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# IMPACT OF INFORMATION SYSTEMS RESOURCES AND CAPABILITIES ON FIRM PERFORMANCE: A RESOURCE-BASED PERSPECTIVE

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## Abstract

*In this paper, we draw from the resource-based theory to examine how information systems resources and capabilities impact firm performance. A basic premise of this paper is that variations in firm performance can be explained by how effective it is in using information technology to support and enhance its core competencies. In contrast to past studies that have implicitly assumed that information systems assets could have direct effects on firm performance, this study draws from the resource complementarity arguments and posits that it is the targeted use of information systems assets that is likely to be rent yielding. We develop the theoretical underpinnings of this premise and propose a model that interrelates IS resources, IS capabilities, IT support for core competencies, and firm performance.*

**Keywords:** Information technology and strategy, competitive advantage, resource-based theory, core competencies

## 1 INTRODUCTION

The potential of information technology (IT) to provide firms with a competitive advantage has been a topic of interest to practitioners and academicians. This interest is reflected in the large number of studies that have examined the strategic value of IT and its impact on firm performance. Despite significant work in this area, the need to examine the IT-firm performance relationship exists for at least two reasons. First, while studies have found that IT impacts firm performance, the underlying mechanisms by which IT relates to firm performance remain under-examined (Bharadwaj 2000). Second, the underlying theories to explain why and how IT innovations contribute to firm performance have undergone a paradigm change creating a need for a more current examination (Sambamurthy and Zmud 1997). The positioning arguments that underlie the industrial organizations economics (I/O) paradigm have been questioned in the strategy literature where it has been suggested that there is a need to focus on firms' internal factors in addition to industry structures in understanding sources of competitive advantage. Researchers have argued that the resource-based theory (Barney 1991) and its extensions (Teece et al. 1997) with their focus on firm resources and capabilities provide an appropriate theoretical base to examine how factors internal to the firm can be a source of competitive advantage.

In this paper, we draw from the resource-based theory to examine how information systems (IS) resources and IS capabilities impact firm performance. A basic premise of this paper is that a firm's performance can be explained by how effective it is in using IT to support and enhance its core competencies. In contrast to past studies that have implicitly assumed that IS assets could have direct effects on firm performance, this study draws from the resource complementarity arguments (Clemons and Row 1991) and posits that it is the targeted use of IS assets that is likely to be rent yielding.

## 2 THEORETICAL BACKGROUND

Resources are stocks of available factors of production owned or controlled by firms (Amit and Schoemaker 1993). Capabilities, in contrast, refer to firms' capacity to deploy resources using organizational processes (Amit and Schoemaker 1993). Capabilities can be viewed as the capacity of a team of resources to perform some tasks or activities, and are often developed in functional and sub-functional areas by combining physical, human, and technological resources (Grant 1991).

Two distinct mechanisms, namely *resource picking* and *capability-building*, underlie the resource-based arguments about how economic rents can be created by firms. The former mechanism asserts that firms create economic rents by being more effective than their rivals in *selecting* resources (Makadok 2001). This Ricardian perspective stresses that heterogeneity in performance is due to ownership of resources that have differential productivity (Wernerfelt 1986). In contrast, the capability-building mechanism asserts that firms create economic rents by being more effective than their rivals at *deploying* resources. While studies have examined these two mechanisms independently, Makadok argued that they are not necessarily independent and may complement each other in some circumstances. One dependency stressed in the literature is that resources are the raw materials to build capabilities (Wernerfelt 1986) and that resource availability determines a firm's ability to develop capabilities. While this position suggests a cause-effect relationship between firm resources and capabilities, this relationship has not been fully examined theoretically nor has it been tested empirically.

## 3 RESOURCE-BASED VIEW OF IT AND FIRM PERFORMANCE

In recent years, several studies have used the resource-based theory to examine the IT-firm performance relationship. These studies have focused on identifying IS resources that are likely to be valuable and inimitable (e.g., Mata et al. 1995; Ross et al. 1995). A common theme underlying these studies is their emphasis on intangible resources as a source of competitive advantage. A related stream of research has focused on the capabilities of the IS function as a source of competitive advantage (e.g., Bharadwaj 2001; Feeny and Wilcocks 1998; Sambamurthy and Zmud 1997). While these studies posit a direct relationship between IS resources and capabilities and firm performance, others have questioned the direct-effect argument. Clemons and Row (1991), for example, argued that IT can provide sustainable competitive advantage when it is used to leverage structural differences between firms such as the degree of vertical integration and diversification. Powell and Dent-Micallef (1997) posited and found that the complementarities between IT use and the human resources practices and business practices in retail stores accounted for variance in firm performance and that IT resources did not have a direct impact on firm performance.

In summary, while IS research has drawn from the resource-based theory to examine the IT-firm performance relationship, key gaps exist in the literature. First, while the literature has identified several IS assets and posited their direct effects on firm performance, the relationships between IS resources and capabilities have not been systematically examined. As pointed out earlier, resources are the raw materials in the development of capabilities and examination of the relationships between IS resources and IS capabilities can provide a better understanding of how resources are deployed to develop inimitable capabilities. Second, past research has emphasized higher-order capabilities such as IS management capabilities and not much attention has been paid to the strategic implications of IS functional capabilities. In contrast, much of the strategy literature has emphasized the strategic value of capabilities in core functional and sub-functional areas. Third, while the complementarities between IS assets and other firm resources have been emphasized, limited work has been undertaken to understand the different ways in which complementarities could be developed and their impact on firm performance. Fourth, much of the past research has been conceptual in nature and only limited empirical work has tested the resource-based arguments in the context of IS.

Our objective is to add to the growing body of IT-firm performance research by developing a theory that bridges some of the identified gaps in the literature. We synthesize the strategy and IS literatures to develop a theoretical model that interrelates IS resources, IS capabilities, IT support for core competencies, and firm performance.

## 4 RESEARCH MODEL AND HYPOTHESES

We propose a research model that interrelates four constructs: firm performance, IT support for core competencies, IS capabilities, and IS resources (see Figure 1). Drawing from the notion of resources complementarities, we posit that a firm's ability to create competitive advantage is a function of its ability to use IT to develop and enhance its core competencies. Firm competencies are developed over a period of time and reflect choices made by the organization about resource acquisition and deployment. All firms have limited IS resources and have to make choices on how these resources are deployed. Choices that result in embedding IT

within areas of critical importance to the organization are likely to yield resource bundles and capabilities that are dissimilar to those of the competitors which in turn can be rent yielding. Embedding IT within areas of core competencies makes IS assets inimitable since it is difficult for competitors to create similar bundles of complementary IS and organizational assets as well as to understand the contributions of IS assets to firm performance. Thus, other things being equal, firms that target their IT initiatives towards their core competencies are likely to realize greater value from their IS assets than firms that are less focused in their IT deployment. This leads to the following hypothesis:

*H1: There is a positive relationship between IT support for core competencies and firm performance.*

Grant (1996) presented a hierarchy of organizational capabilities and argued that organizational competencies are built on the foundation of functional and cross-functional capabilities. Capabilities are socially complex routines that determine the efficiency with which firms transform inputs into outputs (Collis 1994). IS capabilities are the routines within the IS department that enable it to deliver IT services to the organization. While a variety of IS capabilities have been identified in the literature, we limit our focus to the capabilities in the core functional areas such as *planning, systems development, IS support, and IS operation* (Tavakolian 1989). We do this for two reasons. First, the emphasis on functional capabilities is consistent with prior research in strategy where Grant observed “capabilities can be identified and appraised using a standard functional classification of the firm’s activities” (1996, p. 120). Second, despite their strategic value, IS functional capabilities have not been the focus of prior IT-firm performance research.

Building on the notion that capabilities are determined by organizational routines, we adopt a process focus and define IS capabilities in terms of the quality and sophistication of IS processes. Any reference to performance either at the firm level or at the functional level has been purposefully avoided in this definition of capability in order to avoid the well-known tautology of defining capability as an improvement in performance. While functional capabilities are likely to be correlated with performance, this association is neither necessary for the definition of capabilities nor required for theorizing about how capabilities are combined to create organizational competencies.

Drawing from Grant’s (1996) architecture of organizational capabilities, we posit that an organization’s ability to enhance its core competencies using IT is likely to be dependent on IS functional capabilities. Using IT to enhance core competencies requires that firms make choices in how technology resources are deployed, taking into account the strategic thrusts of the organization. First, IS planning is an important process that enables organizations to identify business priorities and ensure that IS goals and initiatives are aligned with business priorities. Second, in addition to making choices about targeting IT resources, firms have to successfully develop and implement technology solutions and ensure their effective utilization in order to improve their core competencies. Ability to develop high quality applications in a timely and cost effective manner is a critical capability that is likely to impact technology deployment. Third, a mature IS support process can ensure that systems are effectively utilized by end users. Since, firms cannot reap benefits from IT unless it is effectively used, IS support could determine how successful a firm is in using IT to improve its core competencies. Finally, for many organizations, continuity of business operations is dependent on efficient and reliable IS operation. With the increased penetration of IT into business operations, systems failures can lead to significant business disruptions and losses. Ineffective IS operation has the potential to damage carefully built reputations for quality and reliability in product and service offerings.

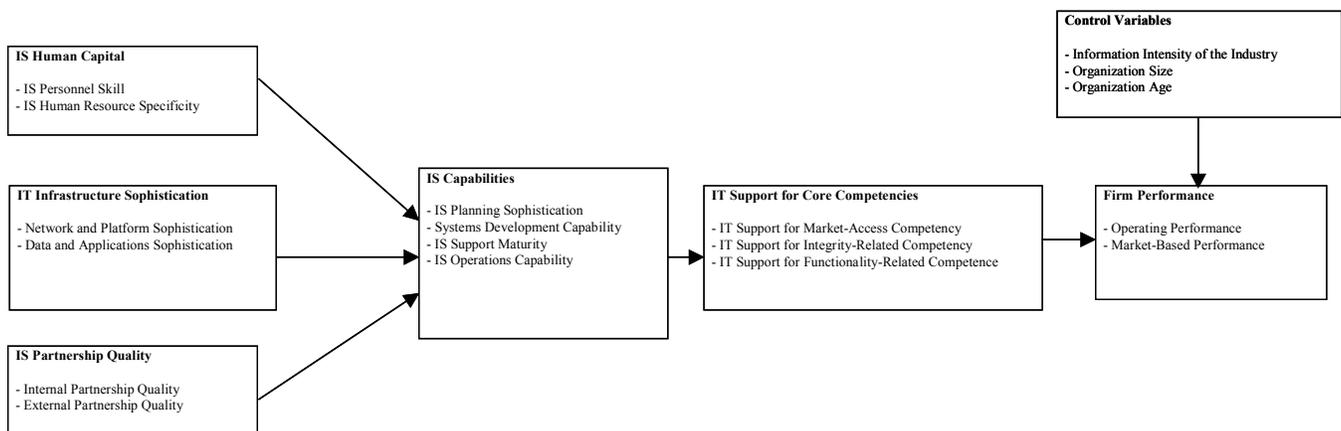


Figure 1. Research Model

In short, organizations that do not have strong IS capabilities might find it difficult to initiate and sustain innovative projects targeted at enhancing the firm's core competencies or in providing reliable IS services that might be critical for smooth business operations. Thus,

*H2: There is a positive relationship between IS functional capabilities and IT support for core competencies.*

As discussed earlier, resources are the raw material in the development of capabilities. This relationship is implicit even in the definition of capabilities as "an organization's ability to deploy resources" (Amit and Schoemaker 1993). The causal relationship between resources and capabilities is more formally stated in the dynamic capabilities perspective where asset positions are posited to impact capability development. Teece et al. (1997) argued that while

the essence of competencies and capabilities are embedded in organizational processes of one kind or another the content of these processes and the opportunities they afford for developing competitive advantage...are shaped by the assets the firm possesses and by the evolutionary path it has adopted. Hence organizational processes are shaped by a firm's asset positions (p. 518).

Consistent with these arguments, we posit a direct positive relationship between IS resources and IS capabilities.

Three broad categories of resources have been identified in the IS literature, namely, human, technological and relationship resources (Bharadwaj 2001; Ross et al. 1996). In this study we include these three categories of resources. Consistent with prior IS research that has emphasized the importance of intangible resources, we focus on the intangible dimensions of these three resources. Specifically, our research model includes IS human capital, IT infrastructure sophistication, and IS relationship quality and posits that each of these resources will have a direct positive relationship with IS capabilities. Thus,

*H3: There is a positive relationship between IS human capital and IS functional capabilities.*

*H4: There is a positive relationship between IT infrastructure sophistication and IS functional capabilities.*

*H5: There is a positive relationship between IS partnership quality and IS functional capabilities.*

## 5 RESEARCH METHODOLOGY

Data for testing the research model was collected through a mail survey of Fortune 1000 firms. The names, titles, addresses, and phone numbers of senior IS executives for these firms were obtained from the *Directory of Top Computer Executives (1999)*. From an effective mailing list of 710 firms, 119 usable responses were received, resulting in a response rate of 16.8 percent. The profile of the respondents was compared with those in the mailing list on variables such as organization size and IS department size. The chi-square analysis revealed no systematic response bias. Chi-square tests comparing early and late respondents on organization size, industry, and IS department size also revealed no significant response bias.

The scales for the various constructs were developed based on a synthesis of past research. Wherever feasible, scale items were borrowed or adapted from existing validated instruments. Table 1 provides a summary of the dimensions and key indicators of the constructs in the research model. The scales were validated using standard procedures recommended in the literature. Items for scales in a related domain were pooled and factor analyzed to assess their convergent and discriminant validity. An iterative process of dropping items with high loadings on multiple factors or with loadings on factors other than the one representing the scale to which they pertain and reassessing the factor loadings was followed in refining the scales. Overall, five items were dropped to yield a set of scales with adequate convergent and discriminant validity. The reliability of these refined scales was then assessed and found adequate.

## 6 CONCLUSION

The research model is being tested using partial least square (PLS) analysis. Preliminary results indicate that the model and the hypotheses are supported. We will be discussing the results of the analysis, the key findings, and their implications for research and practice in our presentation at the conference.

**Table 1. Constructs and Measures**

Constructs	Dimensions	Key Indicators
IS Human Capital	IS personnel skill	The extent to which IS personnel possess the requisite business, technology, and interpersonal skills
	IS human resource specificity	The extent to which IS personnel have firm-specific knowledge of the business culture and their acquaintanceship with people in organizations
IT Infrastructure Sophistication	Network and platform sophistication	Connectivity, speed, and capacity of the networks and IT platforms
	Data and core application sophistication	Modularity and shareability of data and core applications
IS Partnership Quality	Internal partnership quality	The extent to which the relationship between the IS department and the business units reflects benefits and risk sharing, trust, communication, and coordination
	External partnership quality	The extent to which the relationship between the IS department and technology vendors is characterized by trust and involves long-term partnerships and commitment to shared objectives
IS Capabilities	IS planning sophistication	Continuity participation, formalization, and comprehensiveness of the IS planning process
	Systems development capability	Customizability, flexibility, control, and maturity of the systems development process
	IS support maturity	The extent to which the IS support process is responsive and service oriented
IT Support for Core Competencies	IT support for market-access competencies	The extent of IT use in improving customer responsiveness and customer segmentation, and determining customer requirements
	IT support for integrity-related competencies	The extent of IT use in reengineering business processes, enhancing process flexibility, and integrating supply chains
	IT support for functionality-related competencies	The extent of IT use in developing new products/services, identifying new markets, refining scope of business, and entering new markets
Firm Performance	Operating performance	Profitability, productivity, and financial performance
	Market-based performance	Market responsiveness and market share

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