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# THE MODERATOR ROLE OF INFORMATION TECHNOLOGY IN FIRM PERFORMANCE: A CONCEPTUAL MODEL AND RESEARCH PROPOSITIONS

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## Abstract

Debate over the impact that Information Technology (IT) investments have on firm performance continues in the face of conflicting evidence. Questions about the validity of prior studies, in regard to conceptualizing the role of IT and the methodologies adopted for its testing, have both been raised. In this paper, we present a new conceptualization of the effects of IT on firm performance based on prior theoretical works and case studies of IT. IT is hypothesized to *moderate* the relationship between strategic business drivers and firm performance. Drawing from studies in industrial organization and management strategy that explain firm performance in terms of the environment in which a firm operates (industry structure factors), the strategies it adopts (competitive strategy variables), and the resources it utilizes (firm-specific assets and skills), a comprehensive model of firm performance is presented. Propositions delineating the moderating role of IT on the three sets of variables, namely, industry structure, competitive strategy, and firm-specific assets and skills, are put forth and moderator correlation and regression analysis is proposed as a methodology to test this conceptualization.

## 1. INTRODUCTION

Over the years, numerous studies have focused on the economic and behavioral advantages accruing to businesses that invest in Information Technologies (IT). The likely advantages include opportunities to enter new markets, differentiate products, provide cost efficiencies, change the nature of the firm's industry, and ultimately influence the "bottom line" (Kettinger et al. 1994; Clemons 1986; Weill and Olson 1989). The performance disadvantages center on the strong possibility that IT investments are inherently risky. The results of empirical studies examining the relationship between IT and performance have demonstrated mixed results.

Several explanations exist for the variance in results. The primary reasons lie in methodological factors such as sample characteristics and measurement factors. Researchers have also pointed out that the variance in estimates of IT advantages could be due to model underspecification, i.e., failing to specify other factors that impact firm performance (Weill 1992; Ahituv and Giladi 1993; Dos Santos, Peffers and Mauer 1993; Hitt and Brynjolfsson 1994).

In addition to the mixed evidence and differing explanations offered to account for the variance in IT-business performance linkage, the validity of the *main effects* perspective to IT advantage (i.e., IT investments have a direct impact on business performance) must be examined carefully. An argument put forth in this paper is that IT effects are more appropriately captured as *moderation effects*. Although investing in IT is a necessary condition for exploiting IT-related advantages, the factors involved in achieving and sustaining an advantage are considerably complex and result in more than a simple, direct effect. Instead, the interaction of IT with market strategies and marketplace conditions could account more accurately the relationship between IT investments and business performance.

Against this backdrop, the purpose of this paper is twofold. First, this paper addresses the model underspecification problem of prior studies by including in the model both IT and other consensual drivers of business performance. Based on a detailed review of industrial organization (IO) economics (c.f. Bain 1951, 1956; Porter 1980) and strategy literature (c.f. Buzzell and Gale 1987; Barney 1991), our model includes three sets of variables, namely *industry structure variables*, *competitive strategy variables*, and *firm-specific intangibles*.<sup>1</sup> Second, we deviate from the traditional approach of modeling the impact of IT as a

direct effect and instead propose a contingency approach that captures the moderating effects of IT on antecedents to business performance. Thus we subscribe to the view that IT plays an enabling role with respect to business strategies (Henderson and Venkatraman 1993; Kettinger et al. 1994) and examine the extent to which traditional strategic levers are strengthened and adverse industry conditions are mitigated due to the effects of IT.

## 2. REVIEW OF RESEARCH MODELS

Review of the literature on IT and business performance reveals that three different models of the IT-performance linkage have been proposed and tested: the *direct (or main effects)* model; the *conversion effectiveness* model; and the *intermediate effects or mediational* model. The classical main effect perspective (Figure 1a) hypothesizes a direct link between IT and some measure of business performance (see Wilson 1993 for a review of studies). This model implicitly assumes that investing in IT will suffice to produce superior results along some dimensions of organizational performance (Lucas 1993). Taken as a whole, studies employing this model reveal only weak or negative effects of IT's impact on firm level performance (Wilson 1993).

A revised version of the direct-effects model was put forth by Weill (1992), who argued that investments in IT do not per se translate into superior performance, unless the investing firms can efficiently use their IT resources (Figure 1b). A firm's "conversion effectiveness" mediates its ability to translate IT investments into productive output. The advantage of this model is that it captures some of the complexity of the relationship between IT investments and their resultant value; however, the assumption that there is a direct and measurable link between the use of IT and firm performance still persists.

The "intermediate effects" (mediational) model<sup>2</sup> of IT and firm performance (Figure 1c) posits that IT will impact organizational performance indirectly through intermediate outcome variables. The most recent study employing this model (Barua, Kriebel, and Mukhopadhyay 1995) concludes that IT favorably impacts certain intermediate outcome variables (e.g., capacity utilization, inventory turnover), which in turn are found to be significant drivers of market share and ROA.

An alternate conceptualization of IT, that of the *moderator (contingency)* model of IT's effects on business performance, is proposed in this paper. In contrast to the mediational role of IT, this perspective argues that the benefit which a business derives from its IT capabilities is contingent on the joint effects of IT with industry structure variables, competitive strategies, and firm-specific intangibles. The moderator perspective enunciated in this paper can be mathematically represented as follows:

$$BP = f(I, S, R, I*IT, S*IT, R*IT)$$

where BP = business performance,  
 I = set of industry structure variables,  
 S = set of strategy variables,  
 R = set of firm-specific intangibles,  
 I\*IT, S\*IT, R\*IT = the joint effects of IT and the respective predictor.

The contingency perspective of IT is in line with the notion expressed in several IT studies, namely, that IT is an enabler of business strategies and serves to augment a firm's traditional competitive postures (Henderson and Venkatraman 1993; Ives, Jarvenpaa, and Mason 1993; Konsynski 1993; Kettinger et al. 1994).

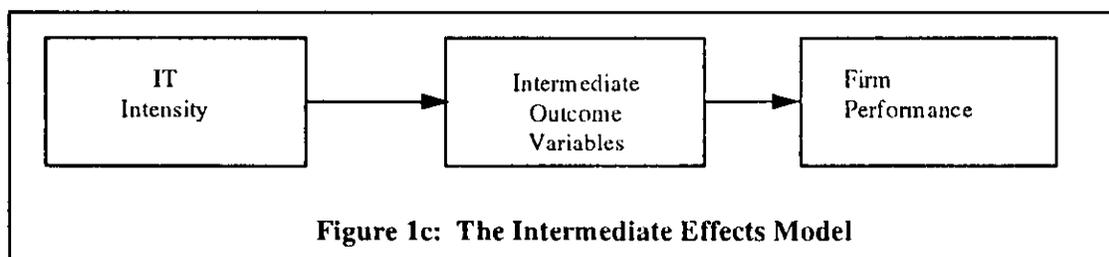
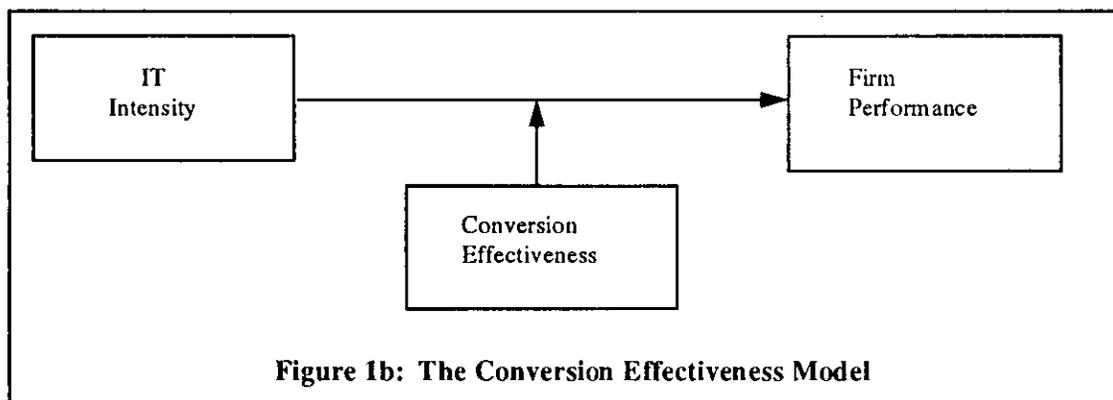
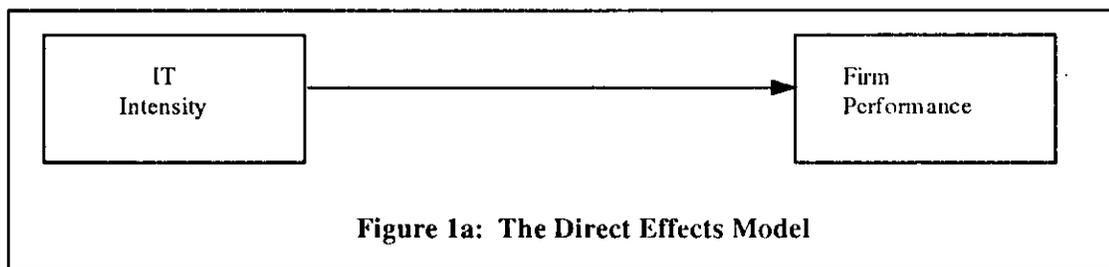
## 3. A CONTINGENCY MODEL OF IT-BUSINESS PERFORMANCE LINKAGE

A conceptual model of the IT-business performance linkage is presented in Figure 2. The role of information technology is posited as moderating the effects of industry structure variables, firm-specific strategies, and the skills and resources underlying a firm's competitive position in the marketplace. A discussion of the constructs central to the model and the proposed links follows.

### 3.1 Industry Structure and Business Performance

Industrial organization researchers have focused on the role of industry factors in explaining performance differences among firms. This stream of research based on the *structure-conduct-performance* paradigm (Bain 1951; 1956) argued that industry structure influenced conduct (strategy) and impacted performance. The primary elements of industry structure identified by this research stream are *barriers to entry*, *industry concentration*, *product differentiation*, and the *overall elasticity of demand* (Bain 1968). A popular model for examining industry structure forces is Porter's (1980) *five forces model*, which explains the sustainability of profits against the bargaining power of suppliers and buyers, competition from entrenched rivals and entrants, and indirect competition from substitutes. Although Porter's model does not include IT as part of a firm's resources, several studies have argued that IT can be used to counter industry structure forces (cf. Benjamin et al. 1984; Cash and Konsynski 1985; Konsynski and McFarlan 1990; Clemons and Row 1988; Glazer 1991; Porter and Millar 1985; Weill 1992). Drawing from these theoretical works, the moderating role of IT on the industry forces are hypothesized as follows:

*the greater the IT intensiveness<sup>3</sup> of a firm, the lower the (negative) impact of threat of new competition on firm performance:*



*the greater the IT intensiveness of a firm, the lower the (negative) impact of buyer's bargaining power on firm performance;*

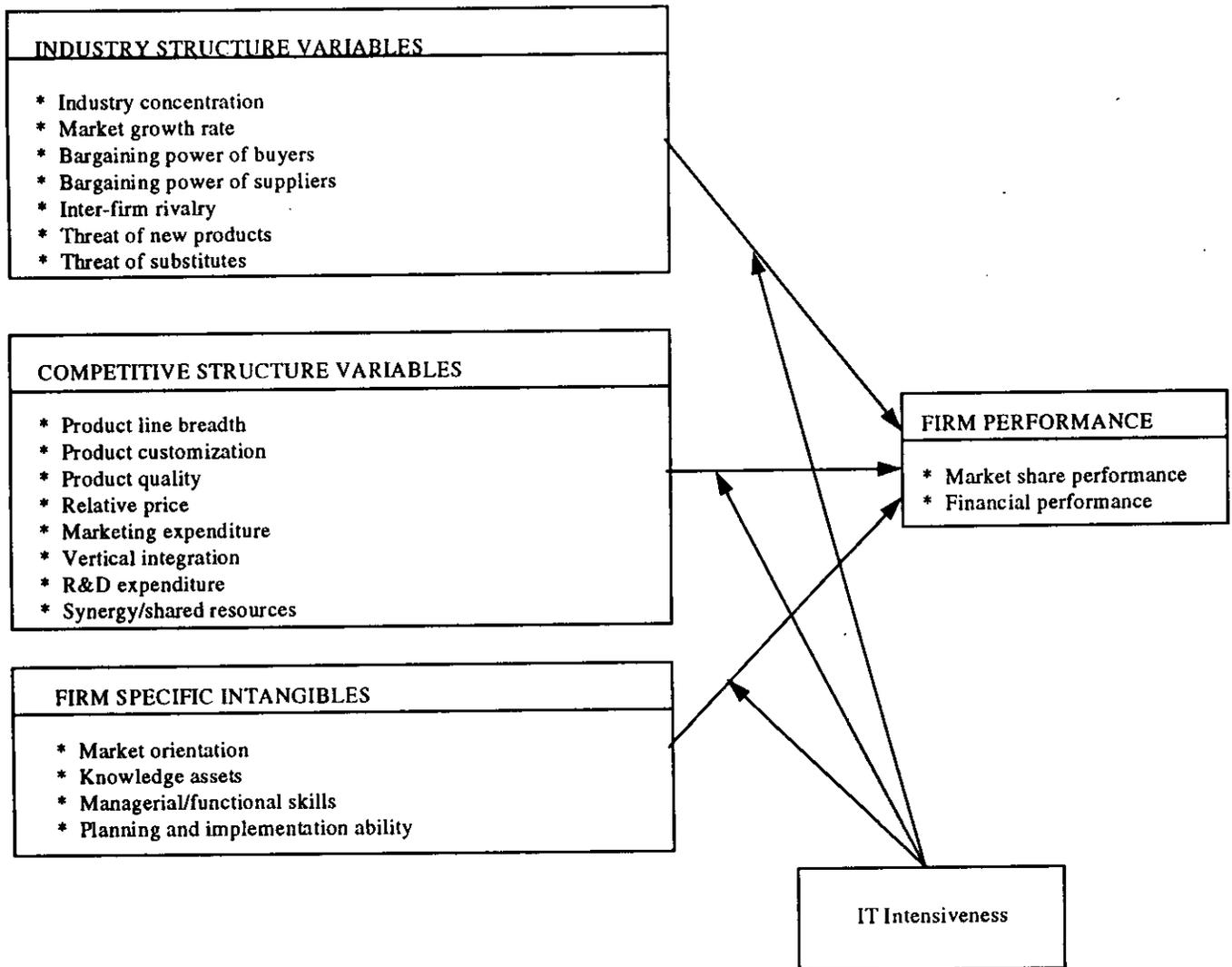
*the greater the IT intensiveness of a firm, the lower the (negative) impact of supplier's bargaining power on firm performance.*

### 3.2 Competitive Strategy and Business Performance

Developing from the efforts of IO researchers and aided by the availability of a large-scale database (the PIMS database), a substantial body of research examining the relationship between business performance and competitive strategy variables has evolved over the years. Studies in this branch have focused on a firm's conduct (i.e., strategy) as a determinant of business performance. These studies have modeled and tested the impact of several competitive strategy variables and industry structure variables on firm performance (see Buzzell and Gale 1987 for a detailed exposition).

A review of these studies was conducted in order to identify the consensual drivers of business performance (i.e., the factors commonly posited to impact on business) and to minimize the chance of model underspecification bias. Identifying the competitive strategy drivers of business performance was facilitated through a review of recent meta-analysis by Capon, Farley, and Hoenig (1990) and by Szymanski, Bharadwaj, and Varadarajan (1993). These authors independently reviewed over two hundred business performance models to identify the following competitive strategy variables that help explain variance in business performance: breath of product line, product customization, product and service quality, relative price, marketing expenditure, vertical integration, R&D expenditure, and synergy/shared resources. Based on case studies and other theoretical works that describe how firms have utilized their IT capabilities to enhance their strategic postures, the moderator role of IT with respect to some of the strategy variables are hypothesized as follows:

*the greater the IT intensiveness of a firm, the greater the (positive) impact of a broad product line strategy on firm performance;*



**Figure 2. A Conceptual Model of the Interactions Between IT and Industry Structure Factors, Competitive Strategy Variables, and Firm Specific Intangibles**

*the greater the IT intensiveness of a firm, the greater the (positive) impact of product customization strategy on firm performance;*

*the greater the IT intensiveness of a firm, the greater the (positive) impact of synergy and shared resources on firm performance.*

### 3.3 Firm-Specific Intangibles and Business Performance

While industry structure and competitive strategy variables help in explaining some of the variance in business performance, the “resource-based” view of the firm takes the position that businesses possess certain intrinsic capabilities or firm-specific

intangibles (resources and skills) that serve as sources of sustainable competitive advantage (Wernerfelt 1984; Barney 1991; Conner 1991; Mahoney and Pandian 1992).

Broadly speaking, the resources of a firm can be classified as either *tangible* or *intangible* assets. While the traditional focus has been on the tangible assets of a firm (capital intensity, relative newness of plant and equipment, etc.), which are relatively easy to measure, the resource-based perspective places a great deal of emphasis on identifying, measuring, and relating a firm’s intangible assets to its performance. Examples of intangible sources of competitive advantage include the extent of market orientation of a firm, the knowledge assets of a firm, corporate reputation, managerial/functional skills, and planning and implementation ability.

Market orientation refers to a firm's ability to generate market intelligence pertaining to current and future customer needs and to effectively respond to it (Kohli and Jaworski 1990). Information technology significantly enhances a firm's ability to be market-oriented. Technologies such as neural networks and data mining help organizations to systematically search large databases for underlying trends, create customer profiles and to better target their product and service offerings. IT initiatives in environmental scanning are enabling companies to offer novel products and to access new markets. Thus,

*the greater the IT intensiveness of a firm, the greater the (positive) impact of market orientation on firm performance.*

An integral aspect of the intangible assets of a firm is its *intellectual capital or knowledge assets*. While much of a firm's "knowledge" is tacit, soft, and distributed, IT provides the means to capture, formalize, and leverage this knowledge. The extent to which intelligence is embedded in the firm's databases, decision support systems, and expert systems may determine its responsiveness to environmental changes (Sabherwal and King 1991). For example, Hughes Space and Communications is building a "lessons learned" database intended to capture the unstructured knowledge of its design team members in the form of wisdom, experience, and stories. IT-based solutions also provide the ability to transfer skills between lines of business, thus leveraging a firm's expertise. In summary,

*the greater the IT intensiveness of a firm, the greater the (positive) impact of its knowledge assets on firm performance.*

#### 4. CONCLUSION

This paper makes two important contributions. First, an integrative model of business performance identifying the factors considered important in explaining the variance in firm performance was developed. Next, a new conceptualization of information technology's impact on firm performance, namely, the moderator role of IT, was hypothesized. Since great care was taken in identifying the consensual drivers of performance, this paper lays the groundwork for identifying what factors (industry, strategic, and firm-specific intangibles) are most important in explaining variance in business performance and which among those are enhanced most through IT initiatives.

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## 6. ENDNOTES

1. The terms intangibles, intangible assets, and firm-specific resources, skills, and capabilities are used interchangeably.
2. See Venkatraman (1989) for an explanation of the mediating and moderating role of variables.
3. Empirical studies on IT and firm performance have typically used IT spending as a surrogate for IT intensiveness, although Weill (1992) found that IT investments are moderated by the ability of a firm to productively utilize its IT capital.

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