Information Technology and Business Value: How Complementary IT Usage Platform and Capable Resources Explain IT Business Value Variation

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ABSTRACT
Understanding information technology’s (ITs) contribution to business value is an imperative issue, and while we have attempted to untangle the relationship between IT and business value with some success, our knowledge of specific factors leading to ITs contribution to business value still remains limited. In this paper we propose that complementing IT resources, by establishing a sound IT platform with capable organisational resources may aid in ITs ability to contribute to business value. We suggest that performance measurement of this contribution be undertaken at the business process level first, and then mapped through to firm level performance measurement to obtain a better understanding of the path of IT business value contribution.

Key words

INTRODUCTION
Information Technology (IT) business value research examines the organisational performance impacts of IT, an important issue for researchers, resource managers, and other stakeholders. Researchers have attempted to untangle the relationship between IT and business value for almost a decade. While the productivity paradox has been explained by substantive and methodological considerations (Aral and Weill, 2007; Brynjolfsson, 1996), recent studies established that IT does contribute to business value (Melville, Kraemer and Gurbaxani, 2004), our knowledge of specific factors leading to ITs contribution to businesses value still remains quite limited. In this paper, we address this issue by complementing two important perspectives, and suggesting an alternative measurement path in IT business value research.

First, the importance of synergy between IT and related factors must be recognised. Barua and Mukhopadhyay (2000) highlight factors like level of fit with business strategies, employee empowerment, and team orientation of business processes. However, with the current focus on efficient management and use of organisational IT and other resources, governance of IT resources, and decision making and reward structures are important issues to consider. It is important to establish and promote a platform that encourages efficient use of the business resources. Since ITs ability to create value depends on the processes within which they are used and the incentives of people to use the new systems, changing IT applications on an ad-hoc basis is unlikely to be productive. Such a nature of platform related complementarity has received little attention in IT business value research.
Second, another perspective that addresses the complementarity of IT and related resources is the resource-based view. The resource-based view, a distinct but related approach, argues that the durable business value emerges from unique combinations of resources that are valuable, scarce, and difficult to imitate (capable resources) (Barney, 1991). The imperfect mobility of these resources, the fact that firms may use different strategies in deploying these resources, and being protected from imitation due to path dependencies and causal ambiguity means these resources together with IT resources provide differences in IT business value (Barney, 1991; Mata, Fuerst and Barney, 1995). The platform complementarity and resource-based view perspectives suggest that an understanding of the organisational IT usage platform and how unique organisational resources are utilised in relation to IT resources may provide better insights into ITs contribution to business value. Understanding how IT may contribute to business value by exploring the complementarity between the IT related synergies and capable resources has not been adequately explored.

Third, even if a firm makes complementary investments and utilises its capable resources, the total return from these may not show up in measurement studies that consider input factors in isolation. The first focal point of the IS research should be IT reliant work processes, and assessment and performance measurement should occur at the process level. However, since the ultimate concern of business is the monetary return on their investments, these process performance measures should be mapped to firm level performance measures. An organisation’s overall performance depends on, amongst other factors, the effectiveness of these business processes in supporting its business goals (Ray, Muhamma and Barney, 2005). Ceteris paribus, organisations that complement their IT resources well, and use the IT resources efficiently, could generate greater benefits, and this in turn will likely contribute to overall business value.

The aim of this research is to understand how IT investments, a complementarity IT usage platform, and resources with distinctive capabilities contribute to business process performance, and how the business processes are associated with net benefits. This paper is organised as follows. The following section reviews the literature on IT business value studies, and this follows discussion on the study’s theoretical approach. Then, based on literature and theoretical framework, propositions are developed, followed by a brief discussion of the research methodology.

**LITERATURE REVIEW**

The lack of identification of a positive relationship between IT investments and business value has been well noted in the early literature (Barua, Kriebel and Mukhopadhyay, 1995; Brynjolfsson, 1993; Panko, 1991; Wilson, 1993). Studies that considered the contribution of IT investments on performance measures, and IT productivity using the production function approach (see for example, Cron and Sobol, 1983; Loveman, 1994; Roach, 1987; Strassmann, 1985) and other economic-based studies, were unable to establish any significant relationship between IT investments and productivity. Despite this disappointing start, research in IT investments continued, and Brynjolfsson and Hitt (1993) and Lichtenberg (1993) were the first to provide evidence that IT may indeed contribute to business value, making these studies a turning point in the history of IT productivity assessment (Barua and Mukhopadhyay, 2000). Based on new data, these studies asserted that a shortfall of evidence may not necessarily mean a fall of IT productivity. The studies that followed took a path of providing promising results on IT investments productivity assessment (e.g., Brynjolfsson and Yang, 1999; Dos Santos, Peffers and Maurer, 1993). This also included process oriented studies (Banker and Kauffman, 1988; Bharadwaj, Bharadwaj and Konsynski, 1999; Kauffman and Kriebel, 1988).

In a distinct but related approach to process oriented studies, the effect of IT has been measured at the intermediate level, and then related to financial performance. According to Barua et al., (1995), such an approach enabled one to open up the black box of IT usage and detect and measure IT impacts where they occur. A number of studies adopted this approach (for example, Davamanirajan, Mukhopadhyay and Kriebel, 2002; Mukhopadhyay, Lerch and Mangal, 1997; Mukhopadhyay, Rajiv and Srinivasan, 1997) and found that IT and related factors contribute to intermediate level performance measures. However, at this stage, while it was well established that the economic impact of IT is indeed positive, criticisms were raised that the production economics and business value studies have ignored the synergy between IT and related factors – an important interaction (Barua and Mukhopadhyay, 2000). A complementarity theoretic perspective was suggested that argued that objects, processes, people, and technology have a value synergy amongst themselves (Barua and Whinston, 1998). The IT inputs are a component in organisation design and investments in IT must be complemented by investments in appropriate business strategies, processes, incentives, and control systems (Barua and Whinston, 1998). Studies embedded this complementarity perspective in production economics (for example, Brynjolfsson and Hitt, 2000; Hitt and Brynjolfsson, 1997) and business value (Grenci, Barua and Whinston, 1998), and showed IT to be complementary with processes, decision authority, and people characteristics.
Recent IT business value studies have shifted attention to the firms’ resources, and using the resource-based view, argue that firms possess resources, a subset of which enable them to achieve competitive advantage and superior long-term performance (Barney, 1991; Wernerfelt, 1984). While defining what a firm’s resource is has been challenging, conceptual studies (Byrd, 2001; Feeny and Willcocks, 1998; Mata et al., 1995) and empirical studies (Aral and Weill, 2007; Oh and Pinsoneault, 2007; Ray et al., 2005; Santhanam and Hartono, 2003) have supported the resource-based view. The resource-based argument is useful in the IT context as it provides a robust framework for analysing whether and how IT may be associated to business value (Melville et al., 2004). While the theoretical and conceptual strength of the resource-based view has been well highlighted and demonstrated in IT business value research, more empirical research should help identify the type of resources and the context in which these resources, together with IT resources contribute to business value. This is the basis for our proposal for considering the complementarity between the IT usage platform and capable organisational resources in understanding ITs contribution to business value. Next, we provide the theoretical basis for this study.

**THEORETICAL FRAMEWORK – BUSINESS VALUE COMPLEMENTARITY AND THE RESOURCE-BASED EXPLANATIONS FOR BUSINESS PERFORMANCE DIFFERENCES**

The central thesis of complementarity theory involves the contribution of factors, objects, processes, people, and technology that have a value synergy amongst themselves (Barua and Whinston, 1998). As Barua and Whinston (1998) argue, IT inputs are a component in organisational design, and investments into IT must be complemented by investments and consideration into appropriate business strategies, processes, incentives, policies, and control systems. Often, firms that undertake changes in their IT applications do not consider changes in related or complementary issues (Barua, Lee and Whinston, 1996). If a firm does not invest in complementary factors, the payoffs are likely to be limited (Barua and Mukhopadhyay, 2000). The complementarity associated with creating a sound IT usage platform also seems an important consideration. Businesses should have a sound mechanism for governing their IT resources and should promote an IT usage environment to ensure that this IT resource is utilised well. One of the ways to achieve this is to provide flexibility to the users of the resources and any initiatives rewarded appropriately. However, while a complementarity initiative may contribute to ITs ability to add value to business, within the resource-based logic, the complementarities could be easily replicated by businesses, thus, on their own, they may not be sufficient to derive maximum value from the IT investments. Essentially, the resource-based argument seems an important complement to the business value complementarity perspective in understanding ITs contribution to business value.

The resource-based theory suggests that firms possess resources, a subset of which enables them to achieve competitive advantage and superior long term performance (Barney, 1991), and is based on two underlying assumptions developed in strategic management theory (Barney, 1986). The first is that the resources and capabilities possessed by competing firms may differ (resource heterogeneity), and second, that these differences may be long lasting (resource immobility) (Mata et al., 1995). The resource-based theory brings in the argument that differences in performance are explained in resource-based logic in terms of the types of resources and capabilities that different firms control (Ray et al., 2005). The core argument within the resource-based logic is that valuable resources ability to explain variance in performance across competing firms depends upon how rare and costly they are to imitate. This theoretical basis and the review of the literature forms the basis for the research propositions.

**PROPOSITIONS**

**Information Technology Resources**

For the purpose of this research, we adopt the definition of IT from Information Technology Association of America (ITAA), as the study, design, development, implementation, support of management of computer-based information systems, particularly software applications and computer hardware (Information Technology Association of America, 2008). Businesses invest to acquire the IT resources, and hire people with IT skills to develop their IT applications.

**IT Spending**

The level of raw dollar spending on IT, including outsourcing costs, is an important resource for business. Failure to invest in IT resources and capability may put firms at a disadvantage in terms of performance. Recent studies have shown that successful use of IT can improve firms performance (Bharadwaj, Bharadwaj and Konsynski, 2000). However, within the resource-based view, and as is widely agreed within the management community, any performance advantage granted by IT...
may be short lived because computer information systems can be easily replicated (Ray et al., 2005). Nevertheless, IT is an important resource for every business. These arguments lead to the following proposition:

**Proposition 1**: The level of IT spending, ceteris paribus, will be positively associated with business process performance.

**Technical IT Skills**

Technical IT skills refer to general skills and expertise possessed by firms to develop their IT applications (Copeland and McKenney, 1988). These skills are valuable to the firm, but since they are widely available, are not rare, and costly to imitate. Technical IT skills are indispensable for the effective use of IT, but do not possess the characteristics required to be a source of sustained competitive advantage (Mata et al., 1995). These arguments lead to the following proposition:

**Proposition 2**: The level of Technical IT skills, ceteris paribus, will be positively associated with business process performance.

**IT Complementarities**

IT value creation may relate to how IT is used in organisations, but this is not entirely dependent on the amount invested on IT, or the particular applications that are implemented. There are number of common organisational factors that can enhance the business value obtained from IT investments, i.e. these factors are complementary to IT investments (Barua et al., 1995; Barua and Mukhopadhyay, 2000). We propose the following complementarity factors as important in realising the benefits of IT.

**IT Governance**

IT Governance (ITG) is a management process that focuses on the responsibility and control of IT related domains across key areas to ensure IT benefits the long-term sustainable success of a firm (Information Technology Governance Institute, 2006) (ITGI). ITG is necessary for unified and faster decision making regarding IT investment, deployment, and use in order to compete with increasingly adaptive and agile competitors (Broadbent, 2005). ITG also provides the organisational capacity to manage the formulation and implementation of IT strategy (Van Grembergen, 2000). Lack of sound ITG could result in unaligned IT strategies, uncontrolled expenditure, poor performance measurement, and non-compliance with legislation and corporate policies (Doughty and Grice, 2005). Accordingly, effective IT governance is crucial for an organisation to achieve its performance goals, and sound ITG need to be complemented with IT investment to generate business value. These arguments lead to the following proposition:

**Proposition 3a**: IT spending, in the presence of sound IT governance, will be positively associated with business process performance.

**Proposition 3b**: Technical IT skills, in the presence of sound IT governance, will be positively associated with business process performance.

**Organisational Design**

The belief that employee performance has implications for firm-level outcomes has been prevalent for many years (Huselid, 1995). Bailey (1993) suggested that human resources are frequently “underutilised” because employees often perform below their maximum potential and that organisational efforts to elicit discretionary effort from employees are likely to provide returns in excess of any relevant costs. Bailey argued that human resources practices could affect such discretionary effort through their influence over employee skills and motivation, and through organisational structures and designs that provide employees with the ability to control how their roles are performed. Organisation design involves the specification of decision rights, performance evaluation systems, and compensation systems (Brickly, Smith and Zimmerman, 1996; Hitt and Brynjolfsson, 1997; Jensen and Meckling, 1992).

Organisations use many different types of information, and people have a finite ability to process and communicate this information (Hitt and Brynjolfsson, 1997). Where communication is costly and central decision makers have an infinite
capacity to digest information, it may be optimal to have centralised decision making in order to economise on communication costs (Hitt and Brynjolfsson, 1997). However, such a structure would place heavy burden on central decision makers. Further, since people are limited as information processors, highly specific information is likely to reside at lower levels of organisation (Hitt and Brynjolfsson, 1997). This puts the knowledge and people together, and as Hitt and Brynjolfsson (1997) found, performance is broadly associated with a work system that includes a decentralised authority. These arguments lead to the following proposition:

**Proposition 4a:** IT spending, in the presence of a sound decentralised decision-making authority will be positively associated with business process performance.

**Proposition 4b:** Technical IT skills, in the presence of a sound decentralised decision-making authority will be positively associated with business process performance.

**Incentive Systems**

While a decentralised system may result in better use of operational level knowledge, it can also exacerbate agency problems (Jensen and Meckling, 1992). In the absence of appropriate incentive systems, workers may not necessarily use their decision-making authority in the interest of the firm (Hitt and Brynjolfsson, 1997). Incentive systems may ensure the alignment of worker’s goals to those of the organisation. Workers seek appropriate compensation for their will to share knowledge. These arguments lead to the following proposition:

**Proposition 5a:** IT spending, in the presence of an appropriate and sound incentive system will be positively associated with business process performance.

**Proposition 5b:** Technical IT skills, in the presence of an appropriate and sound incentive system will be positively associated with business process performance.

**Capable Business (Heterogeneous and Immobile) Resources**

Viewed from a resource-based perspective, it is how firm’s leverage their investments in IT to create unique capabilities and resources that determine a firm’s IT investment contribution to business value. The following capabilities and resources are deemed important in realising the benefits of IT.

**Top Management Commitment**

Successful IT requires top executives who act as ‘business visionary’, supporting and articulating the need for IT, and communicating its functionality within the context of the organisation’s strategy, structure and systems (Henderson and Venkatraman, 1993). Top Management Commitment relates primarily to having commitment from top management for its IT investments (Powell and Dent-Micallef, 1997). Top management commitment enhances IT successes as they make IT resources available, support and guide the IS functions, integrate IT with business strategy and processes, and ensure continuity in IT investments over time and is perceived to enhance the input of the IT investment on performance (Armstrong and Sambamurthy, 1999; Powell and Dent-Micallef, 1997; Ross, Beath and Goodhue, 1996; Wade and Hulland, 2004). The lack of such support may see IS resources having little effect on performance, even when substantial investments are made to acquire or develop such resources (Wade and Hulland, 2004), thus top management commitment is an important resource in organisations. These arguments lead to the following proposition:

**Proposition 6:** The level of Top management commitment, will be positively associated with business process performance.

**Shared Knowledge**

Shared knowledge between line and IT managers may determine the strategic use of IT (Henderson, 1990; Ray et al., 2005; Rockart, 1988). Using absorptive capacity theory, Boynton and Zmud (1994) showed that an organisation’s IT use is influenced by the presence of a mosaic of IT related knowledge that binds the firms IT and line managers. A major component of the firm’s absorptive capacity regarding IT is represented by the conjunction of IT and business related
knowledge possessed and exchanged amongst the IT and line managers (Ray et al., 2005). Shared knowledge is, therefore, an important capability resource that enables the organisations to effectively implement and use IT applications in which the organisation has invested. These arguments lead to the following proposition:

**Proposition 7: The level of Shared Knowledge, will be positively associated with business process performance.**

**Flexible IT Infrastructure**

IT infrastructure has also been identified as a capability that can influence the firm’s ability to contribute to performance (Duncan, 1995; Sambamurthy et al., 2003). IT infrastructure is a shared set of capital resources that provide the foundation on which IT applications are built (Duncan, 1995), and consists of hardware and operating systems, communication networks, critical shared data, and core data processing applications (Byrd and Turner, 2000). A flexible IT infrastructure facilitates rapid development and implementation of IT applications (Ray et al., 2005) that enable organisations to respond swiftly to take advantage of emerging opportunities. These arguments lead to the following proposition:

**Proposition 8: The level of Flexible IT Infrastructure, will be positively associated with business process performance.**

**Business Value Measurement Levels**

As Alter (2003) argues, the first focal point of the IS research should be IT reliant work processes or work systems whose efficient and effective operation depends on IT. Therefore, assessment and performance measurement should occur first at the process level, as significant investment decisions are made at this level (Curtin, Kauffman and Riggins, 2007; Davamanirajan, Kauffman, Kriebel and Mukhopadhyay, 2006). This is basis for associating IT resources, IT complementarities and capable resources to business processes, as proposed above. However, ultimately, businesses are concerned about the return on their investments (monetary implications) as processes performance is not an acceptable alternative to measuring net benefits directly (DeLone and McLean, 2003). Nevertheless, business process performance indicators are a precursor for organisation wide performance, and an organisations overall performance depends on, amongst other factors, the effectiveness of these business processes in supporting its business goals (DeLone and McLean, 2003). These arguments lead to the following proposition:

**Proposition 9: Business Process Performance Improvements resulting from use on IT resources with sound IT Complementarities, and capable resources will be positively associated with Organisational level performance.**

**CONTROL VARIABLES**

This research will control for firm size, market share, market concentration, the presence of an IT department, and the number of years of IT investment to discount for rival hypothesis that may drive process level and organisational level performance.

**RESEARCH MODEL**

The propositions and the theoretical framework lead to the following research model.
METHODOLOGY

Although this is an exploratory study, many of constructs have already been developed, so we will apply a survey research methodology. Where possible, construct measurement will be sourced from prior studies, however, new items will be developed where required. The instrument will be tested by an expert panel and by pilot testing. Firms that make substantial investment in IT will be the focus of this study. The target respondents will be senior managers or executives. We will use structural equation modelling to test our model.

CONCLUSION

Understanding ITs contribution to business value is an important issue for researchers and businesses. This study proposes that in order to derive IT benefits, a good IT usage platform (complementarities) is important and businesses should be "agile" in using the IT resources. This study further proposes that the path to measuring IT benefits should be similar to the flow path of IT benefits. This study is expected to deepen our understanding on how IT contributes to business value.

We plan to conduct a pilot study in May 2008 and will present the findings at AMCIS 2008. We look forward to receiving valuable feedback from the conference that will help us craft the main study.

REFERENCES


