt et al., 2011). Such information is critical for leaders because it enables them to make crucial adjustments to their resources and mobilize requisite resources as conditions change. Melnyk et al. (2004) recognized the orchestrating role of PM systems in operations management and assert that the “performance measurement system is ultimately responsible for maintaining alignment and coordination” (p. 213). Operations management leaders, for instance, need information regarding inventory performance to decide whether additional space to house inventory is necessary in order to pursue a new “same-day delivery” strategy that demands high service levels, such as the expansive Amazon.com *Local Express Delivery* strategy. Via the diagnostic attributes of a PM system, managers can focus attention on issues of strategic significance, monitor performance, and detect whether the desired service level can be achieved given the current level and blend of resources. In addition, the active and personal engagement of the leadership with performance measurement processes can serve as a catalyst in orchestrating the acquisition and bundling of essential resources and capabilities to meet delivery targets. Melnyk et al. (2004) highlight that metrics and respective PM systems serve “as essential links between strategy, execution, and ultimate value creation” (p. 209). A PM system can also be characterized as a management control system that incorporates a

structured framework specifying key financial and non-financial performance metrics. From a theoretical point of view, a PM system can be described as an ambidextrous system because it incorporates both mechanistic and organic elements.

As an orchestration mechanism, the organization can use the PM system to control organizational behavior (alike to a mechanistic use) but on the other hand it can use it to promote organizational innovation and strategic renewal (resembling an organic use). The literature however tends to focus more on the “mechanistic” use of PM systems while the more “organic” use is in general neglected. The mechanistic use is coined as the *diagnostic use* in the literature and it is primarily responsible for furnishing information. From an organizational information processing theory (OIPT) perspective (Galbraith, 1974), diagnostic use is liable to reduce uncertainty. On the other hand, the *organic use* can be described as interactive in nature and is deployed by top management to enact debate and reduce equivocality. Simons (1995) acknowledges the complementary nature of the two systems, but only few studies explicitly test relationships between types of uses of PM systems (e.g., Widener, 2007) or specify and account for their interactions (e.g., Henri, 2006a). However, these authors operationalize organizational performance only via perceptual measures rather than objective and longitudinal financial performance measures.

Underscoring the importance of PM systems, Kaplan and Norton (2008) made a rather revealing statement suggesting that “We believe that if you don’t measure progress toward an objective, you cannot manage and improve it” (p. 7). From an ROT perspective, firms that deploy their PM systems should be capable of shaping capabilities to meet or exceed target performance. Highlighting and motivating interest in adopting a PM system is, therefore, the claim that organizations with a PM system outperform their counterparts without a PM system (Davis & Albright, 2004; Crabtree & DeBusk, 2008). Unfortunately, this claim is debatable in part because there is only a handful of published empirical research studies investigating the claim (e.g., Ahn, 2001; Chenhall & Langfield-Smith, 1998; Henri, 2006a; Hoque & James, 2000; Ittner & Larcker, 1998; Chenhall, 2005; Widener, 2007) and in part because the extant empirical literature has reported mixed results regarding the effects of PM system usage on organizational performance (Chenhall & Langfield-Smith, 1998; Ittner et al., 2003a). Henri (2006a) surmises that prior work examined the role of PM systems toward strategy implementation and strategy formulation, but concedes there is scant empirical evidence attesting to the professed virtues of such systems. The operations management literature is especially devoid of studies in this respect and much of what is currently published can be ascribed as contributions from the accounting discipline.

Henri (2006a) submits that the specific relationship between PM systems and strategy is ambiguous and at times contradictory and attributes such results to differences in definitions and operationalizations of the variables. Pavlov and Bourne (2011) add that the mechanism relating a PM system to performance is poorly understood. Henri (2006a) notes that prior research has specified and tested direct links between PM system usage and performance but the effects may actually be reflected instead by the capabilities that PM systems incite as orchestration mechanisms. Pavlov and Bourne (2011) argue that it has not been demonstrated exactly how PM systems are linked to performance, thus leaving the gap between PM systems and performance still unresolved. As Pavlov and Bourne state, the power of a PM system can be seen as significant and yet somewhat opaque. In other words, there is still a “black box.”

Overall, there are three gaps in the literature which merit investigation. The first gap relates to the specific types of uses of PM systems: *For what purposes do organizations use PM systems?* The second and related gap pertains to the modality by which different types of uses of PM systems impact performance: *How do specific*

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