Research Paper

Review To Information Technology And Quality Management

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Abstract

The introduction of information technology (IT) has become a necessity to compete in most industries, so simple implementation of an IT strategy is not enough to achieve a better firm performance. Literature review shows IT as a useful tool only when it is combined with other firm resources and practices. The ability to obtain information on markets and customers can improve firms' predisposition to adapt to changes in the environment and thus to improve their competitive position with respect to competitors who are poorly informed and therefore slower to adapt.

Keywords: Information Technology, Quality Management, Structural equation modeling.

1. Introduction

Many firms have thus begun to develop strategies that understand information technology (IT) as a resource that facilitates the acquisition and use of information. In spite of the growing academic and practical interest in understanding how IT can sustain competitive advantage, there is no clear understanding of the processes by which IT impacts firm strategy or performance improves[1].Research has conceptualized IT as a useful tool only when it is combined with other resources or practices in the firm. In other words, the utility of IT is tied to its complementarily with other organizational resources or practices, developing IT-related resources. For example, the literature review shows that IT facilitates other business processes, such as new product development, customer service quality and entrepreneurial culture[2].

Despite these advances, however, the processes by which IT resources interact with other human and organizational resources, as well as the nature of these resources, have hardly been studied. Previous research also shows that studies that are undertaken to study IT do not consider the role of IT capabilities, key variables for the proper implementation of IT assets[3].

It is therefore necessary to develop and study the impact of IT competence or Information Systems strategy on the different organizational resources. When analyzing the complementarily of IT competence with other organizational resources and practices, it is necessary to define a well-structured set of the competences present in the business area. In that sense, quality management (QM) offers one of the sets of organizational practices related to Operations Management that is most frequently and well-established in firms. The literature review shows that QM plays an important role in improving the firm's competitive position and that the proper application of IT can influence this relationship[4].

Thus, the development of an IT competence will improve the efficacy of QM practices, enabling firms to achieve a better competitive position. Various studies have examined the relation between IT and QM. describe a theoretical framework that analyzes the impact of a set of IT tools present in the firm on success in the implementation of QM practices. The main

limitation of this study is that it defines IT as a mere possession of these tools. The results of one of the main empirical studies to analyze the relationship between IT and QM, by Forza (1995), show that there is no significant statistical evidence between these variables. This study also provides merely a technical conception of IT. The study by Mc Adam and Henderson (2004) concludes that the empirical study of the relationship between QM and its antecedents (including IT) should be considered in future research[5].

Among the more recent studies, we would distinguish those of Sanchez- Rodriguez and Martinez-Lorente (2011), whose results show a positive and significant relationship between IT and QM. Here too, however, the definition of IT limits the degree of implementation of software, hardware, and communications infrastructure in the firm. Finally, the study by Perez-Arostegui et al. (2012) tackles the definition of IT as a competence composed of IT infrastructure, IT technical and managerial knowledge, and the integration of IT with the firm strategy. This study concludes that IT competence has a positive and significant impact on quality performance but does not analyze its impact on QM practices[6].

One of the main contributions of this paper is to develop an empirical study of the complementarily of IT competence with other organizational resources. The integrated study model provides a basis for calculating the level of influence of IT strategy on QM practices. Further, our study provides empirical evidence for the development of a second-order factor to evaluate the different dimensions of IT competence, providing new perspectives for researchers who wish to examine the multidimensionality of this variable. The study also provides a guide for managerial practice by improving existing knowledge of the efficacy of a QM system. The positive impact of IT competence on different QM practices guarantees greater efficacy of the QM program. We also express the need for managers not to limit themselves to mere investment in an IT infrastructure, but to develop a set of IT-related capabilities that facilitate the development of other organizational practices[7].

To achieve these goals, the following section presents a theoretical review of the study variables, as well as justification of the different hypotheses that give our goal concrete form. Methodology section explains the research methodology, the origin of the scales chosen, their psychometric properties, and the characteristics of the study performed. After analysis and discussion of the theoretical model proposed in analysis and discussion section, the last section synthesizes the main conclusions, as well as the limitations and implications (academic and practical) of the study.

2. Information technology competence

The literature on IT capability or competence analyzes the existence of various resources related to IT, whose combination composes an IT competence or capability that is valuable, non-imitable, and non-substitutable.

From this perspective, Bharadwaj (2000, p. 171) defines IT capability as the ability to mobilize and use IT-based resources through the combination or coexistence of other resources and capabilities in the firm. For Tippins and Sohi (2003, p. 748), IT competence represents the degree to which a firm possesses IT knowledge and employs it effectively to manage the information generated in the firm. In other words, the different dimensions of the construct" IT competence", composed of IT knowledge management, IT infrastructure (IT objects), and IT operations, represent co-specialized resources that reflect the organization's ability to understand and use IT tools and processes necessary to manage the information derived from customers and from the market. Along these lines, Bharadwaj et al. (2002, p 4) redefine IT capability as the firm's ability to acquire, develop, and direct its IT resources to determine and support its business strategies and value chain activities.

	Technology, property)	knowledge	knowledge	
Ross et al. (1996)	Technology assets	IT human resources (IT staff)		The relationship between IT and firm strategy
Powell and Dent-Micallef (1997)	Technology assets	IT human resources (IT staff)		Organizational resources related to IT
Feeny and Willcocks (1998)	IT infrastructure design			IT vision, IT services delivery
Bharadwaj (2000)	IT infrastructure	IT human resources (IT staff)		IT-related Intagible assets
Dehning and Richardson (2002)	IT spending			IT strategy IT management
Tippins and Sohi (2003)	IT objects (hardware, software and IT staff)		IT knowledge management	IT operations (use of IT to manage information)
Melville et al. (2004)	IT infrastructure and IT applications	IT technical knowledge	IT knowledge management	IT synergies
Ray et al. (2005)	Flexible IT infrastructure	IT technical knowledge		knowledge shared
Crawford et al. (2011)	IT infrastructure	IT technical knowledge		IT strategy and firm strategy
Chen et al. (2010)				IT use, IT planning, IT shared vision
Perez-Arostegui et al. (2012)	Flexible IT infrastructure	IT technical knowledge	IT managerial knowledge	IT integration with firm strategy

Figure 1: IT competence dimensions

The study by Chen et al. (2010) develops a new way of evaluating IT competence, coining the concept of "Information Systems Strategy." This study only focuses on how to manage such a strategy, however. The authors define a construct that considers the strategic management of IT through the following: IT use to sustain firm strategy, planning of the IT function, and shared vision of the Information System within the organization. Their definition does not consider either IT infrastructure or IT technical and managerial knowledge.

Figure 1 identifies various dimensions that define IT competence based on a prior literature review. We can identify four different dimensions proposed, related to the following: IT infrastructure present in the firm; technical knowledge that the firm's human resources have of IT (IT technical knowledge); IT knowledge at the managerial level (IT managerial knowledge); and, finally, the degree to which IT is integrated into firm strategy (IT integration with firm strategy). We analyze these four dimensions, which are representative of IT capabilities or competences, taking the business unit as the unit of analysis. There are stances in the literature, however, that argue that the unit of analysis should be the process in itself as the level most appropriate for observing the strategic effects of IT[8].

IT infrastructure includes the different software, hard-ware, shared technological services, etc., for managing information, as well as the specific business applications that this infrastructure uses. A flexible IT infrastructure facilitates the implementation and development of IT applications, improving the firm's capability to respond to new and emerging opportunities and neutralizing possible threats[9].

IT technical knowledge refers to the know-how needed to implement IT applications using the technology available Mata et al. (1995) specify these as knowledge of programming languages, experience in operating systems, and understanding of communication protocols. Tippins and Sohi (2003) conceptualize this measure as the degree to which a firm possesses a body of technical knowledge of IT applications such as computing-based systems. Ravichandran and Lertwongsatien (2005) analyze both technical skill and the specificity of IT human assets. In contrast, Melville et al. (2004) find that IT managerial knowledge should include the skill to identify and plan IT projects properly, to allocate scarce resources, to direct and motivate the development of teams to implement different projects, and to foster collaboration with other business units. Mata et al. (1995) conceive these skills as the management's skill to conceive, develop, and exploit IT applications that facilitate the implementation of other organizational functions. These authors thus propose that managerial knowledge consists not only of anticipating future IT needs for the organization but also of considering aspects related to the ability to integrate the information system into the firm's vision and strategy and implement it as a facilitator of the labor of agents both inside and outside the firm. Finally, IT is used not only to acquire, store, and analyze the information generated in the firm which is provided by mere IT implementation, but also to direct the development of firm strategy. In addition to proper use of IT from a strategic point of view, it is crucial

that there be a relationship between those in charge of IT, IT users, and the top management who facilitate communication between the different are as and involve users' greater understanding of the potential of IT[10].

Thus, all business units bear responsibility for the proper implementation of an information system in the organization.

3. Information technology and quality management

QM is defined as a philosophy of management that seeks excellence through continuous improvement and customer focus. This philosophy takes concrete form in a set of principles whose fulfillment is grounded in a set of practices and techniques[11].

determine that, at the empirical level, the study of QM should be based on analyzing a set of practices, since principles of quality are too general for empirical research and techniques too detailed to obtain reliable results. QM practices have been widely researched, and the resulting information is synthesized in literature reviews by Nair (2006) and Sousa and Voss (2002), among others. Both studies show the existence of seven practices to implement and evaluate QM: leadership, strategic planning, customer focus, human resources management, information and analysis, process management, and supplier management. These seven practices compose the framework of the study of QM in the papers with high research impact[12].

The first studies relating IT and QM date back to the 1990s and focus on IT as a facilitator in the implementation of a QM program. This initial research conceives IT only in its technical aspect, that is, how the tools that compose IT facilitate data collection in real time and permit the control of internal processes and other measurement systems needed to support the implementation of a total quality management system (TQM) (Aiken et al., 1996; Counsell, 1997; Miller, 1997; Murray, 1991); or, more generally, how IT influences QM through the strategic areas of human and technological resources[13].

The study by Ayers (1993) is one of the first to relate these two disciplines to each other. This study obtains empirical evidence to establish that QM has a positive impact on IT, since it is a management philosophy that goes beyond mere investment in a specific technology infrastructure. The paper specifies however, that it is very important to define IT correctly so that it pursues QM principles of customer focus and continuous improvement. Although theoretical evidence exists for the critical role that IT plays in the success of QM implementation (Collins,1994; Matta et al.,

1998; Perez-Arostegui et al. (2012); Zadrozny and Ferrazzi, 1992), there are hardly any empirical or quantitative studies that support these propositions[14].

Among the few existing studies, we emphasize several contributions. In the manufacturing sector, Forza (1995) analyzes the impact of information and IT on issues related to quality assurance: continuous improvement, simplicity of process design, process control, and measurement of performance with respect to customers and suppliers. Burges and Gules (1998) alsoanalyze empirically the impact of using generic IT on quality assurance. Ngai and Cheng (1998) analyze the impact of IT on QM in a broad set of organizations and conclude that this impact is low, even when IT is used intensively.

4. The relationship between IT competence and strategic planning

According to Barney (1991), a planning system can produce competitive advantages when it permits the firm to recognize and exploit its other resources, and some of these resources are the source of competitive advantage. In the literature on QM, Black and Porter (1996) believe that the development of plans and strategies that take into account questions of quality as well as analysis of the results of performance is key to achieving continuous improvement. In addition, strategic planning is what permits the coordination of quality efforts in an organization. Dumond (1995) finds that quality planning includes, among other issues, the preparation of documentation to develop a quality strategy. These plans must be specific, focused, integrated, and aligned with other business plans[15].

The existence of IT competence will thus facilitate the identification of questions of quality, gathering and processing of the documentation necessary to carry out quality, the possibility of processing information related to other business units, analysis or measurement of performance, and communication of the objectives and functions of QM to the entire organization.

5. Conclusions

For managers, they must be aware that the impact of IT on competitive performance need not to be direct; it can exert its influence through the complementarily of other organizational practices such as QM practices. Likewise, IT benefits depend on conceiving IT as the firm's ability to acquire, develop and direct its IT resources to support its business strategy. Our study also provides a detailed description of IT related capabilities key to ensuring the IT implementation success, as well as a analysis of the main QM practices common to the most import ants QM programs (ISO, EFQM,

Malcolm Baldrige, etc.). Thus, managers are able to take advantage of the synergies derived for implementing both QM and IT programs.

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