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# Developing Dynamic IT Capabilities: Sustaining IT Advantage Over Time

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## INTRODUCTION

The relationship between IT and business performance and the pursuit of a sustainable advantage has been widely studied by researchers (Roach, 1991, 1996; Mata, Fuerst, and Barney, 1995; Hitt and Brynjolfsson, 1996; Bharadwaj and Konsynski, 1999; Carr, 2003). Some researchers have found a positive relationship between IT capability and business performance. For example Bharadwaj (2000) suggest that IT capability rather than IT leads to better business performance. This is so, because as IT becomes more ubiquitous and standardized its ability to be sources of competitive advantage erodes (Carr, 2003). Technology resources, such as those incorporating advanced information technology, do not convey competitive advantage because of their ease of acquisition and imitation. It is more likely that sustained advantage will come from the effective and adroit application of IT, a capability resulting from the possession and development of managerial IT knowledge (Ray, Barney and Muhanna, 2004). Even here, however, the advantages enjoyed by the prescient and adroit exercise of organizational IT capabilities may be fleeting and last only until competitors have duplicated or outmaneuvered them.

Undoubtedly, IT capability is a potent resource and if used judiciously can provide advantage, but the sustainability of this advantage remains debatable. It also does not mean that just because a capability provides advantage it will also provide competitive advantage. A specific IT capability may or may not provide competitive advantage but this does not mean that it has no impact upon the firm's performance. In many instances IT applications become "strategic necessities" (Clemons and Kimbrough, 1986). Adoption of these applications becomes necessary for the organizations to survive but they may not provide strategic advantage. It may also be the case that IT-derived advantages are effective at the business process level but fail to manifest itself sufficiently at the firm level (Ray, Barney and Muhanna, 2004). This raises the question - what makes them "strategic necessities"? The adoption of new IT technology by one organization does not make it necessary for others to imitate. However, a firm may wish to imitate another in adopting IT, if it presumes that the competing firm is getting some competitive advantage by doing so. The result of many firms adopting similar IT though, is that it quickly becomes standard practice, eroding the advantage that may have accrued to the early adopter. Such has been the case for firms adopting enterprise system software from firms such as SAP and Oracle. Thus, protecting advantages provided by IT has become increasingly difficult in the rapidly changing business and technological environment. The innovator will only be able to exploit its advantage for a limited period of time before its competitors launch a counterattack. With the launch of this counterattack, the original advantage begins to erode and therefore a new initiative is required.

In this paper we advocate that instead of concentrating on sustaining advantages generated by a specific IT capability for the long term, organizations should focus upon generating short-term advantages while, at the same time, putting significant effort into continuously creating opportunities for developing new advantages. We provide background to our arguments in the next section. This is followed by the presentation of a conceptual model. We use a brief case study to illustrate our arguments and model.

## BACKGROUND

Selznick (1957) coined the term "distinctive competence" to describe activities, resources or skills of an organization that are its special strengths. Some researchers applied the concept to strategy and argued that distinctive competence is not only a single thing that an organization can do well, but it can be viewed as the entire set of things that differentiates an organization from its competitors. Hamel and Prahalad's (1990) article on core competency, based upon the concept of "distinctive competence", further popularized the notion among the practicing managers. The terms resources, competencies, capabilities are used widely, sometimes interchangeably in research (Barney, 1991; Grant, 1991; Henderson and Cockburn, 1994; Barney, 2002; Ray, et al., 2004). Since there was confusion regarding the operational definition of resources and capabilities Grant (1991) provides some clarification. He classified resources as - tangible, intangible and personnel based providing some insight into the characteristics of resources. He suggests that firms assemble different resources to create capabilities, which are firm specific and extremely difficult to imitate.

Barney (1991), applying the resource-based view (RBV), provided a framework for analyzing the effect of a firm's capability on its performance. This approach links the firm's performance to resources and skills that is firm-specific, rare and difficult to imitate. The resource-based view identifies the resources and capabilities that can generate sustainable competitive advantages and lead to above-normal rates of return (Wernerfelt, 1984; Barney, 1991). Generally, resources and capabilities will provide sustainable advantages only if they are rare, valuable, inimitable, and non-substitutable (Barney, 1991).

Dierickx and Cool (1989) argue, however, that when a firm has an advantage resulting from a unique combination of resources that is difficult to imitate, competitors may attempt to develop alternative resources which can produce similar benefits. If the competitors are successful in their endeavor then the firm having competitive advantage over others may not only lose its advantage but may also find itself in a disadvantageous position. The economic value of the critical resources may go down and they may lose their importance. Therefore, to sustain the competitive advantage a firm has to repeatedly do something different from others and has to ensure that it enhances current operational effectiveness.

The development of organizational capabilities does not take place in a sterile environment where factors can be easily controlled. Organizations operate in dynamic environments that require constant and prescient responses to challenges and opportunities generated by the elements at play in any given context. Researchers have often ignored the importance of external factors i.e. the business environment, on the formation of business goals, business strategy, and IT strategy. However, we cannot talk of any form of advantage without considering the impact of business environment and the intensity of competition.

Consequently, while the RBV appropriately recognizes the importance of accumulating and deploying resources that are valuable, difficult to imitate, replicate, and substitute, it has been criticized for not sufficiently explaining how "entrepreneurial rents and competitive advantage" are sustained over time, especially dynamic and volatile environ-

ments (Teece and Pisano, 1994; Teece, et al., 1997). They propose the notion “dynamic capabilities” to refer to the ability firms possess to allow them to adopt to rapid changes in their environments. According to Jarvenpaa and Leidner (1998), the dynamic capabilities view can be distinguished from the traditional RBV in that the latter focuses on matching current firm resources and capabilities with opportunities in the marketplace while the former focuses on the need to develop capabilities that will allow it to respond to and shape circumstances emerging in the environment. Teece, et al. (1997) argue that

*“The term ‘dynamic’ refers to the capacity to renew competences so as to achieve congruence with the changing business environment; certain innovative responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competition and markets difficult to determine. The term ‘capabilities’ emphasize the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external skills, resources, and functional competences to match the requirements of a changing environment” (Teece, et al., 1997 p. 515).*

In their conceptualization of dynamic capabilities, Teece, et al. (1997) outline three classes of factors that shape development. These are identified as processes, positions, and paths. According to them, processes refer to the routines and practices that define the way things are done in the firm. Positions are the “current specific endowments of technology, intellectual property, complementary assets, customer base, and its external relations with suppliers and complementors” (Teece et al., p. 518). Paths encompass the firms strategic opportunities and related path-dependent properties. The notion of path dependencies is crucial to understanding the pivotal role history places in shaping the trajectory along which the capabilities develop. A firm’s ability to seize opportunities presented to it or to respond adroitly to environmental turbulence is supported or constrained by routines, structures, resources, learning, and other factors that were developed and accumulated in the past.

Eisenhardt and Martin (2000), in extending the construct, suggests that dynamic capabilities should be viewed as “tools that manipulate resource configurations”. They advise that rather than viewing dynamic capabilities as sources of competitive advantage in and of themselves they should be seen as “specific organizational and strategic processes by which managers alter their resource base (p. 1111). In a departure from earlier conceptualizations, the capabilities may not be totally idiosyncratic but could exhibit commonalities across firms in the form of ‘best practices’. Instead of being represented in the form of detailed analytical routines they may be applied in the form of more simple, experiential processes. Consequently, the outcomes from the application of dynamic capabilities may be unpredictable, especially in dynamic and volatile environments. So while dynamic capabilities with the traditional characteristics (valuable, rare, inimitable, non-substitutable) may provide advantage, it is also likely that for such advantage to be derived dynamic capabilities that are valuable, somewhat rare, equifinal, substitutable, and fungible. Dynamic capabilities evolve along a unique path that is ‘shaped by learning mechanisms such as practice, codification, mistakes, and pacing (Eisenhardt and Martin, 2000, p. 1111).

Grant and Liebenau (working paper) suggest that firms should develop high levels of IT capability in order to derive advantages from the investments in IT. They define IT capability as an organization’s effectiveness in leveraging complimentary organizational resources in designing, acquiring, deploying computer based information systems to create competitive business value. IT capabilities consist of both intangible and tangible elements. For the most part, the tangible elements of a firm’s IT capability are easily replicable. For example, firms competing in an industry can easily acquire appropriate IT hardware, software, and IT services on factor markets. However, intangible aspects, such as managerial IT knowledge (a combination of shared business and IT knowledge applied to executing business routines within a firm), result from a path-dependent evolutionary process that is idiosyncratic and difficult to replicate (Ray, Barney and Muhanna,

2004). Mata et al. (1995) developed a model based on the RBV of the firm and then applied it to the four attributes of IT – capital requirements, proprietary technology, technical IT skills and managerial IT skills - which might provide sustained competitive advantage. They defined managerial IT skills as the management’s ability to conceive of, develop and exploit IT applications to support and enhance other business functions. They concluded that only managerial IT skills had the potential to provide sustainability. It takes time to evolve managerial IT skills. A firm cannot copy these skills by reading a book. Katz (1974) argues that managerial IT skills are often developed over longer periods of time through the accumulation of experience by trial and error learning. Williamson (1975) refers to them as “learning by doing” skills.

## CONCEPTUAL MODEL

IT capabilities are shaped by the environmental context in which they are developed, the resources that are invested in, and the routines (business processes) to which they are applied. Based on Teece and Pisano’s (1994) and Teece, et al. (1997) notion of processes, positions, and paths, we propose a conceptual model (Fig.1) that considers IT resources and routines as the two important variables for the development of IT capabilities. The quality and substance of IT resources and routines are promoted or constrained by a wide variety of environmental factors. These factors should be taken into consideration before deciding which IT capabilities to develop because of the path-dependent nature of such investments.

The proposed model suggests a recursive relationship between current IT capabilities and future capabilities. Firms employ their routines to apply IT resources in creating IT capabilities. The routines and resources and their employment are subject to the prevailing environmental conditions. The resulting capabilities afford the exploitation of new opportunities that lead to the creation of more advanced capabilities (Ray et al., 2004).

## IT Resources

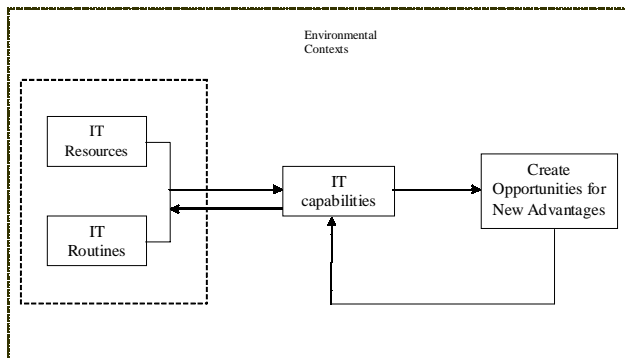
The IT resources of a firm includes - the availability of the highly skilled managerial and technical employees (Brancheau et al., 1996; Ross et al., 1996), the investments that the firm has made in building up IT infrastructure (Brancheau et al., 1996), the expertise that has been developed within the organization by implementing various IT projects (Roepke et al., 2000) and the information available to the firm related to its competitors, customers and about the overall market. The efficient exploitation of these resources helps the creation of IT capabilities that may provide advantage. The resources should be strategically deployed to facilitate and enable the creation of new IT capabilities. Commitment to specific IT resources creates a degree of path-dependency (Ray, et al., 2004). For example, when companies committed to investing vast resources in deploying ERP systems they essentially committed themselves to a series of investments around that technology. It is crucial therefore, for such commitments to be made with great care and strategic foresight.

## IT Routines

IT routines encompasses the efforts of the firm in conceptualizing, designing, coordinating and executing organizational activities related to the implementation of computer-based information systems (Grant and Liebenau, working paper). The firm has to efficiently and effectively perform them to enhance its IT capability. Important strategic routines highlighted in the IS literature include:

- Strategic IT planning – the firm’s IT strategy must serve the strategic intent of business strategy and must be dynamically aligned to it in order to generate optimal business performance (Henderson and Venkatraman, 1993; Boar, 1994; Chan et. al., 1997). Alignment is a continuous process of learning and adaptation. Consequently, as changes in business strategy occur, the IT strategy should also change.
- IS structure and governance – this involves crafting the governance structure, processes and staff composition for effective IT systems

Figure 1. Proposed Conceptual Model



and services delivery. The structure and governance approach adopted should reflect the IT strategy. A mismatch between strategy and structure will precipitate difficulties in deploying IT systems and services.

- c. IT systems delivery and integration – revolves around integrating the functional managerial and IT skills, processes, technology and information necessary to deploy and deliver IT systems and related services. Successful integration is promoted by effective top management support and involvement; genuine and substantive buy-in on the part of business managers; proficient project management; and the competent application of the skills of IT project teams, suppliers and partners.
- d. IT-enabled change management – focuses on managing IT-generated organizational change to effectively adapt to new technologies, organizational routines, and environmental realities. IT deployment tends to precipitate change in organizational structure, routines, and relationships. These need to be presciently managed in order to forestall unintended and deleterious consequences.
- e. IT performance and risk management – the firm has to continuously monitor the performance of the IT systems to achieve the desired outcome. Different levels of risk are associated with each type of IT investment and deployment approach. If these risks are not managed effectively it could result in implementation or even organizational failure.
- f. IT-related learning – involves incorporating the experience and knowledge gained from previous IT related projects in their organizational routines (Andreu and Ciborra, 1996; Bell, 1994). Effective learning facilitates the development of new capabilities at a faster pace.

IT routines are essential to IT capability development since they embody what the organization is able to do (Nelson and Winter, 1982) in relation to deploying, managing, and exploiting IT.

### Environment

We conceptualize the environment in which the firm operates in terms of three different but interrelated contexts – general environment (political, economic, legal, technological, social), industry context (industry structure, competitors, opportunities, threats and challenges) and firm/business context (management style, resources, culture). The increasing rate of change in the political, economic, legal and regulatory, social, and technological environments has forced firms to become more diligent and thorough in monitoring and analyzing environmental elements before making any investment decision. Globalization has effectively restructured the competitive landscape shattering the stronghold of many industrial giants and paving the way for the smaller firms to compete with the big players. The change in industry structure became more evident in the late 80s' with the increase in the number of players in certain industries (e.g. service and information industries) and decline in other industries (Ulrich and Wiersema, 1989). In the last decade, there has been a significant shift in political and government policies towards greater liberalization of markets. As a result we now witness the

development of a worldwide market for certain skilled human resources. Many developing countries now attract the attention of the companies operating in the developed countries through their ability to provide high quality services at much lower costs. Also, rapid technological change has shortened the life cycle of many technologies and has made investment decisions very complicated for firms. These environmental issues have far-reaching strategic implications. Firms have different capacities to respond to the developments because of their prevailing culture, resources, and management style. To deal with the challenges presented by the environment, companies like Ford Motor Co., General Electric, Gillette and others have formed environment-monitoring groups to track the moves and counter moves of their competitors (Elofson and Konsynski, 1991). Consideration of environmental context and factors in any decision to develop IT capabilities is vital to the success of firms seeking to maintain a competitive edge over their industrial rivals.

### Case Illustration: Creating New IT Capabilities at Wal-Mart

Wal-Mart Stores Inc., by far the largest retail company in the United States, has been known as a leader in adopting new technologies that streamline inventory and supply chain management processes. In the mid 1980's, Wal-Mart was one of the first major retail firms to standardize the use of bar code scanning as a means of tracking inventory. Although Wal-Mart is a pioneer among retailers in using and improving bar code scanning technology, Wal-Mart has continuously endeavored to maintain IT advantage by developing multiple IT capabilities. For more than twelve years, Wal-Mart, in collaboration with research-based organizations has been analyzing the potential use of RFID technology in a retail environment.

In June 2004, Wal-Mart announced that that it would require its top 100 suppliers to attach RFID tags on shipping crates and pallets by January 1, 2005. Radio frequency identification (RFID) is a wireless technology that uses radio wave frequency to automatically identify objects. Unlike conventional identification systems based on Universal Product Codes (UPC), RFID systems have an advantage in that the item to which an RFID tag is attached does not have to be physically handled for recording purposes. In fact, multiple RFID tags can be read simultaneously without the need to open each and every container. Using RFID technology, Wal-Mart hopes to be able to identify, track and manage every item as it moves through the supply chain without having to scan items separately. The basic goal of using RFID system is to improve inventory management, increase shipping and receiving efficiency while reducing overall operating costs. In the case of Wal-Mart, the cost savings benefit is estimated at \$8.4 billion per year (Roberti, 2003).

The decision by Wal-Mart to require its suppliers to incorporate RFID tags on cases and pallets shipped to their facilities is an attempt to stay way ahead of its competitors. Being a long time leader in retail industry, Wal-Mart is not under immediate pressure to enhance its performance by adopting RFID Technology. However, to stay ahead of the competition, a firm has to continuously endeavor to create opportunities for new advantages by developing new IT capabilities. Such capabilities cannot be developed overnight. Although RFID technology has been successfully used in other industries, experts are of the opinion that Wal-Mart's competitors would not be able to develop their IT capability immediately because it is not a simple "plug-and-play" technology. Competitors would have to develop new on demand systems, policies, and procedures in order to fully integrate RFID technology into their inventory management operations. While other retailers respond to the latest in RFID technology, Wal-Mart, in taking the lead, will be one step ahead of the pack, constantly opening new windows of opportunity to create new series of advantages.

### DISCUSSION AND CONCLUSIONS

Competitive advantage, particularly those based on resources and capabilities with a substantial tangible component such as IT are not sustainable over the long term (Ray et al., 2004). Therefore, attempts to sustain such advantage may not be beneficial for the firm over the long

term because sooner or later a competitor may not only erode away that advantage but could also create a situation where the survival of the firm could be jeopardized. Therefore, to sustain advantages over time, it is advisable that firms continuously pursue the acquisition of new capabilities so that the competitor always has to emulate the new capabilities and never gets the opportunity to erode away the current advantages enjoyed by the firm. Since IT capabilities bear the characteristics of being somewhat imitable, equifinal, and fungible (Eisenhardt and Martin, 2000) firms need to be prescient and adroit in acquiring new capabilities to cope with the technological and competitive dynamics of environment in which they operate.

Wal-Mart's strategy with regards to the development of its competence in deploying and managing with RFID illustrates its attempt to bolster and extend its advantage over its competitors. Even though it has strong capabilities in using bar code technology it is taking steps to respond to the technological and competitive changes that it faces. Bar code technology, though effective, is about to be replaced. Should Wal-Mart fail to invest in the new strategic technologies and capabilities it may find its advantage eroded by competitors. Rather than allow competitors to erode its advantages, Wal-Mart is taking steps to erode and supersede its own capabilities, replacing it with new advanced capabilities, thus preserving the economic rent generated.

We believe that to sustain advantage over time, a firm should continuously innovate and develop new IT capabilities at a much faster pace than its competitors. These competitors would be challenged to imitate or surpass the new capabilities. Because developing new IT capabilities are idiosyncratic, path-dependent, and take time to develop, the leading firm should be in a position to move on to newer, more advantageous capabilities before its competitors.

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