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**A NEW CLASSIFICATION OF IT RESOURCES: A RESEARCH
AGENDA UNDER THE COMPLEMENTARITY OF THE RBV**

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A New Classification of IT Resources: A Research Agenda under the Complementarity of the RBV

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Abstract

The effects of Information Technology (IT) on firm performance constitute one of the most recent lines of research. In developing this study, we take a Resource-Based View (RBV) as our basic theoretical focus. Adopting this paradigm means that IT alone is incapable of sustaining a competitive advantage (CA), making it necessary to analyze the existence of resources that complement IT to achieve greater organizational performance. The goal of this paper is to determine the combination of key resources, both exclusively IT resources and other organizational resources not necessarily belonging to this technology, to set a useful research agenda to contribute to the improvement of current knowledge of the IT effects on organizational performance.

Keywords: Information Technology, organizational performance, RBV.

1. Introduction

The effects of IT on entrepreneurial results constitute one of the most recent lines of research. A wide variety of studies have been developed to determine whether the firm's efforts in the area of IT can sustain a long-term CA (e.g. Mata et al., 1995; Brynjolfsson and Hitt, 1996; Ross et al., 1996; Powell and Dent-Micallef, 1997; Bharadwaj, 2000; Dehning and Stratopoulos, 2003; Santhanam and Hartono, 2003; Ray et al., 2005). Many of these studies conclude that the results obtained from the firm's IT implementation establish, at least in part, the foundations that will support the improvement of its competitive position.

The contribution of IT to organizational performance has been studied from various perspectives. Among them, a strategic orientation based on the competitive strategic model developed by Porter (1980 and 1985). This model underlines the importance of market power and structure of the industry as primary causes of strategy and performance (Henderson and Mitchell, 1997). In the IT field, we would emphasize studies by Porter and Millar (1985), Ives and Learmonth (1984), Levy et al. (1999) and Tallon et al. (2000).

A second paradigm used in IT research is the RBV (e.g. Penrose, 1959; Wernerfelt, 1984; Prahalad and Hamel, 1990; Grant, 1991; Barney, 1991; Peteraf, 1993). This approach emphasizes the importance of specific and valuable firm resources that should be used to formulate and implement competitive strategies. It attributes the differences in the entrepreneurial results to factors internal to the firm.

The RBV provides a robust framework to analyze whether IT can be associated with a better competitive position (Mata et al., 1995) and to calculate empirically the complementarities that

can exist between IT and other organizational resources (Powell and Dent-Micallef, 1997). A large number of studies that seek to analyze the impact of IT on organizational performance support their propositions using this theory (e.g. Bharadwaj, 2000; Santhanam and Hartono, 2003).

The purpose of this study is to determine a combination of key resources, both those specific to IT and other organizational resources not necessarily belonging to this technology, in order to develop a useful guide that facilitates future research and contributes to improving existing knowledge of the IT effects on organizational performance. The second section of the paper reviews the literature between IT and firm performance, focusing on whether IT is a valuable resource capable of supporting a CA. It also emphasizes the importance of studying the complementarity of resources in analyzing the relation between IT and firm results. After describing the methodology used in the literature review, we develop a classification to synthesize the assets and capabilities most used in IT research, as well as the resources complementary to IT that improve competitive results. Finally, we present a series of conclusions and the limitations and research implications.

2. IT from a RBV

The first studies analyzing the impact of IT on firm strategy presented some positive results focused on studies of cases in which IT had obtained spectacular success (reserve system SABRE, American Airlines; Buday, 1986). Based on the presence of this strong relationship between the two variables, firms should integrate IT in their organizational strategy.

In the 80s, different studies emerged that showed the lack of productivity derived from significant investments made in IT, what has come to be known as the *Paradox of Productivity*

(e.g. Brynjolfsson, 1993; Brynjolfsson and Hitt, 1996): The growth of productivity had stagnated or even decelerated just when the growth of IT was increasing and firms' investments in it reached increasingly significant quantities.

In addition, to the recent empirical studies that cast doubt on the strategic importance of limiting the adoption of new IT, the rise of the RBV (e.g. Penrose, 1959; Wernerfelt, 1984; Prahalad and Hamel, 1990; Grant, 1991; Barney, 1991; Peteraf, 1993) as a powerful paradigm to integrate research in this field, weakened some of the results in the existing literature. The RBV seeks advantages that are the result of specific, intangible resources in the firm, such as organizational culture and learning. The result of recent research on IT is the notion that these technologies per se do not generate a sustainable competitive advantage (SCA).

One of the papers that inaugurated this current of less optimistic research was Clemons and Row (1991), which proposed the *Strategic Necessity Hypothesis*. Generally, this hypothesis presents two propositions:

- IT provides value to the firm by increasing internal and external coordinating efficiencies, and firms that do not adopt them will have competitive disadvantage.
- However, firms cannot expect IT to produce SCA because the technology will be available to all firms in competitive factor market.

The RBV provides some solid theoretical foundations for investigating the context and condition under which IT can provide a SCA. Wade and Hulland (2004) determine the utility of this paradigm in the research on management of information systems (MIS): The RBV facilitates the specification of information systems (IS) resources, enable comparison between these and other

resources in the firm, and offer the mechanisms needed to study the relation between IT and the obtaining of CA by providing an efficient way to measure the strategic value of IS resources.

2.1. IT Resources from a RBV

Resources are all of the assets, attributes, knowledge and organizational processes controlled by the organization on which firm strategy is grounded (Barney, 1991). There is no single classification or typology of resources. According to Barney (1991), resources can be grouped into three categories: Physical capital resources, human capital resources and organizational resources. On the other hand, Grant (1995) distinguishes between human, tangible, and intangible resources, although the classification most generally accepted distinguishes only between tangible and intangible resources (Hall, 1992). Tangible assets include financial and physical assets, while intangible assets are composed of human resources, technologies and reputation. In contrast to tangible resources, intangible resources are difficult to identify and imitate and thus have greater competitive potential.

Capabilities are the specific abilities and knowledge that the firm possesses to develop its assets using a series of organizational processes. Nelson and Winter (1982) define capabilities as combinations of different resources that are produced by organizational routines. Capabilities are important because they are the main determiner of CA (Grant, 1991).

The RBV began to be applied to the IT field study in the mid 90s. Various typologies can be found to classify IT resources. Mata et al. (1995) determine five key IT factors in the achievement of CA: Customer switching costs, access to capital, technological property, technical and managerial IT skills. Their study finds theoretical support for the latter. Ross et al. (1996) distinguish between IT assets and IT processes. Assets are composed of human,

technological and relational assets. Processes include everything related to planning (capabilities such as improvement in delivery time, cost effectiveness, etc). Powell and Dent-Micallef (1997) group IT resources into three categories: Human resources, business resources and technological resources.

Feeny and Willcocks (1998) classify the different resources into areas: Business and IT vision, design of IT architectures, delivery of IT services and a combination of basic capabilities such as IS leadership.

Bharadwaj et al. (1999) measure IT capability using six dimensions: IT business partnerships, external IT linkages, business IT strategic thinking, IT business process integration, IT management and IT infrastructure. Bharadwaj next study (2000) generalizes these dimensions into three areas: IT infrastructure, human IT resources and IT-enabled intangibles. She then defines a firm's IT capability as the ability to mobilize and deploy IT resources in combination with other assets and capabilities.

Finally, Wade and Hulland (2004) perform a literature review of the role of the RBV in IS research and identify eight key capabilities grouped into three categories: Capabilities that are developed inside the firm in response to market needs and opportunities (inside-out), capabilities that anticipate environment requirements (outside-in), and capabilities that involve both external and internal analysis and thus integrate the other two capabilities (spanning).

2.2. Conditions for Sustaining a CA Based on IT

The RBV determines that the basis of competitiveness is the firm's capability to combine a group of resources. Barney (1991) proposed that the resources should be scarce, valuable, inimitable and non-substitutable; that is, they should be valuable for firm strategy, difficult for

competing firms to imitate and not able to be substituted easily by other resources. Wade and Hulland (2004) draw on the model developed by Peteraf (1993) to explain how the firm's resources and capabilities generate a CA. To do this, they identify six attributes grouped into two conditions: Ex-ante limits to competition (resources must be rare and valuable, and the profits generated must be able to be appropriated) and ex-post limits to competition (resources must not be able to be imitated and substituted and must be imperfect mobility).

In general terms, all IT resources are valuable (Mata et al., 1995; Ross et al., 1996; Bharadwaj, 2000). However, some assets and capabilities, such as the abilities of IT managers, the degree of integration of IT with the firm strategy and experience in the use and application of IT technologies will tend to be more valuable and rare, less imitable and less substitutable than other assets, such as IT infrastructure or technology property.

Therefore, only some strategic resources will enable the generation of future profit that can be appropriated by the firm. The fact that resources are heterogeneous and imperfectly mobility explains the differences in organizational performance. However, heterogeneity and imperfect mobility are necessary but not sufficient conditions for obtaining SCA. Rumelt (1984) established a series of conditions that strategic assets must include to achieve a lasting competitive position. These conditions are called *isolation mechanisms*: Causal ambiguity, diseconomies of time, first-mover advantages. Similarly, Barney (1991) determines the following attributes: The role of history, since some attributes require long periods of time for their development; causal ambiguity, since CA is based on tacit knowledge and a combination of different complementary resources; and social complexity, given that competitive position is also the result of other firm attributes, such as the culture of the organization or its reputation.

Of the IT resources analyzed by Mata et al. (1995), only managerial IT skills were able to sustain CA. This kind of ability, which in many cases takes concrete form in relations with other agents, is the fruit of the evolution of firm's activity, many decisions taken over time, and accumulated experience, making the degree of complexity very high. Dehning and Stratopoulos (2003) ratify the previous result. Wade and Hulland (2004) determine that only inimitable, unsubstitutable and with imperfect mobility IT resources can affect competitive position in the long term.

2.3. Complementarity of IT Resources

From the analysis in the previous section, we can conclude that, even if IT can be a source of CA, it will be necessary to consider another series of factors that act as necessary complements to obtain and maintain greater performance (Bharadwaj, 2000; Teo and Ranganathan, 2003). Complementarity represents an increase in the value of the resource, since it is present when the resource produces greater benefits in the presence of another resource than when it is used alone. According to the RBV, complementary interaction of resources generally increases their value, although the causality can be ambiguous (Barney, 1991).

Benjamin and Levinson (1993) determine that the effects of IT on performance depend on the integration of organizational, business and technological resources. Keen (1993) determines that IT success implementation lies in the capability for its integration into existing human and business resources to achieve an advantage based on specific attributes of the firm. Powell and Dent-Micallef (1997) argue that CA will depend on the use of relations between the different complementary organizational resources. Jarvenpaa and Leidner (1998) conclude that IT can generate a CA only if it is complemented by a combination of pre-existing human and business resources in the organization.

The literature review shows studies that find a negative or weak relation between IT and organizational performance (e.g. Weill, 1992; Brynjolfsson, 1993; Barua et al., 1995). However, more theoretical and empirical evidence indicates that IT implementation enables firms to improve their competitive position directly (e.g. Mata et al., 1995; Brynjolfsson and Hitt, 1996; Bharadwaj, 2000), although most of the studies analysed find a contingent relation between IT and organizational performance (e.g. Clemons and Row, 1991; Powell and Dent-Micallef, 1997; Tanriverdi, 2006).

Therefore, assets and capabilities related directly to IT should be complemented by other kinds of resources, usually business or human resources, to enable improvement of the firm's competitive position.

3. Methodology

The purpose of this study is to determine a combination of key resources, both IT and non-IT resources to develop a useful guide to facilitate future research.

First, we reviewed the literature between IT and organizational performance, using the RBV as our study framework. To do this, we follow the methodology proposed by Webster and Watson (2002). We explored the following databases: *Business Source Premier*, *ABI/Inform Global (ProQuest Direct)* and *Elsevier Science*, introducing as search options a series of keywords related to the area of study: “*Information technology*”, “*competitive advantage*”, “*IT resources*”, “*firm performance*” and “*resource-based view*”. We utilized the *Social Sciences Citation Index* to identify additional articles and reviewed the *International Conference on Information Systems Proceedings*. To find other articles that analyzed this relationship, we

additionally used previous literature reviews (e.g. Melville et al., 2004; Wade and Hulland, 2004; Piccoli and Ives, 2005).

To choose the articles, we read both title and abstract to identify whether the paper examined the relation between IT and firm performance/CA. The next stage was to confirm whether this research was performed within the RBV framework, since IT is a subject studied from the perspective of different theories (e.g. Macroeconomic Theory, Theory of Industrial Organization, etc.). Then, we selected articles that identified IT assets and/or capabilities, as well as the existence of complementarities with other organizational resources. Finally, we identified assets and capabilities related to the area of IT that enabled us to classify them.

4. Analysis of the Relation between IT-Related Resources and Firm Performance

4.1. Classification of IT-Related Resources

The idea of developing a classification that enables us to identify clearly the IT assets and capabilities itself or complementary to IT in order to study the effects of IT on organizational performance, arises from the controversies found in the literature. Abstract classifications are often used and capabilities included that are considered assets, and vice versa. We adopted the classifications of Barney (1991) and Grant (1995) proposed in section two of this paper. We have also based our research on previous classifications of IT assets and capabilities (e.g. Powell and Dent-Micallef, 1997; Bharadwaj, 2000; Melville et al., 2004; Wade and Hulland, 2004; Piccoli and Ives, 2005).

Adapting the classification by Grant (1995) to our study and taking into account the importance of including the existence of organizational resources that complement IT assets and capabilities in the analysis, we can define:

- *Assets Related to IT*: The combination of elements (of tangible and intangible nature) related directly or indirectly to IT that the firm possesses for the creation or acquisition, processing and exploitation of information to obtain performance derived from their use.

- *Capabilities Related to IT*: The combination of abilities and knowledge (of intangible nature) related directly or indirectly to IT that the firm possesses to develop the assets related to IT and obtain improvement in organizational performance.

Proposition 1: Assets Related to IT (Fig. 1):

Physical Assets: Include all tangible elements that shape the physical infrastructure related to IT: Computer hardware, software, and linkages (Powell and Dent-Micallef, 1997; Bharadwaj, 2000; Teo and Ranganathan, 2003; Ray et al., 2005). They will also be shaped by all business applications that use this infrastructure (Melville et al., 2004).

Financial Assets: Include the quantity of financial resources that the firm assigns to the IT department. Only two of the authors analysed include this variable in their studies: Mata et al. (1995) and Ray et al. (2005), since access to capital and the quantity of these resources dedicated to IT management and innovation can affect their competitive position.

Human Assets: This combination is composed of all human resources related to IT, such as personnel in the IT department or other departments (upper management, other workers, etc.) and the existence of training programs or teaching of specialized IT skills. The previous

literature shows some controversies concerning this group, as most of the authors include its abilities in this section (e.g. Mata et al., 1995; Ray et al., 2005).

Technological Assets: Include all IT-related technology that the firm holds as property, that is, that are protected legally through patents, copyright or other kinds of figures (Mata et al., 1995; Ross et al., 1996).

Business Assets: Business or organizational assets (Barney, 1991) include the organizational structure, policies and rules, workplace practices, corporate culture, etc. (Melville et al., 2004): Coordination of buyers and suppliers (Benjamin and Levinson, 1993; Powell and Dent-Micallef, 1997; Bharadwaj et al., 1999; Tanriverdi, 2006), flexible structures (Powell and Dent-Micallef, 1997; Ray et al., 2005), a culture favourable to IT innovation (Bharadwaj, 2000), etc.

Proposition 2: Capabilities Related to IT (Fig. 2):

Human Resources Capabilities: Include the abilities and knowledge, both technical and managerial, of human resources related to IT: The level of learning (Benjamin and Levinson, 1993), the abilities of IT personnel (Mata et al., 1995; Ross et al., 1996; Feeny and Willcocks, 1998; Bharadwaj, 2000; Byrd and Davidson, 2003; Dehning and Stratopoulos, 2003; Ray et al., 2005; Tanriverdi, 2006), the abilities of the IT managers (Mata et al., 1995; Bharadwaj et al., 1999; Bharadwaj, 2000; Dehning and Stratopoulos, 2003; Teo and Ranganathan, 2003; Tanriverdi, 2006), leadership (Ross et al., 1996; Jarvanpaa and Leidner, 1998), CEO commitment (Powell and Dent-Micallef, 1997; Byrd and Davidson, 2003; Teo and Ranganathan, 2003; Sher and Lee, 2004), etc.

Organizational Capabilities: Include the organizational abilities and knowledge that facilitate the development of IT-related assets. Among these are the capability to redesign business processes

depending on IT (Benjamin and Levinson, 1993; Bharadwaj, 2000; Teo and Ranganathan, 2003), the ability to manage relations with agents related to IT (Benjamin and Levinson, 1993; Feeny and Willcocks, 1998; Bharadwaj, 2000; Tanriverdi, 2006), the capability to develop synergies between the different IT assets and between these and assets of other business areas (Ross et al., 1996; Bharadwaj, 2000; Sher and Lee, 2004; Tanriverdi, 2006), the existence of open organization, open communications and consensus (Powell and Dent-Micallef, 1997), etc.

4.2. Effects of IT-Related Resources on Firm Performance

As mentioned above, our literature analysis includes studies that find a negative or weak relation between IT and organizational performance (e.g. Weill, 1992; Brynjolfsson, 1993; Barua et al., 1995). However, more theoretical and empirical evidence indicates that the implementation of IT enables firms to improve their competitive position directly (e.g. Mata et al., 1995; Brynjolfsson and Hitt, 1996; Bharadwaj, 2000) or in a contingent way (e.g. Clemons and Row, 1991; Tanriverdi, 2006).

Mata et al. (1995) propose that only managerial IT skills are able to sustain a CA over time. These take concrete form in the understanding and appreciation of the demands of other business areas and agents, in the ability to work with other agents in developing IT applications, in the capability to coordinate activities related to IT and in willingness to anticipate the firm's technological needs. Ross et al. (1996) determine that the application of IT to increase competitiveness depends on the effective development of its capabilities. Powell and Dent-Micallef (1997) determine that some firms can obtain competitive gains from IT through the complementarity of intangible human and business resources such as the strategic planning-IT integration, the existence of a flexible culture or supplier relationships. However, this study only

finds empirical support for human resources. Feeny and Willcocks (1998) find that the ability to calculate, learn and transform different IT resources with complementary human and business resources determines that the firm will achieve a new CA in a continually changing environment. Bharadwaj (2000) determines that the IT infrastructure should provide a platform to stimulate new IT applications through external firms; and that human resources in IT should enable the rapid implementation of these IT applications, for which there must be a series of intangible capabilities able to guide the exploitation of these resources in the firm, such as customer orientation and the ability to identify and take advantage of the synergies derived from complementarity of the resources. However, this study finds a series of statistical inconsistencies between IT and organizational performance, due to incomplete understanding of the nature of the firm's resources and abilities and poor measurement of IT. Santhanam and Hartono (2003) start from the model presented by Bharadwaj (2000) and verify it empirically through a new measurement of the variables. Dehning and Stratopoulos (2003) establish that managerial IT skills are positively related with the SCA, while this relation is negative for competitor's knowledge. There was no support for technical IT skills and IT infrastructure as a source of SCA. A study of performance in the customer service process by Ray et al. (2005) determine that specific firm resources with a high degree of social complexity will affect organizational performance positively, e.g. the knowledge shared between the IT area and the service customer units. Thus, the improvement of performance based on IT will be supported on the assets and capabilities developed specifically within the firm that influence effective relations between IT and managers of other business areas. The capital dedicated to IT or the IT department's technical abilities is thus not sufficient to achieve superior performance.

It follows from the literature that IT infrastructure will not cause greater organizational performance, since the different software applications as well as the different physical components are easily acquired on the factor market.

As to financial assets, Mata et al. (1995) argue that some investments require large quantities of capital for their development and that the cost of this capital will be greater or lesser depending on technological or market uncertainty. Therefore, firms that can obtain financing can achieve a temporary CA from their privileged situation. However, as the introduction of IT has become a near necessity for competing in most industries (Ray et al., 2005), these assets do not explain the variations in organizational performance.

In contrast to tangible resources, intangible resources are difficult to identify and imitate, and thus hold greater competitive potential. Thus for the human resources related to IT, the existence of a specific IT department or concrete programs for IT training will not support a better competitive position, as they are elements that can easily be acquired on the factor market. Nor can assets of technological property, such as patents or copyrights be considered a source of CA. A technological application is difficult to patent and, even when patented, the legal figures existing offer little protection against imitation (Mata et al., 1995).

Finally, intangible business assets include organizational structures, practices and policies, etc. They are resources specific to the firm, the fruit of the business evolution and the taking of many decisions over time. Thus, the use of IT to manage relations with other agents, its institutionalization, its integration into organizational strategy, the development of applications that are cost effective and their relation to the other areas of the firm can improve the firm's competitive position.

The literature review performed also shows the great relevance of the different capabilities, both belonging and not belonging to IT, in analyzing the effects of IT on organizational performance. Teece et al. (1997) develop the concept of *dynamic capabilities* as the firm's capability to integrate, construct and reconfigure those internal and external competences to achieve a rapid fit with the changing environment. Firms must develop dynamic capabilities to identify new opportunities and respond quickly to them. Since this study, the idea of dynamic capabilities has been included in IT studies (Feeny and Willcocks, 1998; Jarvenpaa and Leidner, 1998; Bharadwaj, 2000).

Following our classification, we must distinguish between technical and managerial abilities for the abilities of human resources. Mata et al. (1995) establish that technical abilities can create a CA, but only a temporary one, given possible mobility of labor, while IT managerial skills are indeed a source of SCA. This result is supported by most of the literature consulted (e.g. Ross et al., 1996; Ray et al., 2005). However, Melville et al. (2004) extend the results of Mata et al. (1995) to temporary CA, since the growing institutionalization and maturity of IT factor market enables the externalization of technical functions and even those related to IT management to specialized firms (IT outsourcing). Therefore, CA supported by the existence of an IT department does not seem sustainable, due to the large number of possibilities for imitation. Melville et al. (2004) also propose the possible complementarity of physical IT resources to the capabilities of human resources as a basis for sustaining temporal CA. Tanriverdi (2006) determines that the synergies derived from the complementarities between the IT infrastructure and IT process management through the different business units of a multibusiness firm have a positive effect on firm performance.

Finally, as to organizational capabilities related directly or indirectly to IT, the literature review shows a positive impact on organizational performance, as it complements both IT and non-IT resources (Ross et al., 1996; Bharadwaj, 2000; Sher and Lee, 2004; Tanriverdi, 2006) because these abilities are developed in the firm, they are the result of the evolution of its activity and their degree of complexity is very high.

Therefore, the synergies derived from the complementarity between both IT and non-IT resources sustain a CA over time if: These assets and capabilities are the result of a process of their accumulation immersed in organizational routines and complex interaction between resources, depend on the causal links that generate complementarity, and are socially complex (Barney, 1991).

5. Conclusion

The adoption of the RBV means that: IT is incapable, per se, of sustaining a CA, making it necessary to analyze the existence of the resources that complement IT to achieve greater organizational performance. Only IT-related resources that are inimitable, non-substitutable, and imperfect mobility will be able to affect the competitive position in the long term (Wade and Hulland, 2004).

From the literature review, there is great consensus in admitting the existence of the complementarity of resources. The literature identifies the following, among others, as resources determining the performance improvement: IT managerial skills (e.g. Mata et al., 1995), CEO commitment to IT (e.g. Powell and Dent-Micallef, 1997), capability to understand the effect of IT with other business areas (e.g. Benjamin and Levinson, 1993), IT/strategy integration (e.g.

Teo and Ranganathan, 2003), IT infrastructure flexible (Bharadwaj, 2000), and IT/business synergy (Tanriverdi, 2006).

Now that we have identified the assets and capabilities employed in the different studies, we can see the existence of inconsistencies in their classification, as well as the need to offer an integrated vision of IT resources themselves and other organizational resources not necessarily belonging to IT.

The classification of IT-related assets and capabilities is based on the model proposed by Grant (1995), the classification of resources by Barney (1991) and previous classifications of IT resources and capabilities (Powell and Dent-Micallef, 1997; Bharadwaj, 2000; Melville et al., 2004; Wade and Hulland, 2004; Piccoli and Ives, 2005). According to our classification and based on the literature analysis the assets and capabilities that have greater impact on performance would be capabilities of human resources of managerial character, the organizational capabilities present in the firm and intangible business resources.

The main limitation of this analysis is that it does not take into account the impact of the competitive environment in analyzing the effect of different assets and capabilities in competitive performance. In subsequent research, it would be interesting to include the characteristics of the industry, of rival firms and of the macro-environment and to analyze their complementary role with IT-related assets and capabilities.

Our literature review is also limited to a specific number of journals: *MIS Quarterly*, *Information Systems Research*, *Information & Management*, *Journal of Management Information Systems*, *Strategic Management Journal*, *Communications of the ACM*, *Management Science*, *Harvard Business Review*, *MIT Sloan Management Review*, *IBM Systems Journal*, and *Journal of Strategic Information Systems*. A more extensive review could enrich the results.

Finally, we have taken into account only articles developed from a RBV. A deeper analysis could include a combination of results proposed by other paradigms used in IT research. The purpose of this study is to determine a combination of key resources, both exclusively IT and other organizational resources not necessarily belonging to this technology, in order to develop a useful guide that will facilitate future research and contribute to improving existing knowledge of the effects of IT on organizational performance. It offers a classification that integrates assets and capabilities belonging to IT as well as complementary resources in order to facilitate the selection of assets and capabilities in analysing the effects of IT on competitive position.

6. Appendix

Table 1. Assets Related to IT					
Authors	Tangible Assets		Intangible Assets		
	Physical	Financial	Human	Technological	Business
Benjamin and Levinson (1993)	Hardware and software infrastructure				Integrate IT and business processes, manage stakeholders relationships, capacity to understand the effect of IT on other business areas, IT institutionalization
Mata et al. (1995)		Access to capital		Proprietary technology	
Ross et al. (1996)	IT infrastructure, data and platform		IT staff, formal training	Proprietary IT projects	Cost effective operations and support, IT/business partnerships,

	standars		of IT		aligned IT planning
Powell and Dent-Micallef (1997)	Computer hardware, software and linkages		IT training		IT infrastructure flexible, supplier relationships, IT/strategy integration, IT planning, benchmarking
Jarvanpaa and Leidner (1998)	IT infrastructure (networks)				IT/strategy business integration, firm culture
Feeny and Willcocks (1998)	Design IT architecture, architecture planning		IT staff		Integrating IT effort with business purpose and activity, IT outsourcing
Bharadwaj et al. (1999)	IT infrastructure				IT business partnerships, multi-disciplinary teams, IT business process integration, IT management
Bharadwaj (2000)	IT infrastructure		IT staff, IT training, IT know-how		IT planning, cost effective operations, firm culture, reputation, coordination of buyers and suppliers, integrate IT and business process
Dehning and Stratopoulos (2003)	IT infrastructure				
Teo and Ranganathan (2003)	Technology and applications		IT training		IT planning, IT/strategy integration, IT-driven interorganizational relationships

Byrd and Davidson (2003)			IT staff		IT/supply chain relationships, IT planning
Sher and Lee (2004)	IT infrastructure				
Melville et al. (2004)	IT infrastructure, and business applications				Organizational structure, policies and rules, workplace practices, culture
Piccoli and Ives (2005)	IT infrastructure, information repositories				
Ray et al. (2005)	Generic technologies	IT spending			IT infrastructure flexible
Tanriverdi (2006)	IT infrastructure		IT training		IT vendor management, IT/strategy integration, culture

Table 2: Capabilities Related to IT		
Authors	Human Resources Capabilities	Organizational Capabilities
Benjamin and Levinson (1993)	Level of learning	Ability to business process reengineering, ability to manage stakeholders relationships, capacity to manage IT change
Mata et al. (1995)	Technical IT skills Managerial IT skills	
Ross et al.	Technical IT skills	Problem solving orientation, ability to manage

(1996)	Top management leadership in establishing IT priorities	synergies between IT resources, IT planning
Powell and Dent-Micallef (1997)	CEO commitment	Open communications, consensus, open organization, teams, process redesign
Jarvanpaa and Leidner (1998)	IT leadership	Ability to experimentation with new technology, organizational flexibility, strategic flexibility
Feeny and Willcocks (1998)	IT leadership, technical IT skills, business skills	Ability to design IT architectures, manage the IT sourcing strategy, ability to manage IT service suppliers
Bharadwaj et al. (1999)	IT managerial skills	Ability to be related to IT agents, restructuring of IT business works process
Bharadwaj (2000)	IT managerial skills	Customer orientation, IT/business synergy, open communications, process redesign, technical innovation, using knowledge assets, IT strategic flexibility, manage stakeholders relationships, ability to act quickly
Dehning and Stratopoulos (2003)	Managerial IT skills Technical IT skills Competitor's knowledge of CA	
Teo and Ranganathan (2003)	Top management commitment to IT Managerial IT knowledge	Ability to IT-based process redesign, flexible organization, cross-functional orientation
Byrd and Davidson	IT technical skills	Ability to use formal IT plans, ability to manage IT applications to facilitate the

(2003)	Top management support of IT	operations in the supply chain
Sher and Lee (2004)	Top management commitment to IT	IT/knowledge management synergies, IT/processing marketing knowledge, IT/processing supply chain knowledge, IT/acquiring knowledge
Melville et al. (2004)	IT managerial skills IT technical skills	
Piccoli and Ives (2005)	IT managerial skills IT technical skills	Relationships assets
Ray et al. (2005)	IT technical skills	Shared knowledge
Tanriverdi (2006)	IT managerial skills IT technical skills	Ability to manage stakeholders relationships, complementary IT resources and management process, learning orientation, alignment of business and IT strategies.

7. References

- Barney, J.B. (1991). "Firm Resources and Sustained Competitive Advantage", *Journal of Management* (17:1), pp. 99–120.
- Barua, A., Kriebel, C.H., and Mukhopadhyay, T. (1995). "Information Technologies and Business Value: An Analytic and Empirical Investigation", *Information Systems Research* (6:1), pp. 3-23.
- Benjamin, R.I., and Levinson, E. (1993). "A Framework for Managing IT-Enabled Change", *MIT Sloan Management Review* (34:4), pp. 23-33.
- Bharadwaj, A.S. (2000). "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation", *MIS Quarterly* (24:1), pp. 169-196.
- Bharadwaj, A.S., Sambamurthy, V., and Zmud, R.W. (1999). "IT Capabilities: Theoretical Perspectives and Empirical Operationalization", in De, P., and Degross, J.I. (Eds.). *Proceedings of the 20th International Conference on Information Systems*, Charlotte, NC, pp. 378-385.
- Brynjolfsson, E. (1993). "The Productivity Paradox of IT", *Communications of the ACM* (36:12), pp. 66-67.
- Brynjolfsson, E., and Hitt, L. (1996). "Paradox Lost? Firm Level Evidence on the Returns to Information Systems Spending", *Management Science* (42:4), pp. 541-558.
- Buday, R. (1986). "Sabre Gives the Edge to American Airlines", *Information Week* (26:1), pp. 34–35.
- Byrd, T.A., and Davidson, N.W. (2003). "Examining Possible Antecedents of IT Impact on the Supply Chain and its Effect on Firm Performance", *Information & Management* (41:2), pp. 243-255.
- Clemons, E.K., and Row, M.C. (1991). "Sustaining IT Advantage: The Role of Structural Differences", *MIS Quarterly* (15:3), pp. 275-292.
- Dehning, B., and Stratopoulos, T. (2003). "Determinants of a Sustainable Competitive Advantage due to an IT-Enabled Strategy", *Journal of Strategic Information Systems* (12:1), pp. 7-28.

Feeny, D.F., and Willcocks, L.P. (1998). "Core IS Capabilities for Exploiting Information Technology", MIT Sloan Management Review (39:3), pp. 9-21.

Grant, R.M. (1991). "The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation", California Management Review (33:1), pp. 114-135.

Grant, R.M. (1995). Dirección Estratégica: Conceptos, Técnicas y Aplicaciones. Ed. Cívitas, Madrid.

Hall, R. (1992). "The Strategic Analysis of Intangible Resources", Strategic Management Journal (13:2), pp. 135-144.

Henderson, R., and Mitchell, W. (1997). "The Interactions of Organizational and Competitive Influences on Strategy and Performance", Strategic Management Journal (18:Summer Special Issue), pp. 5-14.

Ives, B., and Learmonth, G.P. (1984). "The Information Systems as a Competitive Weapon", Communications of the ACM (27:12), 1193-1201.

Jarvenpaa, S.L., and Leidner, D.E. (1998). "An Information Company in Mexico: Extending the Resource-Based View of the Firm to a Developing Country Context", Information Systems Research (9:4), pp. 342-361.

Keen, P.G.W. (1993). "Information Technology and the Management Difference: A Fusion Map", IBM Systems Journal (32:1), pp. 17-39.

Levy, M., Powell, P., and Galliers, R. (1999). "Assessing Information Systems Strategy Development Frameworks in SMEs", Information & Management, (36:5), pp. 247-261.

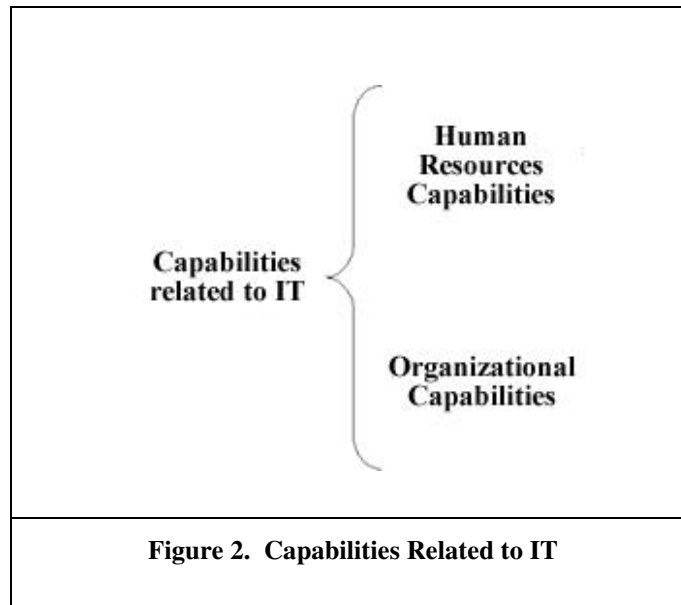
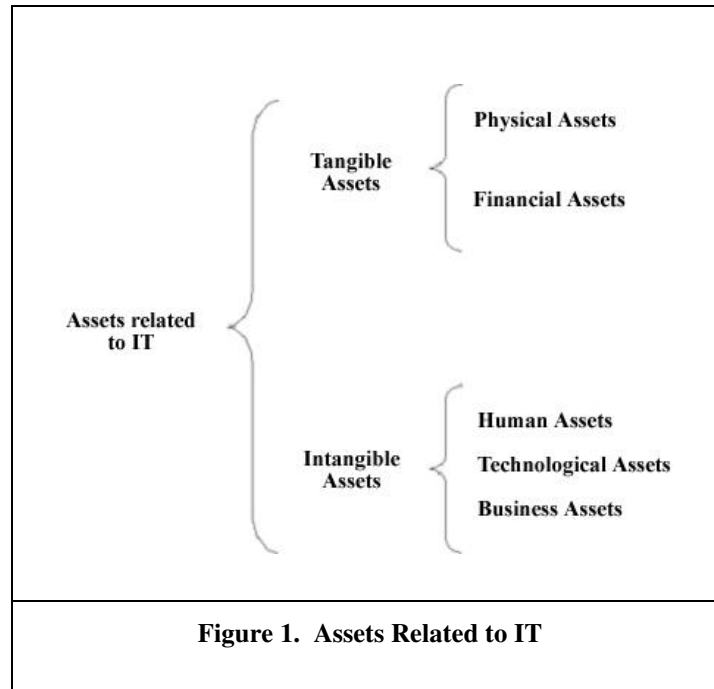
Mata, F.J., Fuerst, W.L., and Barney, J.B. (1995). "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis", MIS Quarterly (19:4), pp. 487-505.

Melville, N., Kraemer, K., and Gurbaxani, V. (2004). "Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value", MIS Quarterly (28:2), pp. 283-322.

- Nelson, R., and Winter, S. (1982). *An Evolutionary Theory of Economic Change*, Harvard University Press, Cambridge.
- Penrose, E.T. (1959). *The Theory of the Growth of the Firm*, Wiley, New York.
- Peteraf, M.A. (1993). "The Cornerstones of Competitive Advantage: A Resource-Based View", *Strategic Management Journal* (14:3), pp. 179-191.
- Piccoli, G., and Ives, B. (2005). "Review: IT-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature", *MIS Quarterly* (29:4), pp. 747-776.
- Porter, M.E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, The Free Press, New York.
- Porter, M.E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*, The Free Press, New York.
- Porter, M.E., and Millar, V.E. (1985). "How Information Gives you Competitive Advantage". *Harvard Business Review*, (63:4), pp. 149–160.
- Powell, T.C., and Dent-Micallef, A. (1997). "Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources", *Strategic Management Journal* (18:5), pp. 375-405.
- Prahalad, C.K., and Hamel, G. (1990). "The Core Competence of the Corporation", *Harvard Business Review* (68:3), pp. 79-92.
- Ray, G., Muhanna, W., and Barney, J.B. (2005). "Information Technology and the Performance of the Customer Service Process: A Resource-Based Analysis", *MIS Quarterly* (29:4), pp. 625-652.
- Ross, J.W., Beath, C.M., and Goodhue, D.L. (1996). "Develop Long-Term Competitiveness through IT Assets", *MIT Sloan Management Review* (38:1), pp. 31-42.

- Rumelt, R.P. (1984). "Towards a Strategic Theory of the Firm", in Lamb, R.B. (Ed.). *Competitive Strategic Management*, Prentice-Hall, Englewood Cliffs, NJ, pp. 556-570.
- Santhanam, R., and Hartono, E. (2003). "Issues in Linking Information Technology Capability to Firm Performance", *MIS Quarterly* (27:1), pp. 125-153.
- Sher, P.J., and Lee, V.C. (2004). "Information Technology as a Facilitator for Enhancing Dynamic Capabilities through Knowledge Management", *Information & Management* (41:8), pp. 933-945.
- Tallon, P.P., Kraemer, K.L., and Gurbaxani, V. (2000). "Executives' Perceptions of the Business Value of Information Technology: A Process-Oriented Approach", *Journal of Management Information Systems*, (16:4), pp. 145-173.
- Tanriverdi, H. (2006). "Performance Effects on Information Technology Synergies in Multibusiness Firms", *MIS Quarterly* (30:1), pp. 57-77.
- Teece, D.J., Pisano, G., and Shuen, A. (1997). "Dynamic Capabilities and Strategic Management", *Strategic Management Journal* (18:7), pp. 509-533.
- Teo, T.S.H., and Ranganathan, C. (2003). "Leveraging IT Resources and Capabilities at the Housing and Development Board", *Journal of Strategic Information Systems* (12:3), pp. 229-249.
- Wade, M., and Hulland, J. (2004). "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research", *MIS Quarterly* (23:1), pp. 107-142.
- Webster, J., and Watson, R.T. (2002). "Analyzing the Past to Prepare for the Future: Writing a Literature Review", *MIS Quarterly* (26:2), pp. xiii-xxiii.
- Weill, P. (1992). "The Relationship between Investment in IT and Firm Performance: A Study of the Valve Manufacturing Sector", *Information Systems Research* (3:4), pp. 307-333.
- Wernerfelt, B. (1984). "A Resource-Based View of the Firm", *Strategic Management Journal*, (5:2), pp. 171-180.

8. Figures



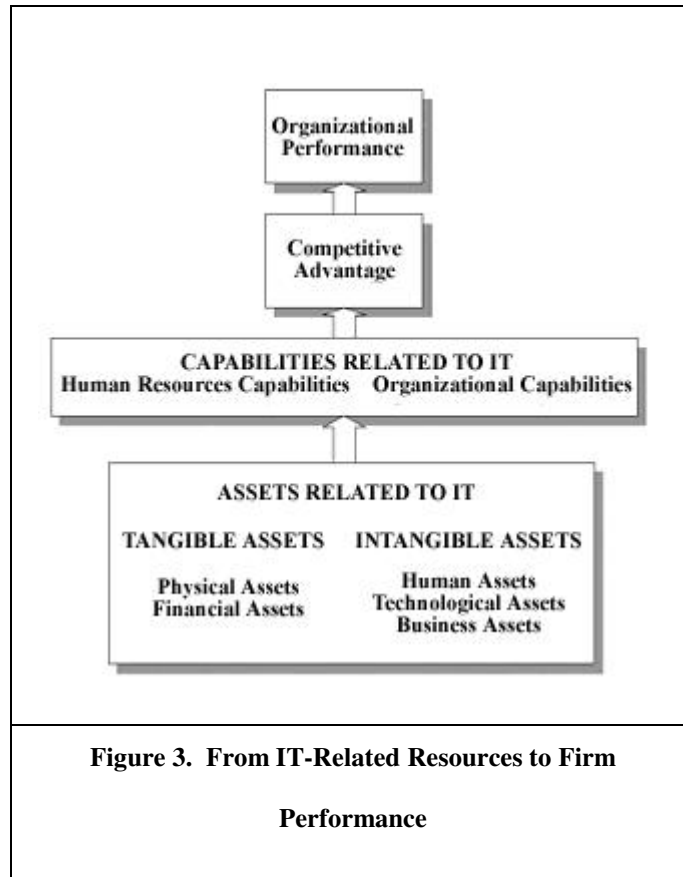


Figure 3. From IT-Related Resources to Firm Performance