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Information Technology and Organisational Performance: An Integrative Model of IT Business Value

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Abstract---Managing Information Technology (IT) investments continues to be a challenge for firms due to the difficulty associated with demonstrating IT contributions to organisational performance. Many IT contributions are not accounted for because they cannot be easily quantified. Linking IT to organisational performance is a complex problem that is informed by insights from multiple theoretical paradigms. This paper aims to comprehensively review work done by both academics and practitioners and to explore why new approaches to managing IT investments are needed. To achieve this aim, we will start by defining IT assets and business value and exploring the different dimensions used to measure the business value of IT. Then, we will look at the early research on IT business value and the emergence of the Productivity Paradox. After that, we will delve into the three current theoretical paradigms: economics, management and sociology. The theoretical lenses and models used in these paradigms will also be discussed. Finally, future research directions are suggested.

Keywords---information technology, business value, IT business value, performance.

Introduction

As the global business environment has become more dynamic and complex, competition among firms has accelerated to unprecedented levels amid tighter budget constraints (Chanopas et al. 2006). IT is today a critical tool in attaining desired levels of growth and competitiveness, often constituting a major portion of an organization's capital investment (Huang et al. 2006; Kumar 2004; Alshawhi et

al. 2003). Compared to the 1990s, organisations today are carefully scrutinising IT investments and questioning their value (Carr 2003).

Literature Review

According to a recent survey, 60% of executives do not know the size of their core software assets, and more than half of them feel that the financial value of the organization's core software assets was poorly assessed compared to other corporate assets such as brands and intellectual property, and only 10% rated their team's efforts to communicate the business value of their core software assets to their boards (Dutta 2007). Firms do not appropriate all of the value they generate from IT, because they cannot capture many of the qualitative and intangible benefits (Farbey et al. 1992). Despite evidence of a positive relationship between IT investments and organisational performance, firms have managed their IT as an expense item to be minimised rather than an asset for value creation (Dutta 2007). Findings are not conclusive and still vary across firms and performance measures (Aral and Weill 2007). Before we look at the business value of IT research, we will clarify what is meant by IT assets and business value.

IT Assets

IT infrastructure is a long-term asset, impacts long-term shareholder value and represents the long-term options for an organisation (Weill and Broadbent 1998). Organisations are increasingly recognising the critical importance of the effective management of their IT infrastructure (Kumar 2004; Byrd and Turner 2000; Broadbent and Weill 1997). One of the top strategic goals for firms is reported to be associated with IT infrastructure (Eastwood 2008). Several typologies have been adopted to conceptualise IT resources (e.g. Aral and Weill 2007; Melville et al. 2004). Ross et al. (1996) provide a good classification of IT assets:

- Human assets: IT employees are valuable in solving business problems and addressing business opportunities through their accumulated firm-level IT knowledge and competence. Technical skills, business understanding and problem-solving orientation are three dimensions of human assets.
- Technology assets: They consist of shareable platforms and databases. A technology asset is valuable for integrating systems and making IT applications cost-effective in their operations and support. The characteristics of the technology assets are well-defined technology architecture, and standards for data and platforms.
- Relationship assets: The relationship between business and IT is valuable when risks and responsibilities are shared for the effective application of IT. Strong relationship assets include business partner ownership of, and accountability for, all IT projects; and top management leadership in establishing IT priorities.

IT Business Value

Melville et al. (2004) define the business value of IT as 'the organisational performance impacts of information technology at both the intermediate process level and organisation-wide level, and comprising both efficiency impacts and

competitive impacts'. From reviewing the IT business value literature, they claim that 'IT is valuable, offering an extensive menu of potential benefits ranging from the flexibility and quality improvement to cost reduction and productivity enhancement'.

A generic list of benefits that may be expected from IT investments has been suggested by Farbey, et al. (1993). This list includes strategic benefits (e.g. providing customers with a unique value proposition), management benefits (e.g. increase agility), operational benefits (e.g. improved quality at reduced cost), and functional benefits (e.g. improved communication and collaboration opportunities).

Davern and Kauffman (2000) distinguish between two types of IT value: potential value, which represents the maximum value opportunity available to the investor if the IT is implemented successfully, and realised value, which is the measurable value that can be identified after the implementation. Chircu and Kauffman (2000) explain why not all of the potential value is realised after implementation. They argued that valuation barriers (industry barriers and organisational barriers) and conversion barriers (resource barriers, knowledge barriers and usage barriers) are a series of specific value discounting factors.

According to Aral and Weill (2007), different types of IT assets (transactional, informational, strategic and infrastructure) are implemented to achieve different management objectives. They argued that one explanation of why two firms with the same amount of IT capital perform differently is that they are investing in different types of technology with different goals. They also found that IT investments deliver high performance only along dimensions consistent with the strategic purpose of that asset. They explained that while investments in transactional IT applications are associated with lower costs but not with more firm-level product innovation, investments in strategic IT applications are associated with more product innovation but not with lower costs.

IT Business Value Dimensions

Several dimensions exist in assessing the business value generated from IT. Stratopolous and Dehning (2000) classify financial performance variables into profitability measures such as returns on assets and gross profit margin, and efficiency measures such as fixed assets turnover and inventory turnover. A comprehensive review by Dehning and Richardson (2002) classifies measures into IT measures (e.g. spending, strategy, management or capability), process measures (e.g. gross margin, inventory turnover, customer service, quality and efficiency), firm performance measures (e.g. Tobin's q, market value) and accounting measures (e.g. return on asset, market share).

Murphy and Simon (2002) claim that classical quantitative techniques, such as cost-benefit analysis, are not adequate for the evaluation of IT, except when dealing with cost avoidance issues. They argue that many projects deliver benefits that cannot easily be quantified. These benefits may include information access, improved workflow and interdepartmental coordination, and increased customer satisfaction (Emigh 1999). Tallon et al. (2000) argue that economic and financial

measures fail to assess accurately the payoff of IT projects and suggest that one means of determining value is through the perception of executives. Intangible benefits of IT investment include internal improvement, customer service, foresight and adaptability (Hares and Royle 1994). Murphy and Simon (2002) argue that intangible benefits are more difficult to measure as the time horizon over which they are being evaluated becomes longer. They also added that externally-oriented factors such as customer perceptions or market forces are more difficult to assess than internal factors.

Based on work done by Harris (1996), Irani and Love (2000) propose a framework that categorises benefits into operational, tactical and strategic. As one moves from operationally oriented projects through tactical to strategically oriented projects, the benefits move from those that are generally tangible and quantitative to intangible and non-quantitative ones.

Early Research on IT Business Value

There has been a long-running debate over whether IT contributes to productivity. Research has attempted to untangle the relationship between IT, productivity and a firm's performance for more than 2 decades. Early studies found no relationship between IT investment and productivity at the level of the firm, industry or the economy as a whole (e.g. Loveman 1994; Strassman 1990). This has been referred to as the Productivity Paradox.

The paradox in the relationship between IT and productivity has been explained by pointing out that heavy IT investments have occurred parallel with the US productivity slowdown that began in 1973. Brynjolfsson (1993) identified four possible explanations:

- Mismeasurement: The benefits of IT investments are quite large, but a proper index of its true impact has yet to be analysed.
- Time lags: The benefits take a long time to be realised.
- Redistribution: There are private benefits, but they come at the expense of others, so no net benefits can be realised at the aggregate level.
- Mismanagement: There are no benefits because of poor investment decisions, misallocation or misuse.

This has not deterred researchers from demonstrating IT contributions by undertaking research which used larger datasets, more refined research methods and precise measurements (e.g. Bharadwaj et al. 1999a; Dewan and Min 1997; Brynjolfsson and Hitt 1996). These studies revealed a convincing positive relationship between IT investments, economic productivity and business value.

Current Theoretical Paradigms

Having resolved the productivity paradox, the complex problem of linking IT to organisational performance has been informed by insights from multiple theoretical paradigms: economics, management and sociology. Several theoretical lenses and models have been used to assess IT contributions to organisational performance.

Economics-Based IT Business Value Research

Econometric techniques are used to study how financial measures of organisational performance depend on measures of IT investments (for a review see Kohli and Devaraj 2003). There are mixed results on the financial benefits due to IT investments. Hitt and Brynjolfsson (1996) found evidence that IT may be increasing productivity and consumer surplus, but not necessarily leading to firm profitability. Basing their econometric models on IT usage, Devaraj and Kohli (2003) present evidence of improved financial performance as a result of IT investments.

Practically, managers responsible for forecasting returns from projects have experienced a growing awareness of the relevance of success metrics that elude financial qualification (Murphy and Simon 2002). Forrester Research suggests that financial measures such as ROI (Internal Rate of Return) are not enough because using financial measures has serious flaws: too many to choose from; imply a precision that does not exist; fail to account for intangible benefits; do not account for future opportunities, and fail to incorporate risk (Symons 2006). Kumar (2004) argues that it is essential to consider IT usage in measuring the business value from IT since value does not only depend on investments but also on IT usage.

According to Fichman et al. (2005), real options are similar to financial trading and Kulatilaka (1999) but have increasingly been applied to more intangible investments, such as those related to IT (Benaroch and Kauffman 1999). This stream of research highlights the limitations of the traditional financial evaluation methods. Real options theory has been used to account for inherent risks and uncertainties (Melville et al. 2004). It has been applied to the evaluation of several IT investments including automated teller machine networks (Benaroch and Kauffman 1999), decision support systems (Kumar 1999), and enterprise resource planning software (Taudes et al. 2000). IT infrastructure in banks (Panayi and Trigeorgis 1998), software upgrades (Taudes 1998) and object-oriented middleware (Dai et al. 1999).

According to Kumar (2004), although the real options research stream presents a promising conceptual framework for IT projects evaluation, its limitations include assumptions regarding uncertainty modelling, traceability and risk neutrality; estimating the expiry time of an option (Benaroch and Kauffman 2000; Benaroch and Kauffman 1999); the absence of contracts to enforce the exercise of options (Taudes et al. 2000); and difficulties in modelling multiple types of uncertainty in options (Trigeorgis 1996).

Management-Based IT Business Value Research

To justify new IT investments, managers are required to make decisions about what and where to invest today taking into account future strategic choices. These investments are often shared across several business units, multiple business initiatives and many applications. This sharing requires negotiation about how much is needed, who pays for it, where it should be placed and who owns it. IT infrastructure decisions are complicated and confuse managers with

questions such as: are we spending too much or too little on IT? Are we spending on the right areas? Are we getting the best value from our IT investment? These are business decisions and business managers typically lack frameworks to assist in their choices (Weill et al. 2002).

This paradigm focuses on the organisational value of IT infrastructure flexibility, which includes both technical as well as human IT infrastructure flexibility (Byrd and Turner 2000; Broadbent and Weill 1997; Duncan 1995; Henderson and Venkatraman 1994). IT infrastructure flexibility is multidimensional and includes: the ability to easily upgrade the infrastructure to network different parts; integrate disparate data sources through the use of middleware; resist systems failure due to redundant components; and easily add new applications (Byrd and Turner 2000; Fan et al. 2000; Kapinski 1999; Wagner 1998). IT infrastructure flexibility is a complex and multidimensional concept that represents the ability of the technical and managerial parts of the infrastructure to effectively respond to multiple types of uncertainties including user requirement changes, technology changes and system usage changes (Kumar 2004).

Some suggest that many of the derived benefits from IT are not accounted for because of the models used to assess IT contributions (e.g. Cline and Guynes 2001; Thatcher and Oliver 2001). Waterhouse (2008) argues that communicating the business value of IT has never been more critical. He stresses that adopting a strategic approach to measuring IT performance supported by advanced IT management models enables IT to better demonstrate how it is contributing to business growth and success. By adopting this approach, firms can benefit from the following:

- Stopping the endless cycle of IT cost reductions that can ultimately damage the business;
- Providing IT and the business with a common language and framework upon which to identify and derive strategic improvements; and
- Increase business agility and IT responsiveness to changing conditions (Waterhouse 2008)

Value Creation Models

These models focus mainly on depicting the process of how organisations can realise business value from IT. They have been developed by academics to explain the phases organisations have to go through to improve their organisational performance from deploying IT.

‘How IT Creates Business Value’ Model

Based on a synthesis of previous literature (Beath et al. 1994; Sambamurthy and Zmud 1994; Grabowski and Lee 1993; Lucas 1993; Markus and Soh 1993), Soh and Markus's (1995) theoretical model explains the steps of involved in creating value from IT. The model identifies three processes: the first is the conversion of purchased IT assets into assets that can be used by the firm; the second is the appropriate use of these assets by the firm, and the third is the transformation of effective use into meaningful organisational performance. This framework is one

of the earliest syntheses of literature. Although it is a useful starting point to conceptualise the process of value creation, it is very much a simplistic view that focuses mainly on IT usage. Also, this model has not been popular among business managers.

IT Value Creation Process

Expanding on prior models of IT value (Lucas 1999; Soh and Markus 1995; Markus and Soh 1993), and rather than starting with the cost of an investment in IT, the conceptualisation of Davern and Kauffman's framework begins with the potential value of an IT investment. Conversion contingencies act as intervening and moderating factors in the process by which potential value is transformed, or fails to be transformed, into realised value (Davern and Kauffman 2000). Like Soh and Markus's framework, this model explains the phases of transforming potential into realised benefits. It also fails to be popular among business managers.

IT Business Value Model

Melville et al. (2004) developed a model of IT business value that integrates the various strands of research into a single framework. Their principal finding is that 'IT is valuable, but the extent and dimensions are dependent upon internal and external factors, including complementary organisational resources of the firm and its trading partners, as well as the competitive and macro environment' (p. 283).

The derived integrative model comprises three domains: focal firm, competitive environment and macro environment. Melville et al. (2004) argue that the locus of IT business generation is the organisation that invests in and deploys IT resources, which is referred to as the focal firm. Also, external factors are claimed to play a role in shaping the extent to which IT business value can be generated and captured. This model integrates previous models and shows both the process of value creation and the forces that affect organisational performance. Although this is a conceptual model that highlights the 'big picture of what entails the creation of IT business value, this model has not gained widespread use.

Performance Measurement Models

Unlike the value creation models, performance measurement models are practitioner-oriented models. Firms are more familiar with these models because they are used to measure the entire organisational performance. The balanced scorecard for IT and Six Sigma will be considered for this section.

Balanced Scorecard for IT

Kaplan and Norton (1992) developed a model that suggests organisations should not only be evaluated against one set of criteria but rather should be evaluated against a set of goals and measures. The original four perspectives in a balanced scorecard are financial, customer, internal business and innovation and learning. Although initially developed at an enterprise level, the balanced scorecard can be

applied to IT as an instrument to measure IT performance (Bon and Verheijen 2006). Although it is relatively easy to tailor a balanced scorecard framework to the specific needs of IT, there are no generic IT measures that fit all organisations and the IT perspective might be too narrow (Willcocks and Lester 1994).

Six Sigma

Unlike other frameworks, Six Sigma is not owned and maintained by any specific community (Harris et al. 2008). It was originally developed by Motorola in the 1980s. Its roots are in Total Quality Management. The process model is abbreviated as DMAIC, which stands for the phases of a Six Sigma project: define; measure; analyse; improve, and control. If a firm already uses Six Sigma, it can be a tool that provides a common language between IT and the business. Although Six Sigma has proven to be a powerful approach to improving performance by eliminating defects, its 'rigid' nature makes it vulnerable when it comes to organisational innovation.

IT Investment Models

Benefits Dependency Network

This is one of the few models developed by academics at Cranfield School of Management for practitioners' use. This framework explicitly links the overall investment objectives and the required benefits with business changes necessary to deliver those benefits and the essential IT capabilities that enable these changes (Peppard et al 2007). This model can be used to engage with senior managers because it communicates the business benefits. Although this model specifies both tangible and intangible benefits, it does not quantify them.

Business Value Index (BVI)

Developed by Intel – one of the most technology-intensive organisations in the world where IT plays a critical role in its success (Symons 2006). BVI helped Intel to prioritise investment options, make data-driven decisions and monitor progress (Baldwin and Curley 2007). The BVI was mainly developed by practitioners and has been used since 2002. According to Symons (2006), the BVI method goes beyond the financial measures to account for both tangible and intangible benefits. He argues that Intel used the BVI internally as part of its portfolio management process, to document the business value of IT in its annual performance report.

Total Economic Impact (TEI)

Developed by an independent technology and market research company Forrester Research for valuing IT investments. This model includes four elements:

- Cost – Impact on IT: the changes to IT spending which can be positive, when money is saved, or negative, when money is spent
- Benefit – Impact on IT: capturing the quantified data relating to changes in the non-IT departments (e.g. the impact of training on the long-term productivity gain)

- Flexibility – Future options: the value of the options to take a second or third action in the future
- Risk: risk analysis translates the initial estimates for cost and benefits into a range of potential benefits

While containing several aspects that BVI touches upon such as valuing intangibles and calculating financial returns, TEI adds a method for quantifying risk and valuing flexibility (Symons 2006).

IT Governance Models

Most firms under-manage their core software assets (Dutta 2007). According to Weill and Ross (2004), IT governance is the most important factor in generating business value from IT. They define IT governance as 'specifying the decision rights and accountability framework to encourage desirable behaviour in the use of IT'. They argue that effective IT governance must address the following three questions: What decisions must be made to ensure effective management and use of IT? Who should make these decisions? How will these decisions be made and monitored?

Weill and Ross (2004) claim that IT governance is essential because good IT governance pays off; IT is expensive; IT is pervasive; new information technologies bombard enterprises with new business opportunities, firms need to learn about IT value, and IT value depends on more than good technology, senior management has limited bandwidth, and leading enterprises govern IT differently.

CobiT and Val IT will be considered in this section

CobiT

The Control Objectives for Information and Related Technology (or CobiT) has been developed by the Information Systems Audit and Control Association (ISACA), and the IT Governance Institute (ITGI) in 1996. CobiT is an IT governance framework that allows managers to bridge the gap between control requirements, technical issues and business risks (ISACA 2008). It provides managers with a set of best practices to help them maximise IT benefits through the development of IT governance and control. CobiT 4.1 consists of 34 high-level processes that cover 210 control objectives categorized in four domains: Planning and Organisation, Acquisition and Implementation, Delivery and Support, and Monitoring and Evaluation. One of the major criticisms of CobiT is that it describes what needs to be done but it fails to assist managers to meet these needs.

Val IT

Val IT framework is closely aligned with CobiT components (ITGI 2008). While CobiT sets good practices for the means of contributing to the process of value creation, Val IT sets good practices for the ends, by providing enterprises with the structure they require to measure, monitor and optimise the realisation of business value from their IT investment. Val IT consists of three major domains:

Value Governance, Portfolio Management and Investment Management. While CobiT focuses on the execution – *‘are we doing them the right way, and are we getting them done well?’* – Val IT focuses on the investment decision – *‘are we doing the right things?’* – and the realisation of benefits – *‘are we getting the benefits?’* (ISACA 2008).

Sociology-Based IT Business Value Research

Compared to the other two paradigms, sociology-based business value research seems to have had less attention. The sociological theory of embeddedness (Uzzi 1997) advocates that the structure and quality of social ties between firms shape their economic activities. Economic action here includes joint action undertaken by two or more firms collaboratively, such as joint ventures and strategic alliances, as well as economic behaviour unilaterally decided by the focal firm or by a trading partner. Uzzi identifies three characteristics of embedded inter-firm relationships: exchange of sensitive information, joint problem-solving arrangements and trust. Uzzi claims that a cooperative relationship shapes economic action differently and hence has differential strategic implications for performance. This theory can be used to inform our understanding of how firms realise more IT contributions through inter-organisational relationships, and it has been applied in the context of EDI (Chatfield and Yetton 2000).

The socio-political perspective has been used to study the relationship between IT investment and firm performance (Hoogeveen and Oppelland 2002). Instead of this perspective focusing on politics and conflict as the primary interaction model, it focuses on collaboration and cooperation as the key to understanding interaction processes. This perspective introduces the third rationality of information systems in which trust, social capital and collaborative relationships become the key concepts for interpretation (Kumar et al. 1998).

Conclusion and Future Research

Having reviewed the work done by both academics and practitioners in this area, it is clear that new approaches to managing IT investments are needed. Moreover, the questions of how firms transform or fail to transform the potential value of IT remain under-studied. Although a great deal of research has examined the business value of IT, several aspects remain relatively under-studied (Melville et al. 2004). Because the majority of firm-level analysis measures IT in the aggregate, we know little about the relative performance contributions of different types of IT investments and whether different IT assets affect different aspects of firm performance (Aral and Weill 2007). We need to explore the evolving role of IT and the changing nature of its contribution to organisational value creation unless we can identify how and where IT is contributing to value creation, we cannot measure it; unless we can measure it, we cannot demonstrate value, thus failing to dispel the prophecies of diminishing IT value (Kohli and Grover 2008, p. 28). Some of the research questions that can be explored further are:

- Do different types of IT resources drive performance differences?
- Are IT resources associated with improved operational efficiencies or competitive advantage?

- How do IT resources generate operational efficiencies and competitive advantage?
- How do firms allocate aggregate IT investments?
- What type of organisational factors and management practices contributes to a firm's ability to generate value through IT?

Abbreviations:

BVI Business value index

CobiT Control objectives for information and related technology

EDI Electronic data interchange

IRR Internal rate of return

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