



Paper to be presented at the DRUID Academy 2012

on

January 19-21

at

University of Cambridge /The Moeller Centre

## **The impact of IT resources on SMEs innovation performance**

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### **Abstract**

This work aims to develop a research framework to examine the impact of information technology resources on the innovation performance of Saudi small-and-medium enterprises (SMEs). SMEs innovation capability influences growth and technological progress (Bruque & Moyano, 2007). However, many developing countries exhibit moderate or even low innovation performance. For instance, Saudi Arabia is ranked 54th by the Global Innovation Index (GII 2011). Innovation systems studies focus on the alignment between the interactions of innovation actors with their constantly changing environment toward better innovation performance (Etzkowitz & Leydesdorff, 2000). The dynamic capabilities of organisations have been highlighted as a crucial characteristic that helps to achieve a sustainable competitive advantage (Teece et al., 1997). The indirect impact IT resources on innovation performance represents an attractive research area (Benitez-Amado et al., 2010). Therefore, we argue that a closer look at Saudi SMEs information technology resources and their impact on the firm dynamic capabilities and innovation performance would make a significant contribution to existing knowledge. Areas such as the organisation strategies of developing countries, innovation management, dynamic capabilities, open innovation and strategic information systems are few examples of areas that might benefit from this work.

# **The Impact of Information Technology Resources on SMEs’ Innovation Performance**

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This work aims to develop a research framework to examine the impact of information technology resources on the innovation performance of Saudi small-and-medium enterprises (SMEs). SMEs innovation capability influences growth and technological progress (Bruque & Moyano, 2007). However, many developing countries exhibit moderate or even low innovation performance. For instance, Saudi Arabia is ranked 54th by the Global Innovation Index (GII 2011). Innovation systems studies focus on the alignment between the interactions of innovation actors with their constantly changing environment toward better innovation performance (Etzkowitz & Leydesdorff, 2000). The dynamic capabilities of organisations have been highlighted as a crucial characteristic that helps to achieve a sustainable competitive advantage (Teece et al., 1997). The indirect impact IT resources on innovation performance represents an attractive research area (Benitez-Amado et al., 2010). Therefore, we argue that a closer look at Saudi SMEs’ information technology resources and their impact on the firm dynamic capabilities and innovation performance would make a significant contribution to existing knowledge. Areas such as the organisation strategies of developing countries, innovation management, dynamic capabilities, open innovation and strategic information systems are few examples of areas that might benefit from this work.

## **1. Introduction**

The performance of firms is affected by exogenous factors such as technology, globalization of market, knowledge, and evolving approaches to value offering forcing them to constantly change their approaches to wealth creation (Stopford, 2001). Hence, the firm with higher innovation prosperity compared to its rival has a crucial advantage (Barnett & Hansen 1996) that enables it to compete in local and global markets (Hitt et al., 2001). How information technology (IT) constitute a competitive advantage, its strategic impact, and its role in turbulent environments (Carr, 2003; Devaraj & Kohli 2003; Overby et al., 2006) are key issues in Information System research. In the debate on whether IT has an impact on a firm's competitive advantage (Carr, 2003), Ray et al. (2005) argue that the strategic advantage of IT can be better illustrated through an analysis of their intermediates (indirect relationship with competitive advantage).

To best of our knowledge, few attempts have been made to understand the relationship between IT resources and innovation capability. Moreover, there has been minimal discussion on how to develop an IT capability that influences the dynamic nature of the capabilities required for innovation success. Drawing on a recent recommendation from an IT capabilities perspective, we address these research gaps by developing a framework that helps answer the following questions:

- Are dynamic capabilities valuable to stimulate a firm's innovation performance?
- How are IT resources positively associated with the development of a firm's dynamic capabilities?
- Do dynamic capabilities mediate the relationship between IT resources and a firm's innovation performance?

## 2. SMEs and Systems of Innovation

Rogers (1995, P 11) defines innovation as “*any idea practice or object that is perceived to be new by an individual or other unit of adoption*”. Innovation refers to the firm embrace of new products and/or processes to improve performance and competitiveness (O’Regan et al., 2006). Schumpeter’s (1934) early work highlights the fact that innovation can occur in different forms such as at the product, process, market, and organisational levels. However, innovation requires an integral effort across a whole organisation (Nelson & Winter, 1982; Yam et al., 2011).

According to Carlsson and Eliasson (1994, P 694), economic competence is “*the ability to identify, expand and exploit the business opportunities*”. Moreover, economic competence relies on four forms of capability: selective (strategic) capability, organisational (integrative or coordinating) ability, technical or functional ability, and learning (or adaptive) ability (Carlsson et al., 2002).

Innovation is a vital source of competitive advantage (Dess & Picken, 2000; Tushman & O’Reilly, 1996). In this strategic context, innovation represents successful commercialisation of invention (Khilji et al., 2006). Distinguishing between the ability to generate great ideas and the ability to capture its benefits and avoid catastrophic consequences.

A widely used definition of SMEs in literature (Zeng et al., 2010) is a firm that has fewer than 500 employees (Wolff & Pett, 2000). SMEs have a higher failure rate compared to large organisations (Lu & Beamish 2001). This led to a contradictory debate on the need for SMEs to develop an efficient structure through formality (Prakash & Gupta, 2008) or, in contrast, emphasise flexibility as a source of competitive advantage (Qian & Li, 2003). This contradiction need to be justified through the recognition of the elements of the formal and informal structures that impact the performance of SMEs (Terziovski, 2010).

Although the vast articles and theoretical discussions of innovation (Crossan & Apaydin, 2010) recommendation for additional theoretical integration to link organisational context with dynamism of the market is probably still valid (Shoham & Fiegenbaum, 2002).

Nelson and Winter (1982) stress that innovation starts by breaking down an organisation's internal routine, such as production, R&D, or management, by searching for a more efficient routing outside the organisation. According to Komninos (2008, P 51), "*these fundamental process of innovation (routine, search and selection environment) create a cognitive space, which is specific and exclusive to each environment*".

In this globalised world, the performance of a firm can no longer be related to its internal capability (Jaffe, 1986, 1989). Clearly, that innovation performance is also associated with external factors, such as other firms' expenditures on R&D, in addition to a firm's internal knowledge activities, such as a firm's own R&D investments.

Carlsson, Jacobsson, Holmén, and Rickne (2002) view an Innovation Systems as a set of interrelated components that interact with each other, and that system is characterised by these components and their relationships and attributes. In the innovation context, components can be a in the form of individual, enterprises, or any other private or public organisation. The characteristic of the behaviour of one component of the system influences the characteristics or the behaviour of the whole system. This mutual interrelationship results in a system that as a whole is beyond being represented by the sum of its component parts (Blanchard & Fabrycky, 1990).

Relationships represent the links between components. Technology transfers or acquisitions are crucial forms of relationships in an innovation system (Carlsson et al., 2002). The interaction between an innovation system's components might occur intentionally, as in technology acquisition, or unintentionally, as in technology spillover. The system dynamism

influences the interactions between its components, but the high dynamism of a system in the wrong direction might result in a collapse rather than an evolution (Carlsson et al., 2002).

The interaction between entities in an ecosystem, from an innovation context, is more than a simple transaction cost relationship. Knowledge flowing through interactions between various actors is a key ‘building block’ that influences the dynamic evolution of an innovation system (Trippel, 2010). Different countries’ innovation performance can be associated to their economic structure, R&D capability, social structure, and institutional configuration (Lundvall, 1992; Nelson, 1993). However, it is crucial to indicate that not all novel ideas can be successfully implemented to lead to prosperous innovation. This highlights that firms and clusters capability of successfully commercialising knowledge assets is significant for a prosperous system of innovation (Trippel, 2010).

Robustness, flexibility, and responsiveness to environmental changes as well as generating changes are key dynamic characteristics of innovation systems (Carlsson et al., 2002). Change can be a result of endogenous factors, such as the addition of new components to the system (actors or technology tools), or exogenous factors, such as the nature and rate of interaction among system components because of the Internet and its impact on the environment (Carlsson et al., 2002). Spencer (2003) shows that the higher a firm is embedded in the global innovation system through knowledge sharing and interaction, the better performance it achieves.

From above, a firm’s innovativeness analysis is not exclusively associated with its endogenous factors. Therefore, a theory capable of comprehending both the endogenous and exogenous factors of a firm’s innovation capability is needed.

### 3. Dynamic Capability

At the core of resource-based view (RBV) is an emphasis on resources and capability heterogeneously (Barnett et al., 1994; Mahoney & Pandian, 1992) where the competitive advantage of a firm is associated with its valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney, 1991). However, this relative advantage requires idiosyncratic capability to benefit from these VRIN resources in order to adapt to the market's dynamism (Eisenhardt & Martin, 2000; Priem & Butler, 2001). Dynamic capabilities emerged to overcome this static nature of RBV and embed an evolutionary genesis in a firm's resources and capability advantage (Eisenhardt & Martin, 2000; Teece, 2007; Teece et al., 1997; Zahra & George, 2002).

Unfortunately, scholars have not reached an agreement on the definition of dynamic capabilities (Wang & Ahmed, 2007). Teece et al. (1997, P 515) explain the term 'dynamic' as follows: *"the capacity to renew competences so as to achieve congruence with the changing business environment"* and 'capabilities' as *"the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment"*. According to Eisenhardt and Martin (2000, P 1107), dynamic capabilities are *"the firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change"* they also argue that dynamic capabilities are *"the organizational and strategic routines by which firms achieve new resources and configurations as markets emerge, collide, split, evolve, and die"*.

Therefore, the essence of the concept of dynamic capabilities is its intrinsic linkage to market dynamism (Wang & Ahmed, 2007). Unlike the static model of RBV, which is unlikely to sustain competitive advantage in a dynamic market (D'Aveni, 1994; Eisenhardt &

Martin, 2000), dynamic capabilities are built on all effort to reconfigure resources and capabilities to enable the firm to change and adapt in the face of a volatile environment (Teece 2007; Teece et al., 1997; Wang & Ahmed, 2007). The static version of the innovation model that theorizes innovation as a linear model or with exclusive association with a firm's internal R&D effectiveness is not sufficient to comprehend the volatility and velocity of the market (Chesbrough, 2003). Access to venture capital, mobility of quality human capital, the complexity of technology, and the globalisation of the market and value chain as well as growing clusters of specialised knowledge pressure organisations to think and act outside of their boundaries where external sources of knowledge and innovation have become imperative (De Backer & Cervantes, 2008; Gassmann, 2006; Porter & Stern, 2001).

Dynamic capabilities are higher-order level that shapes operational capabilities that are at lower-order level. While operational capability is crucial on a day-to-day basis (Wang & Ahmed, 2007), in "*how we earn a living now*" (Winter, 2003, P 992) dynamic capabilities are more associated with changes such as the development of a new product, process, or market (Winter, 2003) which is consistent with Schumpeter's view of innovation.

Eisenhardt and Martin (2000) suggest that dynamic capabilities are the ability to acquire, shed, integrate, and reconfigure resources. Verona and Ravasi (2003) have taken a knowledge-based perspective where dynamic capabilities are advocated as the creation and absorption of knowledge, and the capability to integrate and reconfigure. Zott (2003) suggests they are variation, selection, retention, and reconfiguration as well as competing with rivals. Wang and Ahmed (2007) classify dynamic capabilities as: Adapting, Absorbing, and Innovating. Teece (2007) holds a holistic view of dynamic capabilities, suggesting that sensing, shaping, and seizing opportunities as well as reconfiguring capability are the core of sustainable competitive advantage.

Our belief is that the recent conceptualization of Teece (2007) is of high order and comprehensive enough to be a powerful lens that allows understanding of dynamic capabilities and innovation performance using multi-approaches such as the knowledge-based, network approach and organisational theories.

#### **4. Innovation and Dynamic Capabilities**

In a globally competitive environment, windows are open for newcomers as well as market dominators risking existing profit streams (Teece, 2007). Identification of opportunities is associated with two forces: Schumpeter's (1934) entrepreneurship force, where new internal and external knowledge and information creates an opportunity to innovate, and Kirzner's (1978) force where entrepreneurship activity is associated with access to existing information that creates an opportunity for taking advantage of any disequilibrium in the market. According to Teece (2007), both the distortion and restoration of market equilibrium (Baumol, 2005) are relevant in today's economy.

Innovation is associated with a high degree of variation and exploration (March, 1991). It requires new knowledge and new knowledge combinations that are specific to its particular context (Eisenhardt & Martin, 2000). The exploitation of new knowledge in a specific context (Eisenhardt & Martin, 2000) represents an organisation's break from its traditional, well-established routine (Benner & Tushman, 2003). This is aligned with the nature of change that the dynamic capabilities approach advocates, despite the variations in the definition of dynamic capability (Schreyögg & Kliesch - Eberl 2007; Teece, 2007; Wang & Ahmed, 2007; Zahra et al., 2006).

#### 4.1. Connective Capacity

Teece (2007) labelled the term 'sensing opportunities'. He explained that this capability comprises activities such as scan, search, and explore. This requires access a knowledge infrastructure that includes both 'local' and 'distant' (Nelson & Winter, 1982) information about technologies, markets, current customers demands, suppliers, and the structural evolution of industries that are critical to a firm's short- and long-term survival. This capability of accessing knowledge (e.g. access to in internal and external R&D activities as well as knowledge of current customers needs) is imperative to unlock a wider range of commercialisation opportunities (Teece, 2007). Henderson (1994) advocates that companies might face the risk of being prisoners of their own strategies and dictionary of change and improvement. Successful commercialisation of innovation is highly associated with the developers understanding of customers needs (Freeman 1974). The alertness to opportunities and change in the whole ecosystem has becoming vital especially that a significant percentage of new products introduced by external sources (Teece, 2007).

The concept of open innovation embrace this by embedding linkage with external sources in the innovation strategy in order to benefit from the current high velocity of market (Chesbrough, 2003, P 24). Open innovation is not only about of acquiring new knowledge from external sources but also a mean of invention commercialisation via selling/licensing or even joint venturing (Gassmann, 2006). Therefore, linkage of a firm with it surrounding entities is core for stronger access to knowledge and provides the firm with alternative paths for capturing opportunities.

Porter and Ketels, (2003) advocate the vital role of interorganisational networks in an organisation's innovation capability. Pérez and Sánchez (2002, P 263) define networking as "*a firm's set of relationships with other organizations*". Firms are recognising the importance of collaborating with other firms (Fischer & Varga, 2002) where innovation is

becoming a result of a value network as a whole rather than of an individual or firm (Bougrain & Haudeville, 2002; Powell et al., 1996). Ahuja (2000) and Powell et al. (1996) highlight that networking is key to innovation and competitiveness in variety of industries. Pittaway, Robertson, Munir, Denyer, and Neely (2004) review firms' networking and highlight the benefits of networking as found in the literature as follows: 1) risk sharing (Grandori, 1997); 2) access to new markets and technologies (Grandori & Soda, 1995); 3) speeding products to market (Almeida & Kogut, 1999); 4) increase in skills variety (Eisenhardt & Schoonhoven, 1996; Hagedoorn & Duysters, 2002); 5) securing intellectual property (Liebeskind et al., 1996); and 6) access to external knowledge infrastructure (Cooke, 1996; Powell et al., 1996).

Lichtenthaler and Lichtenthaler (2009, P 1320) highlight 'connective capacity' as a crucial capability to maintain access to external knowledge. They define 'connective capacity' as a "*firm's ability to retain knowledge outside its organizational boundaries*". This capability comprises the process stages of increasing and maintaining the portfolio of external knowledge privileges in inter-organisational relationships (Lichtenthaler & Lichtenthaler, 2009) and then transformed to capture an emerging opportunity (Garud & Nayyar, 1994; Grant & Baden-Fuller, 2004). This complements the elements of ACAP by having a breadth of knowledge that is evaluated at the acquiring stage of ACAP.

Market orientation consistently represents a firm's ability to gather, assimilate, and respond to market intelligence (Jaworski & Kohli, 1993). Dynamic knowledge, such as customers' preferences and demands, competitors' actions and activities, and market conditions, are core business intelligence dimensions and are linked to superior performance (Hult & Jr., 2001; Jaworski & Kohli, 1993). Han et al. (1998) found that market orientation affects organisation innovativeness in both the technical and administrative dimensions. Vázquez et al. (2001) found that market orientation influences a firm's willingness to innovate and commercialise. However, market orientation requires strong coordination with

other capabilities to have an effective influence on radical and incremental innovation prosperity (Baker & Sinkula, 2005).

The literature highlights the impact of an organisation's networking capability and management on its innovation performance (Pittaway et al., 2004). Firms can differ significantly in their competence of managing networks to meet their innovation requirements (Pittaway et al., 2004). According to Gemünden, Heydebreck, & Herden (1992, P 373), who completed a study on 4,564 firms, "*Firms which do not supplement their internal resources and competence with complementary external resources and knowledge show a lower capability for realizing innovations*".

The richness of an organisation's linkage is vital for organisation. According to (Pittaway et al. 2004) different types of partners may lead to different types of innovation. Incremental innovation seems to be a result of more dependency on interaction with customers (Biemans, 1991). New-to-market products seem to be a result of relying on collaboration with suppliers and consultants (Baiman & Rajan, 2002; Ragatz, Handfield, & Scannell, 1997). Innovation that is more radical requires higher collaboration with universities (Häusler et al., 1994; Liyanage, 1995). Therefore, the firm's networking capability may represent an access for the firm to substitute the limitation of its VRIN resources, which is essential to the innovation process (Teece, 1986).

Chesbrough (2003) coined the term 'open innovation' advocating that firms must span out their boundaries, since bright ideas can exist outside the firm's boundaries, and that a firm can use external routes to market. The current globalisation of market seems to influence firms to put an emphasis on the reach of their linkage. Carlsson (2006) highlights globalisation of firms' R&D activities and internationalisation of the innovation system. Ernst (2002) argues that participation in a longer value chain opens new opportunities for the

firm and helps blend variety of local and international knowledge especially in developing countries.

From the above, we build on the (Lichtenthaler & Lichtenthaler, 2009) conceptualization of ‘connective capacity’ and interpret this capability to represent the processes and routines that influence an organisation’s understanding of its current environment and enhances the richness and reach of the organisation’s linkages with other entities that may affect its performance.

By reviewing of literature, we argue that an organisation’s ‘connective capacity’ can be disaggregated into three main dimensions: Richness (the ability an organisation to develop a variety of linkages with other entities) (Carlsson et al., 2002; Chesbrough, 2003; Gassmann & Enkel, 2004; Gemünden et al., 1996; Komninos, 2008); reach (The aggressive seeking for opportunities and linkages at an international level) (Carlsson, 2006; Ernst, 2002b; Komninos, 2008) and the firm’s market orientation (Hult & Jr., 2001; Jaworski & Kohli, 1993). Therefore, it is hypothesized that:

*H1A: A firm’s Connective Capacity has a positive effect on its innovation performance.*

*H1B: The relationship between the firm’s Connective Capacity and its innovation performance is positively moderated (reinforced) by environmental turbulence.*

Nevertheless, inter-organisational networks, although they can be complementary to the innovation process, cannot alone result in innovation (Harris, Coles, & Dickson, 2000).

## 4.2. Absorptive Capacity

When an opportunity is identified, it must be 'seized' in a new product, process, or service (Teece, 2007). Addressing opportunity is associated with the retention and development of technological competence and complementary assets (Teece, 2007).

Wang and Ahmed (2007) recognize absorptive capacity (ACAP) as a key dimension of their dynamic capability framework. Woiceshyn and Daellenbach (2005) explained in their studies how a company with higher absorptive capacity has a higher capacity to adapt to a technological shift. Empirically, George (2005) showed how learning a primary capability influences the development of complementary capabilities. Verona shows how continuous innovation is associated with a firm's capability to manage knowledge. Cepeda Carrion et al. (2010) highlight the imperative influence of absorptive capacity on a firm's innovativeness. Tsai (2001) demonstrate how absorptive capacity enables the firm to improve their innovation and performance through better utilisation of knowledge embedded in an inter-units relationship.

Zahra and George (2002) reconceptualised absorptive capacity into two dimensions: potential absorptive capacity (PACAP), which refers to the ability to acquire and assimilate knowledge, and realized absorptive capacity (RACAP), which refers to the ability to transform and exploit knowledge for commercial means. They argue that these multiple dimensions of knowledge capability represent an essential dynamic capability that helps an organisation to perform in a changing and technologically fast-moving environment. The recent development of ACAP emphasizes how its dynamic nature is embedded in the system process, the routine and structure of an organisation.

Lane, Koka, and Pathak (2006) and Lichtenthaler (2009) argue that ACAP dimension are embedded in an organisation's learning process. ACAP is viewed as a strategic renewal (Sun & Anderson, 2010) of its dependency on the system, process, and structure of the

organisation (Todorova & Durisin 2007; Zahra & George; 2002) and its influence on the organisation's development capability by enabling it to generate and utilize knowledge necessarily from strategic renewal, which leads to a balance between continuity and change at an organisational level (Crossan et al., 1999). Sun and Anderson (2010) highlighted the case of Xerox who pioneered the graphical user interface, yet failed to capture its benefits in opposing Apple and Microsoft. This demonstrates how the existence of prior knowledge is not enough. An organisation needs the ability to transform and exploit prior knowledge for commercial ends.

The view of ACAP as a dynamic capability highlights its ability to maintain the balance between exploration and exploitation, which is the core of the strategic renewal (Sun & Anderson, 2010). The studies on the antecedents of ACAP advocate the importance of elements, such as exposure to an external environment, social relationships, and organisational structure (Sun & Anderson, 2010). For instance, Matusik and Heeley (2005) pointed out that the effectiveness of ACAP depends on the level and density of contacts. Vera and Crossan (2004) highlighted the importance of having an ambidexterity in both transactional and transformational leadership to enable the strategic advantage of organisational learning. The transactional leadership style helps to emphasize and stabilize useful routines while the transformational style triggers routine change by challenging redundant beliefs and assertions of the organisation (Vera & M. Crossan, 2004) enabling the transformation dimension of ACAP (Sun and Anderson 2010). Therefore, it is hypothesized that:

*H2A: The organizational Absorptive Capacity has a positive effect on its innovation performance.*

*H2B: The relationship between the firm's Absorptive Capacity and its innovation performance is positively moderated (reinforced) by environmental turbulence.*

### **4.3. Ambidextrous Capacity**

With the emphases on sustainable competitive advantage in a turbulent environment, an underlying question is how can an organisation solve the dilemma of being efficient and innovative at the same time. Unfortunately, a McKinsey study showed that the life expectancy of firms in the S&P has dropped from 90 years in 1935 to an estimation of 30 years in 2005 (Foster & Kaplan, 2001). Another study on 6,772 firms across 40 industries over 25 years concludes that most of these firms are not achieving superior economic performance (Wiggins & Ruefli, 2002). These data might support the argument that organisations intrinsically suffer from inertia and inability to change (O'Reilly III & Tushman, 2008). Yet these studies do not explain why other companies are still have as strong position and a long record of survival such as IBM, GKN, Harris Corporation, B.F. Goodrich (O'Reilly III & Tushman, 2008) and a list of today's largest automobile manufacturers (Carroll, Bigelow, Seidel, & Tsai, 1996).

This requires more than static theories of strategy that emphasise position or resources advantages (Barnett et al., 1994; Porter, 1980) to better understand such phenomena (O'Reilly III and Tushman 2008). Dynamic capabilities theory consider sustainable competitive advantage at its core and highlights the central role of strategic leadership to adapt, integrate, and reconfigure organisational resources and skills to continually sense and seize opportunities in an unstable environment (Eisenhardt & Martin, 2000; Teece, 2007; Teece et al., 1997). According to Teece (2007), 'reconfiguring' is the continuous renewal, modification, and manipulation of resources and capability to achieve a sustainable competitive advantage in a changing market.

Nevertheless, underneath the dynamic capabilities model is a paradoxical set of capabilities. According to O'Reilly III and Tushman (2008), exploration and exploitation are two distinctive activities that require distinctive routines, process, and skills. Mastering these

two paradoxical capabilities is labelled 'ambidexterity' and it is probably the key capability that separates firms that survive as environments rapidly change from those that fail (Lubatkin et al., 2006; O'Reilly & Tushman, 2004; Rivkin & Siggelkow, 2003).

An ambidextrous organisation is capable of simultaneously handling two conflicting modes of the knowledge management process to exploit current competences and explore critical new domains (Lubatkin et al., 2006).

March (1991) relates innovation and knowledge management to activities associated with exploitation and exploration. Exploitation is based on product extending that results in profit maximizing and consistency, while exploration comprises a change in nature that results in a mix of high visibility success or severe failure (Taylor & Greve 2006). Wadhwa and Kotha (2006) view exploitation as continuously improving product offerings by configuring capabilities in an efficient and convergent manner. On the other hand, exploration requires a different set of abilities that comprise search, variation, and experimentation capabilities to produce a novel combination of knowledge. Although these two modes of knowledge process conflict (Lubatkin et al., 2006), they are of high importance for both successful product development (Sheremata, 2000) and long-term performance (Tushman & O'Reilly, 1996).

There is a variety of interpretations of organisational ambidexterity (agility vs. alignment, flexibility vs. efficiency, initiation vs. implementation, search vs. stability, and exploitation vs. exploration) and how it is implemented (simultaneously, cyclical, structural or at the process level) (Andriopoulos & Lewis, 2009; Gibson & Birkinshaw, 2004; Tallon & Pinsonneault, 2011).

At a strategic level, Gibson and Birkinshaw (2004) suggest that alignment and adaptability can be balanced simultaneously. "*Reconciling exploitation and exploration, the simultaneity of induced and autonomous strategy processes, synchronizing incremental and*

*discontinuous innovation, and balancing search and stability*” are prerequisites for organisational short- and long-term success (Raisch & Birkinshaw, 2008 p. 376). The significance of balancing between continuity and change has been highlighted in a number of studies (Brown & Eisenhardt, 1997; Leana & Barry, 2000; Meyer & Stensaker, 2006; Probst & Raisch, 2005; Volberda, 1996). The work of He and Wong (2004) empirically demonstrates that a firm’s growth rate is positively associated with interactions between both explorative and exploitive innovation strategies.

From a dynamic capability perspective, it is necessary to have an organisation strategy that permits both exploitation and exploration modes to take place internally in an integrated way (Gibson & Birkinshaw, 2004). Put clearly, the organisation must have the capacity to be adaptive in order to be respond to environmental change (Teece, 2007; Wang & Ahmed, 2007) and explore potential opportunities from new and existing knowledge (Wang & Ahmed, 2007; Zahra & George, 2002). An organisation must also have the capability to align all capability to exploit realized knowledge (Nelson & Winter, 1982; Teece, 2007) and achieving a critical balance between short-term success and long run survival (Gibson & Birkinshaw, 2004, O’Reilly III & Tushman, 2008). Therefore, it is hypothesized that:

*H3A: The organizational Ambidextrous Capacity has a positive effect on its innovation performance.*

*H3B: The relationship between the firm’s Ambidextrous Capacity and its innovation performance is positively moderated (reinforced) by environmental turbulence.*

## **5. Information Technology Resources**

Tarafdar and Gordon (2007) highlighted the importance of IT in the innovation process while Pavlou and El Sawy (2006) illustrated the impact of IT resources on new product development using the dynamic capability approach.

Resource picking and capability building have been viewed as strategic enablers for sustainable competitive advantage (Makadok, 2001). Within the IT context, scholars adopt this view to understand how IT contributes to a firm's sustainable competitive advantage (Wade & Hulland, 2004). One key view is that IT resources act as a complement to other organisational capability in an integrative way (Stoel & Muhanna, 2009; Melville et al., 2004) proposing an indirect relationship with a firm's performance (Ravinchandran & Lertwongsatien, 2005).

Although financial performance is the ultimate interest, it is only a result of successful precedents of competitive actions. Hence, it is suggested that heterogeneity of organisation capabilities mediate this relationship (D'Aveni, 1994). Strategically competitive actions are encapsulated in the organisation's capabilities of taking a step ahead of existing market modes of delivering value through innovation in product/service or channels (Ferrier et al. 1999, Jacobson 1992). Sambamurthy, Bharadwaj, and Grover (2003) argue that IT resources impact an organisation's dynamic capabilities by influencing its agility, entrepreneurial alertness and enhancing its knowledge, process, and richness through digitisation. Koellinger's (2008) work highlights the importance of IT resources as a key influencer of a firm's innovation performance.

Wade and Hulland (2004) categorise IT resources capabilities as follows: Inside-out (IT infrastructure, skills, development, and efficient operation) Outside-in (external relationship management and market responsiveness), and Spanning (IT-business partnerships and IT planning and change).

Leveraging the IT capability of a firm might facilitate its innovation capability in different dimensions. Innovation is a knowledge intensive process (Madhavan & Grover, 1998). IT can facilitate information flow throughout an organisation’s hierarchy (Alavi & Leidner, 2001). Nevertheless, a more comprehensive analysis is required to comprehend the complexity of innovation. Figure 1 represents a conceptual model of what we believe could help in achieving this research’s aims. Table 1 summarizes the key literature that comprises theoretical and empirical support of this framework.

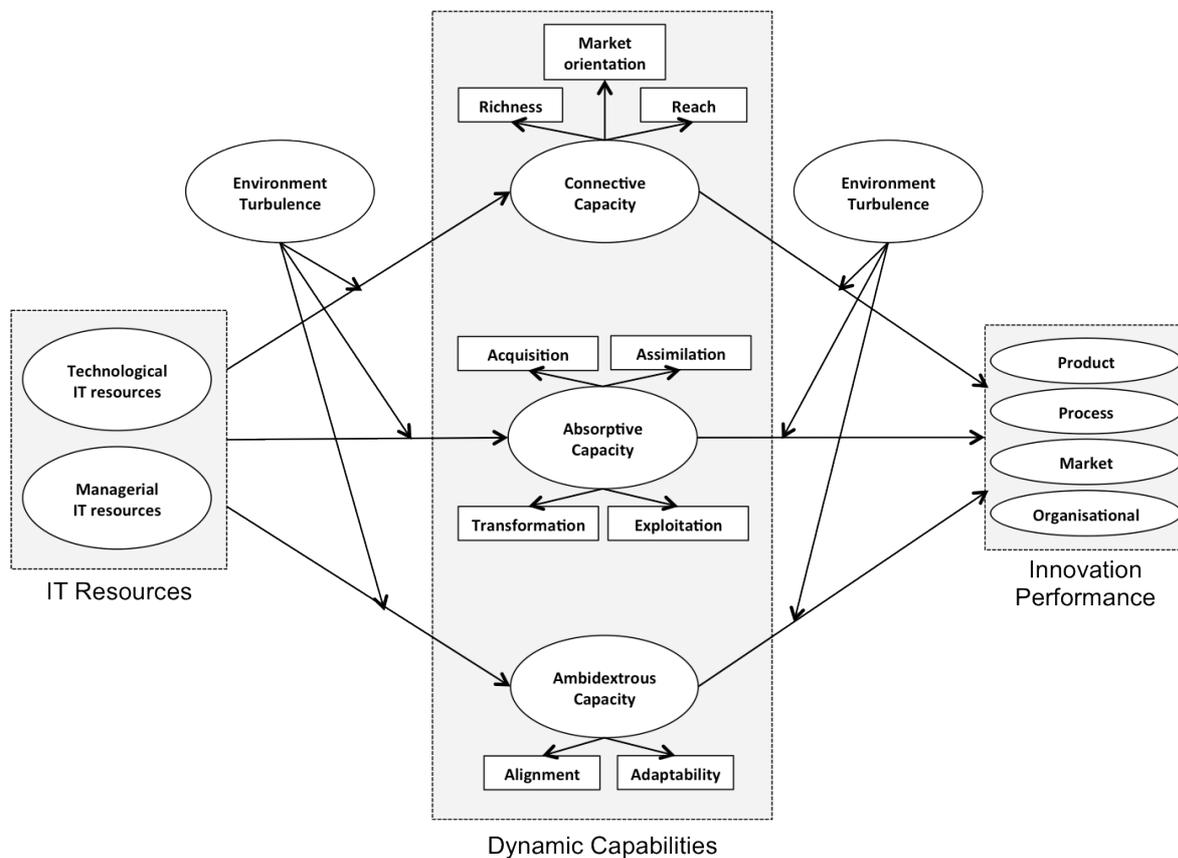


Figure 1: Proposed conceptual research model

Table 1: Literature map of the research framework

Dynamic Capability	Capability dimension	Impact on Innovation Performance	Impact of IT resources
Connective Capacity	Richness	Teece, (2007), Chesbrough (2003), Gassmann (2006), Fischer & Varga (2002), Bougrain & Haudeville (2002), Powell et al. (1996), Ahuja (2000), Powell et al. (1996), Pittaway, Robertson, Munir, Denyer, & Neely (2004), U. Lichtenthaler & E. Lichtenthaler (2009), H. G Gemünden, P. Heydebreck, & Herden (1992), Baiman & Rajan, (2002); Ragatz, Handfield, & Scannell, (1997)	Konsynski & McFarlan (1990), Zaheer & Venkatraman (1994), Srivardhana & Pawlowski (2007), Rai et al. (2006), Subramani (2004)
	Reach	Nelson & Winter (1982), Chesbrough (2003), Carlsson (2006), Ernst (2002), Komninos (2008)	Sambamurthy et al. (2003), Srivardhana & Pawlowski (2007), Rai et al. (2006), Rai et al. (2006)
	Market Orientation	Freeman (1974), Jaworski & Kohli (1993), Jin K. Han Han et al. (1998), Baker & Sinkula (2005)	Pavlou & El Sawy (2006), Overby et al. (2006), Min et al. (2002), Luce et al. (2009)
Absorptive Capacity	Acquisition	Wang & Ahmed (2007), Zahra & George (2002), Sun & Anderson (2010), W. Tsai (2001)	W. Tsai (2001), Pavlou & El Sawy (2006), Alavi & Leidner (2001), Gold et al. (2001), Srivardhana & S. D. Pawlowski (2007), Baskerville et al. (2000), Z. Lee & J. Lee (2000), Gattiker & Goodhue (2005)
	Assimilation		
	Transformation		
	Exploitation		
Ambidextrous Capacity	Adaptability	March (1991), Sheremata (2000), O'Reilly & Tushman (2008), Andriopoulos & Lewis (2009), He & Wong (2004), Gibson, Wang, & Ahamed	Tallon & Pinsonneault (2011), He & Wong (2004), Pinsonneault & Rivard (1998)
	Alignment		

### **5.1. The impact of IT resources on Connective Capacity**

Information technology facilitates the linkage of an organisation with its outer environment. Electronic data interchange EDI systems or other electronic media enhances the exchange of inter-organisational knowledge with key stakeholder such as partners, customers, suppliers, or other entities (Konsynski & McFarlan, 1990; Zaheer & Venkatraman, 1994). Sambamurthy et al. (2003) touches on the value of information technology in helping Accenture gain comprehensive access to codified knowledge from around the globe. Moreover, Srivardhana and Pawlowski (2007) argue that IT resources, such as enterprise resource planning (ERP), compromises knowledge of industries best practices embedded in the information system by vendors, consultancies, and other implementation partners. This leads to further exposure of a firm to other organisations' process and routines. Additionally, by using the fast capability of attaining and circulating information, Overby et al. (2006) suggest that the strategic use of IT resources can positively influence market orientation. Min et al. (2002) argue that an organisation could enhance the effectiveness and efficiency of its market orientation activity through the use of IT resources. Empirically, Luce et al. (2009) found that IT resources have a strong influence on market orientation. Similarly, Bhatt et al. (2010) found that IT resources enhance a firm's market orientation capability. Consequently, this enables IT to leverage a firm's dynamic capability (Pavlou & El Sawy, 2006). Rai et al. (2006) found that effective development of IT resources influences the fluidity of information about customers, suppliers, and other vital supply chain information. Subramani (2004) showed that IT deployment could lead to exploratory benefits through closer vender-supplier relationships. Therefore, it is hypothesized that:

*H4A: The firm's IT resources have a positive effect on its Connective Capacity.*

*H4B: The relationship between the firm's IT resources and its Connective Capacity is positively moderated (reinforced) by environmental turbulence.*

## **5.2. The Impact of IT resources on Absorptive Capacity**

According to Alavi and Leidner, since a firm's ability to obtain new knowledge depends on prior existing knowledge, IT resources "*increase the speed at which organizational memory can be accessed*" (2001, p. 119), which facilitates the recognition of existing knowledge and increases a firm's capability of valuing and acquiring external knowledge (Gold et al., 2001). Similarly, IT resources enhance the knowledge flow and exchanges across the organisation and facilitates communication, coordination, collaboration, collective interpreting, and problem solving (Alavi & Leidner, 2001; Gold et al., 2001) increasing cognitive fitness, which is crucial to assimilating the acquired knowledge (Gold et al., 2001; Todorova & Durisin, 2007).

Pavlou and El Sawy (2006) show empirically that IT resources facilitate access to codified knowledge and enhancing a firm's assimilation capability. In addition, they highlight that IT resources enhance problem solving capability and therefore, a firm's ability to generate new knowledge thereby enhancing its knowledge transformation capability. The researchers add that IT resources contribute to the new product development stage by modifying process and routines for knowledge exploitation.

Srivardhana and Pawlowski (2007) highlight the evolving nature of information systems, such as ERP, which is bridged by vendors and consultants after implementation through system upgrades and modification. This positively affects an organisation's absorptive capacity through higher exposure to evolving process and routines located outside the organisation's boundaries (Ko, Kirsch, & King, 2005; Lee & Lee, 2000; Timbrell, Andrews, & Gable, 2001). Nevertheless, this supports that technology IT resources, such as hardware and software, are easy to copy and require complementing capability to represent a sustainable competitive advantage (Wade & Hulland, 2004).

A key dimension of absorptive capacity is realizing its potential, which requires a higher level of knowledge sharing and understanding across an entire organisation (Spender, 1996; Zahra & George, 2002). IT resources impact the content and structure of organisational knowledge (Baskerville et al., 2000; Lee and Lee, 2000) reducing the complexity of its user's jobs and facilitating a broader set of cross-functional knowledge (Baskerville et al., 2000; Robey, Ross, & Boudreau, 2002), which influences knowledge exchange and understanding. In addition, IT resources facilitates access to common knowledge repositories by multiple business functions and department (Gattiker & Goodhue, 2005) enhancing organisational memory (Goodman, Darr, Ameden, & DeMattia, 1996; Walsh & Ungson, 1991) and in return influencing a firm's ability to acquire, assimilate, transform, and exploit knowledge. Therefore, it is hypothesized that:

*H5A: The firm's IT resources have a positive effect on its Absorptive Capacity.*

*H5B: The relationship between the firm's IT resources and its Absorptive Capacity is positively moderated (reinforced) by environmental turbulence.*

### **5.3. The Impact of IT resources on Ambidextrous Capacity**

From an organisational strategy perspective, a recent study by Tallon and Pinsonneault (2011) shows that IT resources can enable organisational ambidexterity (i.e. alignment and agility). The strategic alignment of IT resources with business strategy impacts profit, productivity, sales growth, and reputation (Bessant & Tidd, 2007; Chan et al., 2006; Preston & Karahanna, 2009; Tallon, 2007). Similarly, agility has been highlighted as a crucial characteristic in dynamic environments (Hitt et al., 1998; Rai et al., 2006; Sambamurthy et al., 2003; Weill et al., 2002). Alignment through user utilisation of IT resources (Chan et al., 1997; Sabherwal et al., 2001; Tallon, 2007) encapsulates a learning genesis that can stimulate users to identify improvements in the use of existing IT resources or introduce innovative ways of combining IT and non-IT resources that in turn enables organisational agility (He & Wong, 2004; Pinsonneault & Rivard, 1998). Therefore, it is hypothesized that:

*H6A: The firm's IT resources have a positive effect on its Ambidextrous Capacity.*

*H6B: The relationship between the firm's IT resources and its Ambidextrous Capacity is positively moderated (reinforced) by environmental turbulence.*

## **6. Conclusion**

This work is aimed at developing a research framework that understands the impact of IT resources on innovation performance. The literature review reveals that innovation performance is a complex behaviour that is influenced by a variety of capabilities. Three vital dynamic capabilities were identified. The ‘connective capacity’ of a firm impacts its access to knowledge and the in local in foreign markets. This affects the firm’s ability to adapt to fast changes in the environment and/or complement the limited access to VRIN resources. The ‘absorptive capacity’ touches on a firm’s ability to utilise its resources to acquire and interpret knowledge and capture its benefit for commercial ends. The ‘ambidextrous capacity’ represents the strategic mode of the organisation that manipulates resources to balance between exploration and exploitation, which is imperative for innovation and commercialisation. We argue that these three capabilities can mediate the relationship between IT resources and a firm’s innovation performance. At this early stage of the research, our work lacks the validation of instruments and the data required to draw conclusions on such relationships, which will be the subsequent phase of this research. At the current stage, we look forward to receiving critique and feedback that will help us improve our understanding on how to best achieve this research’s aims.

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