The Role of Information Technology Infrastructure Capability (ITIC) in Management

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ABSTRACT

Information Technology Infrastructure Capability (ITIC) is said to play a significant role in management. As a significant contribution to a firm's long-term success, ITI has burst as a major antecedent of organizational performance. The development of the basic ITI in management is therefore easily forgotten. Most managers think that the ITI is a separate component of management, but ITI must be placed beside other parts such as finance, marketing, human resource and so on in order to advance the managing. Yet, there is little research that focuses on how availability and use of ITI enable or constrain management. To explore this, we conducted a study and described the availability of ITI and its use in management efforts. In this study the ITI literature in management will be reviewed and furnished, theoretically, followed by posing discussions on different aspect of ITI. A review on the role of Infrastructure commences in advance, and afterwards, the concepts and components of ITI literature will be provided and it continues with ITIC. The paper finds that the literature offers a comprehensive, yet fragmented, picture of ITIC in management and its improvement ways.

Key words: Information Technology, IT Infrastructure, IT Infrastructure Capability.

INTRODUCTION

The American Heritage College Dictionary defines infrastructure as (1) a fundamental basis, especially for an organization or system; (2) the basic facilities, services and installations for a community or society to function, such as transportation and communications systems. Thus, an infrastructure is the base upon which something else "runs" or "operates", without which operations are not possible (Xia & King, 2002). Infrastructure is a resource and capability which enables information sharing through the interaction between technology and people in the organization who share the different elements (Sirkemaa, 2002).

Information infrastructure also involves technological tools and various means used for managing and exchanging knowledge in today's huge flow of information, such as computers, software and telecommunication. Moreover, Popoola (2002) considered that information infrastructure contains human regulation, IT, government support and other institutions. Computers facilitate processing, input, storage and data retrieval; while the internet facilitates data transfer. This integrated communications system includes independent information and communication such as telephone lines, TV cables, and satellite (Enakrire & Onyenania, 2007). In order to achieve a range of goals, managers make IT investments to

positively influence performance by: providing a competitive advantage, responding to rapidly changing market needs, providing resourceful information for better decision making, reducing business costs by automating some transactions, allowing competition in specific technology market areas (e.g. ATMs for banks, EDI for parts suppliers), facilitating flexibility to fulfill more customers' needs without incurring extra cost, and providing technological platform for producing other business (Weill & No, 1992).

THE CONCEPTS AND DEVELOPMENTS OF IT INFRASTRUCTURE

ITI represents the IT resources that facilitate business applications. In the 1980s, IT was becoming known to help firms raise entry barriers, increase bargaining potential with suppliers and customers, and offer new products and services (Bhatt & Emdad, 2010). In the 1990s ITI was being defined as shared, tangible, technological resources including platform technologies (i.e., hardware and operating systems), networks and telecommunication technologies, data, and software applications (Xianfeng, Boxiong, & Zhenwei, 2008). Since then the objective is to find the ways IT can help generate business advantages. However, over the years, a number of scholars have noted that sustaining the advantages

of IT might be difficult, because such applications are eventually imitated and appropriated by competitors (Cash, McFarlan, McKenney, & Applegate, 1992; Mata, Portugal, & Guimaraes, 1995; Sambamurthy & Zmud, 1997). There are theoretical, methodological, and measurement matters producing inconsistent results, and the growing awareness is that IT cannot be a primary source of competitive advantage (Bhatt & Grover, 2005). Today, organizations are recognizing the importance of effective ITI (Downes, 2003) while the development and operation of flexible ITI is of administrative concern (Evans, 2002). ITI effectiveness can be assessed using criteria such as reliability, operation with low downtime; flexibility, efficiently adapting to changing business requirements; and upgradability, efficiently adapting to or deploying multiple, complex technologies as required

(Kumar, 2004). IT is a broad term referring to a combination of ITI, human resources, and IT-enabled abstracts (Bharadwaj, 2000) and therefore each aspect should be studied individually in order to understand their effects on a firm. ITI (a big part of a company's IT budget) encompasses the services shared and coordinated throughout a firm, usually by the IT division, and also goods such as hardware platforms, operating systems, network and telecommunications (e.g. e-mail, instant messaging, and groupware), software applications, databases, intranet, and the Internet (Durmusoglu, 2009; Ross, Beath, & Goodhue, 1996; Sethi, Pant, & Sethi, 2003; Weill & Broadbent, 1998). Some studies on ITI mentioned in this study are summarized in**Error! Reference source not found. Error! Reference source not found.**1.

Table1: Summary of IT Infrastructure Studies

ITI studies	Contributions
(McKay & Brockway, 1989)	This study offers an infrastructure service benefits assessment model to assess the investment in ITI from two dimensional benefits: potential economies and potential capabilities of scale.
(Brancheau, Janz, & Wetherbe, 1996; Niederman, Brancheau, & Wetherbe, 1991)	The construction of responsive ITI is an important IS management issue ranked 6th by IS executives in the 1989-90 three-round Delphi survey, and also identified as the IS management issue of most concern in the 1994-95 three-round Delphi survey.
(Weill, 1993)	This study developed an ITI role and value model to justify ITI investments based on research observations.
(Byrd & Turner, 2000; Duncan, 1995)	Duncan's studies define and develop a framework for ITI flexibility to determine ITI capabilities. Byrd and Turner propose measuring ITI flexibility by means of technical and human ITI instruments.
(Broadbent, Weill, & O'Brien, 1996)	ITI consists of human and shared ITI services. Study proves that the firm context (i.e. industry, marketplace, business synergies and strategy planning) dominates ITICs operationalized by ITI services, and Reach and Range.
(Broadbent, Weill, & Neo, 1999; Weill & Broadbent, 1998)	Weill and Broadbent discern four ITI investment perspectives resulting in the creation of different business values, and business transformation is positively affected by ITI. Broadbent et al. maintain that ITICs can facilitate business process redesign (BPR).
(Xia, 1998)	Developed a model to explore ITIC antecedents (external and internal environment variables) and consequences (IS duty, business processes, and organizational performance). Xia proposed IT organizational/technical ITI to capture ITICs using a 55-item scale for assessment.
Kim (2001)	Six key ITIC concepts as identified by Kim (2001) are: integration, Collaboration, data management, Security, The necessity of basic services like (planning and training) and the other category services are those IT infrastructure capabilities difficult to classify more specifically. This category includes concepts related to integration, collaboration, data management, security, utility and others.
(Lewis & Byrd, 2003)	This study presents a tool for measuring ITI from a 7-dimension perspective.
(Mithas et al., 2004)	Mithas et al. argued that three capabilities bridge ITI and business performance: customer, process, and performance management. This study is among the first to identify the fundamental mechanisms of how ITCs generate value.
(Dai, Kauffman, & March, 2007)	The research found that: 1) ITI investment flexibility is more valuable when uncertainty is higher; (2) cost advantage of ITI investment is made greater by demand uncertainty for IT products and services; (3) in duopoly competition, ITI flexibility value goes up with product or service substitutability level; and (4) with higher demand unpredictability, inter-firm competition has a lower impact on ITI value.
(Fink & Neumann, 2009)	They examined ITI from a multidimensional perspective and the effect of IT flexibility on business value. They defined the flexibility-enabling aspects of ITI, identified major technical and human fields that influence process, established process dimensions as building strategy and competitive edge sources, and identified the effects.
(Durmusoglu, 2009)	Investigated how higher management view on ITI determines the company's ITI potentials and ITI effects new product development (NPD) process results like cost, cycle time, and quality.
(Bhatt & Emdad, 2010)	Presented a model that measures the relationship between ITI, customer focus, and business advantages, with the result that ITI has major effect on customer responsiveness, but no significant connection with product/service innovation. ITI, customer responsiveness, and product/service innovation are considerably related business advantages.

COMPONENTS OF IT INFRASTRUCTURE

According to Dai et al. (2007) ITI can be classified into IT physical, intellectual, and IT-related procedural assets (Bharadwaj, 2000; Kayworth, Chatterjee, & Sambamurthy). IT physical assets are fundamental technical fundamentals shared across organizational units, such as organization-wide technical platforms, architectures, networks and databases. IT intellectual assets are IT-related knowledge, expertise and management of technology within a firm. IT related procedural assets are regulations that specify how other IT assets are evaluated, acquired, built, implemented, used, improved and replaced. IT standards are an example of procedural assets since they make rules for system design and development. McKay and Brockway (1989) were pioneers of defining ITI constituents in a three-layer model which was later modified by Weill (1993) (Figure).

ITI is illustrated as the base supporting specific IT applications which make business processes possible. The infrastructure foundation encompasses the shared technological elements, or building blocks, like hardware, software, communications, and other support necessary for business (Earl, 1989; Xia & King, 2004). Above the foundation of ITI are the human and organizational elements necessary for effectively rounding up IT components into strong, useful IT services, or the 'mortar' as McKay and Brockway (1989) put it. Duncan (1995) sees these middle elements as infrastructure planning and management factors, representing the functionality of everything necessary to operate a business. The elements here make "direct purpose" uses of technology achievable, and allow the successful realization of the IT architecture. IT human resources are IT professionals who have technical, managerial and organizational skills to innovate and support significant business activities. IT planning and management are responsible for architectures, plans, guidelines, policies and rules necessary for IT technological component development throughout the organization (Xia and King, 2004). The IT elements combine into shared IT services that link and sustain IT applications to business processes and IT components to achieve IT functionality and value. Broadbent et al. (1996) define shared IT services as the ITI range.
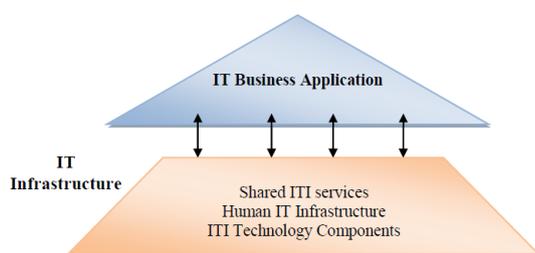

Figure1: Key Elements of ITI. (Adapted from McKay and Brockway (1989)

IT INFRASTRUCTURE CAPABILITIES

Duncan (1995) and Broadbent et al. (1996) provide useful references, but so far no validated ITI characteristic measuring instruments exist. Five components for measuring

ITI characteristics were defined and put into practice: reach ITI reach, shared ITI service range, IS standards and procedures, ITI flexibility, and IS management competence. A study by Patrakosol and Lee (2009) looked into ITICs by sectioning into Technical and Human ITI capabilities. Also, Xianfeng et al. (2008) grouped them into sharing capability, service capability, and flexibility, as follows:

ITI sharing capability refers to how ITI can efficiently provide homogenous services to customers from within and outside the company. If data/applications are not shared, it is a business decision consequence rather than technological capability (Duncan, 1995). Sharing capability can be described as "reach and range" with Reach meaning individuals and places that ITI can connect (Keen, 1991). The way Reach works to connect is that in some firms, employees only communicate within one unit, whereas in others interaction extends to customers and suppliers, no matter where the IT base is situated. Range determines the level of functionality that extends throughout any Reach level, and can tell what services can be offered (Durmusoglu, 2009). Higher reach and range show higher sharing capability, which also means more complex transactions across more business units a firm can handle. This portrays the potential to connect "anything to anyone at anytime" (Xianfeng et al., 2008). IS Standards and Procedures are important for managing ITI. Duncan (1995) suggests that ITI configuration and compatibility standards and rules are central in managing the firm's sharing extent range-wise. IS standards and procedures also provide a foundation for ITI analysis, design and development (Keen, 1991), in other words, the architecture controlling a firm's IT operations. Therefore, IS standards and procedures together with IT services represent the level at which IS function meets a firm's need for IT-related services (Rasli, Huam, Mohd, Maseri, & Asmi, 2011; Xia & King, 2002). Seven elements were employed to measure IS Management Competence regarding IS employees' technical and managerial skills, and IS flexibility in response to fluctuating user needs.

ITI Service Capability is the capacity to meet a firm's business demands, while focusing on current functions' effectiveness, and can be identified from the different kinds of IT services. Weill and Vitale (2002) mention nine types of business related IT services: application infrastructure, communication, channel, data and IT management, security, architecture and standards, IT research, development and education. A business has the choice to provide the desirable services, not necessarily all, according to its unique setup.

Technical ITIC is an organizational ITIC facet defined as functions that the technical ITI provides, or the choices related to IT components like applications, data, and system and technology configurations. Technical ITICs are acquired from the ITI analysis grid and can function in two dimensions: functional efficiency and flexibility of technical ITI elements (Xia, 1998).

Human ITIC means the functions made available by human ITI, including choices on IT staff requisite knowledge and management skills needed for effective IT resource handling within an organization. Byrd and Turner (2000) underline that elements of human infrastructure are experience, capability, commitment, values and norms of IT staff who provide IT products and services. Human ITIC can also

operate at two levels: Functional efficiency and flexibility of human ITI components (Xia, 1998).

The flexibility of ITI refers to ITI's ability to help a firm adjust in its changing environment. Flexibility is the firm's ability to utilize ITI for dealing with fluctuations in business and technology. ITI flexibility can be separated into technical and managerial flexibility. Technical flexibility focuses on software and hardware platform components, while managerial flexibility pertains to human and society elements, such as cooperation, relationships among employees and the organization's norms. These two flexibilities react to each other to fulfill demands, since ITI is an intricate human-machine system. Between the two, managerial flexibility is more crucial than the technical aspects, because management can deal with issues due to frequent and elaborate changes (Xianfeng et al., 2008).

A flexible firm has the ability to efficiently adapt its IT to the many changes in strategy direction. This agility and versatility are necessity to survive in the present competitive environment. Therefore, a firm should invest in both IT technical and human capabilities, to use IT to its full potential to attain business goals (Xianfeng et al., 2008)

CONCLUSION

There is a plethora of literature that claims about the role of ITI in management; however, large part of the researches is either conceptual or dependent upon case studies. Our present study empirically upholds the notion that ITI can be useful in enhancing the management performance, simultaneously; however, ITI is improbably to play a critical role in the development of new products and services and innovation. In this regard, using new ITI and other forms of rich communication are probably to be beneficial. Our study confirms that ITI leads to better performance of company to fulfill customer's needs. It means that the ability of company to respond to customer concerns is impacted by the ITI. By creating relevant, timely and flexible ITI, companies are more likely to sense customer's interests so that they can respond in timely manner. Finally, our study argues that for achievement business advantages, a company should be capable of manages ITI. Summarize the ideas; we hope that the importance of an ITI would be better understood.

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