Synergies of Firms' Innovation Dynamic capabilities and Information Technology

A Study of Saudi Firms' Innovation Performance and Practices

A thesis submitted for the degree of Doctor of Philosophy

By

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Abstract

The ability of firms to innovate has become a cornerstone in the economy of many developed and developing countries. The performance of firms is not exclusively linked to their internal capability. Other external factors, such as technology, globalisation of the market, knowledge, and evolving approaches to value offering, force them to constantly change their approaches to wealth creation. Innovation is vital for firms' competitive advantage. Hence, a firm with higher innovation prosperity compared to its rivals has a crucial advantage that enables it to compete in local and global markets. However, innovation is a complex phenomenon, and a holistic view is required for a deep understanding of the factors that influence firms' innovation performance. Day after day, markets are becoming more dynamic, increasing the necessity to understand how such momentum affects innovation performance. With a focus on how they develop strategic routines that enhance their assessment of opportunities and resource-configuration capabilities, firms may better align their products and services with market demands. Using state-of-the-art dynamic-capability theory, this research highlights the routines of firms that influence their abilities to acquire and multiply knowledge and technology consistent with market status, leading to more novel and successful innovative products and processes as well as better economic advantage. This research aims to provide a framework that comprises factors that may influence Saudi firms' innovation performance. Furthermore, the research aim attempts to understand the impact of information technology on firms' innovation performance. The research is based on survey data from 203 Saudi firms registered at the Riyadh Chamber of Commerce and Industry. The empirical results suggest that firms may enhance their ability to acquire, assimilate, transform, and exploit knowledge by increasing their breadth of knowledge sources and by internationalizing their searching activities for knowledge and skills. Moreover, both explorative and exploitative innovation strategies, although paradoxes, are significant to increasing firms' overall innovative performance. Mutually, information technology (IT) plays a critical role in complementing firms' dynamic capabilities through better provision of IT infrastructure, while IT effectiveness and IT flexibility are vital to increasing firms' abilities to maintain both long-term and short-term competitiveness.

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Dedication

I share with my family all of the beautiful and difficult moments. This thesis stands primarily on the support of many people. I wish to highlight my appreciation of my parents, who provided me from childhood with all possible support and made me believe that dreams are achievable. I also highlight my wife for her support, patience, and sacrifices during this long journey. I am very thankful for my son, Abdullah, for his smile that boosts me day after day with energy and charges my soul to confront challenges. I also appreciate my brother and sisters for all of their love and support.

Publications and Conferences

Albesher, A., & De Coster, R. (2013). *Critical routines for higher innovation prosperity: A dynamic capabilities perspective.* CADMC, Cambridge University, Cambridge.

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De Coster, R., & Albesher, A. (2012). The development of mobile service applications for consumers and intelligent networks. In I. Lee (Ed.), *Mobile Services Industries, Technologies, and Applications in the Global Economy* (pp. 273–289). Hershey, PA: IGI Global.

Seminars

Albesher, A. (2012). *Critical practises for higher innovation performance*. ResCon. Brunel University, London.

Albesher, A. (2012). The impact of IT on the firms' innovation performance. *Advanced Manufacturing and Enterprise Engineering (AMEE) seminars*. Brunel University, London.

Albesher, A. (2011). *System of innovation in Saudi Arabia*. ResCon. Brunel University, London.

Albesher, A. (2011). Intelligent cities. *Advanced Manufacturing and Enterprise Engineering (AMEE) seminars.* Brunel University, London.

Abbreviations

ACAP	Absorptive capacity
AMB	Ambidextrous capacity
ANOVA	Analysis of variance
EFA	Exploratory factor analysis
ENV	Environment turbulence
EXL	Exploitative innovation
EXR	Explorative innovation
KMO	Kaiser-Meyer-Olkin measure of sampling adequacy
KPIs	Key performance indicators
PACAP	Potential absorptive capacity
PCB	Printed circuit board
RACAP	Realised absorptive capacity
RAD	Innovation radicalness index
RBV	Resource-based view
RF	Radio Frequency
SDK	Software development kit
SMEs	Small and medium enterprises
VRIN	Valuable, rare, inimitable, and non-substitutable

Chapter 1: Introduction

1.1 Background of The Study

Markets are becoming more dynamic, day after day, thus increasing the necessity to comprehend how this dynamism affects innovation performance (Eisenhardt & Martin, 2000; Teece, 2007; Zahra & George, 2002). The first stages of the innovation funnel model are critical and may affect whether the results of new product development will lead to innovation failure or prosperity (Khilji et al., 2006; Sun & Anderson, 2010). Yet innovation is a complex phenomenon; a firm's performance may differ from that of others, not only based on its internal capabilities but because of the effect that the macro-environment has on the firm's ability to succeed in innovation. Therefore, the external environment, and the way in which organizations interact with it, impacts the transition of knowledge to practice and influences the modification of the organizations' routines. According to Komninos (2008), *"These fundamental processes of innovation (routine, search and selection environment) create a cognitive space, which is specific and exclusive to each environment"* (p. 51). Nelson and Winter (1982) suggested that innovation is constrained by the technology environment, which acts as a "technology regime" in which an organization conducts its activities. They added that the technology regime has two forms: the *entrepreneurship regime,* which is linked to scientific research, and the *routinized regime,* which is linked to the firm's knowledge base. Breschi (2000) highlighted four dimensions of a technological regime: opportunity conditions, appropriable conditions, cumulativeness of innovation, and the nature of knowledge.

Komninos (2008, p. 49) suggested that innovation performance is also associated with external factors, such as expenditures of other firms and universities on R&D, in addition to internal knowledge activities (firm's investment in its own R&D). Consequently, different agglomerations of firms, universities, and other institutions result in an uneven distribution of innovation-performance firms located in different clusters, regions, or nations. Piergiovanni and Santarelli (2001) demonstrated the same phenomenon in France (i.e. the spillover from universities showed a significant source of innovation in private and state-owned industries when compared with the in-house research). This indicates that firms in less-developed countries may not have much benefit from the local knowledge spillover, and, hence, the ability to reach valuable external knowledge at a

global level is imperative. Many developing countries exhibit moderate or even low innovation performance. For instance, Saudi Arabia is ranked 42nd by the Global Innovation Index as 42nd in 2013 but was 54th in 2011. The report highlights key aspects of the environment that may affect innovation, such as institutions, human capital, infrastructure, market sophistication, and business sophistication. Saudi Arabia is the largest country in the Gulf region of the Middle East and one of the largest oil providers in the world. Between 2002 and 2011, the Saudi Arabia stock market recorded an average growth of 26.36% in trading value (Ibrahim, 2013). The Saudi economy has expanded dramatically in the last decade as a result of its huge role in the oil market, yet the Saudi government understands that the oil economy is not sustainable and is urging transformation into a more knowledge-based economy (Onsman, 2010).

At the heart of the knowledge economy, innovation is critical for the long-term survival of companies (Trippl, 2010). Innovation is a complex phenomenon, and it is critical to identify the scope of the research and the perspective of the analysis. Since firms are a critical, active part of any national innovation system, it is vital to examine firms' innovation activities and measure their innovation output. Therefore, analysing information from firms regarding innovation activity may help to improve the way they pursue innovation and how governments stimulate such activity. Studying innovation at the firm level is part of the complexity of innovation research (Keupp et al., 2012). This is due to fragmentation of views in regard to the relationship between innovation, resources, and performance (Keupp et al., 2012). Hence, the analysis of innovation performance at the organizational level requires more attention (Keupp et al., 2012). This thesis blends the dynamic capabilities theory with networking theory, absorptive capacity, and ambidextrous capacity to identify factors that might better explain the innovation performances at the firm level. It proposes a more comprehensive model that integrates different views of innovation capabilities, portraying how these different capabilities work together to facilitate knowledge transition and development inside firms. It is proposed that at the recognition stage of external knowledge and opportunities, a firm's breadth of knowledge sources, market intelligence generation, and internationalization orientation are critical factors that may stimulate its ability to recognise, absorb, and use knowledge. Potential absorptive capacity and realised absorptive capacity comprise the routines that help firms acquire, assimilate, transform, and exploit absorbed knowledge into innovative products and services. Ambidextrous capacity stimulates the firm to pursue both incremental and radical innovation (through exploitation and exploration innovation strategy, respectively)

in order to maintain both a long-term and short-term competitive advantage. The research further examines the influence of information-technology capabilities on firms' dynamic capabilities.

1.2 Motivations for the Research

This research attempts to identify and test factors that affect Saudi firms' innovation performance and the impact of information technology on these factors. This research is practically and academically motivated. Academically, research in the area of innovation has recently captured a large amount of attention. It is a multidisciplinary field that comprises different perspectives: strategy, design, entrepreneurship, new-product development, human resources, and firm performance are a few examples of areas that are overlapped to comprehend innovation success. According to Keupp et al. (2012), current knowledge regarding firms' innovation is fragmentary, and firm-level research requires more attention. Furthermore, internationalization of learning processes has become an attractive area of research, as new opportunities for firms may exist outside their local markets. Hence, the interplay between firms and foreign knowledge is important to investigate (De Clercq et al., 2012). These two points motivate this research to explore the factors that may affect the abilities of Saudi firms to learn and utilise knowledge for better innovation performance. It is urged that this gap be addressed through vibrant and rigorous analysis of relationships between distinctive innovation capabilities, including the role of information technology in the context of the innovation pathway (Joshi et al., 2010; Benitez-Amado et al., 2010; Easterby-Smith et al., 2009).

This research is also motivated by the recent theory of dynamic capabilities by Teece (2007) and utilises different areas of knowledge deductively in an integral effort, including networking theory, knowledge absorptive capacity, innovation strategy, and information technology. This research attempts to take Teece's (2007) theoretical model a few steps further by identifying and testing related factors through operationalisation and empirical investigation. This should contribute to the gaps highlighted by scholars (Volberda et al., 2010; Datta, 2012; Teece, 2007; Keupp et al., 2012; Gupta et al., 2006; Benitez-Amado et al., 2010; Easterby-Smith et al., 2009) for advancing and enriching with empirical data the field of dynamic capabilities, absorptive capacity and the role of IT in the context of innovation. This research also contributes to the gaps proposed by (Iqbal, 2011; Shin et al; 2012) regarding capabilities and innovation of Saudi firms.

The results will probably provide future researchers with alternative paths of investigation that will help improve understanding of the innovation phenomenon. Furthermore, the results may aid government intervention in gaining a clearer picture of the areas in which firms may need support with regard to innovation, and move further from simple financial support.

Currently the economy is highly dependent on knowledge and knowledge development. Innovation is at the core of the knowledge economy. Saudi Arabia is highly attached to its oil wealth. Hence, its economy, to a large extent, is tied to unsustainable resources. The Saudi government has put a lot of effort into transforming into a knowledge economy by investing in a knowledge infrastructure. Therefore, the ability to understand how Saudi firms could increase their ability to innovate will further contribute to this aim. By identifying practices that facilitate innovation success, Saudi firms may understand how better to develop their internal innovation capabilities and utilise information technology to promote innovation propensity. Moreover, the results of this research will probably provide useful information to the government in understanding how to stimulate innovation activities and reduce obstacles that may challenge Saudi firms. The theoretical model of this research is based on theories and propositions that attempt to explain the innovation phenomenon of firms in both developed and developing countries.

1.3 Aims, Objectives, and Research Questions

This research focuses on the firm-level (strategic) capabilities that enhance firms' innovation performance. Since innovation is associated with change and exploration, there is a need to adopt a theory associated with firms' practices that lead to change in their value provision in order to achieve a sustainable competitive advantage. Dynamic capabilities theory focuses on higher-order level practices that help firms to enhance their operational capabilities at a lower-order level through enabling continuous learning and reconfiguration of resource. Moreover, the dynamic capabilities theory can be used to understand the impact of information technology on firms' innovation capabilities. Hence, this research will use the dynamic capabilities theory deductively in the context of firms' innovation to achieve the aim of this research.

Aim

The aim of this study is to examine the organizational and information technology capabilities concerning knowledge development and innovation performance of Saudi firms.

Research Questions

In order to achieve the research aim, the researcher needs to identify the practices that may reflect the dynamic capabilities theory in the context of innovation. After identifying these practices, the researcher can then study whether these practices stimulate the firms' innovation performance. Moreover, the researcher may also examine the impact of information technology on the practices identified. Therefore, the following research questions are raised:

1. What are the practices that might reflect firms' dynamic capabilities in the context of innovation?
2. What is the role of information technology in firms' dynamic capabilities?
3. Are dynamic capabilities valuable for stimulating firms' innovation performance?

Objectives

In order to meet the research aim and answer the research questions, a number of objectives need to be addressed. The objectives should enable the researcher to extract factors related to dynamic capabilities and information technology in the context of firms' innovation, integrate these factors in a model using knowledge creation and development as the logic of integration, and test the model to verify if these factors have a significant impact in the innovation process inside firms. Therefore, the following objectives are proposed:

1. Conduct a comprehensive literature review using a thematic approach to identify the factors that reflect firms' dynamic capabilities in the context of innovation.
2. Integrate the identified factors in a model that reflects the dynamic capabilities in the context of firms' innovation.
3. Examine the role of information technology on firms' dynamic capabilities.
4. Empirically test the research model by evaluating it in the context of the deployment of innovative products and services using innovation measures that reflect the innovation radicalness and innovation sales performance.

The first and second objectives will help to answer the first research questions. The third objective will help to answer the second research question. The last objective will help to answer the third research questions , whilst also helping to test and verify the research model devised during this research.

1.4 The Context of This Study

This study examines and analyses the innovation capabilities of firms in Saudi Arabia. Saudi Arabia is the largest country of the Gulf Cooperation Countries (GCC). The study explores firms' practices and their abilities to interact with local and global sources of knowledge. This includes (a) a firm's ability to identify opportunities and utilise external sources of knowledge and technology for innovating activities; (b) the firm's internal practices that allow knowledge transition and transformation for innovative products and services; (c) the different innovation strategies a firm adopts and their impact on innovation performance; (d) improved measurements for a firm's innovation performance; and (e) the role of different information technology capabilities on the firm's innovation capabilities.

The research approach is dominated by the quantitative research method due to the gap in quantitative research in the areas of dynamic capabilities and innovation

performance. Further, the quantitative data regarding firms' innovation activities in the GCC are lacking to a large extent. Moreover, the quantitative research allows for a more rigorous and scientific examination to identify significant factors that affect innovation performance through scanning activities and practices of a larger number of firms. In the field of innovation, a number of different case studies have been reported regarding firms' fragmented innovation activities, yet it is not clear if such practices can be generalised or if they are specific to the firms that have been examined. Hence, a more holistic firm-level analysis using a wider range of firms of different sizes and different industries may allow for a clearer picture of the practices that are significant for firms' innovation performance. In addition, a qualitative technique is adopted to validate the results of the quantitative research to add a degree of the mixed-method approach to allow for exploring the scope of this research using different approaches.

1.5 Significance of the Research

Currently, the pressure is placed on organizations to either innovate or die (Hing et al., 2012). This is due to the transformation toward a knowledge-based economy in which learning capabilities and innovation are critical for organization survival (Huggins & Strakova, 2012). Yet many organizations experience learning disabilities, and as result fail to operate as knowledge-based organizations (Hing et al., 2012). This research provides a holistic view of firms' practices of knowledge development which contribute to innovation performance. Using the dynamic capabilities theory, this research proposes and analyses different dimensions of firms' capabilities to interact with their ecosystems and increase their adaption to shift with markets and technologies. Using 203 responses from firms regarding their innovation activities, a clearer picture may be obtained regarding the differences between high and low-innovation performance firms in terms of their internal innovation capabilities and innovation strategies.

As a result, a model may be proposed to augment the knowledge flow and progress inside the firms, as well as their ability to exploit innovative products and services. The quantitative data are valuable and practical at the governmental level for a better understanding of how best to support firms, especially smaller ones, through targeting fragile innovation capabilities as an alternative to blind financial support. In a more specific context, this research provides the government of Saudi Arabia and the GCC with a better feeling of the results of their innovation policy activities though numeric expressions that allow more accurate future interventions. Further, this research provides

executives with practical information on how to better utilise available resources through implanting practices that direct efforts inside their boundaries toward a knowledge-based orientation that helps to increase their innovation performance. From a different perspective, the practices identified in this research might act as a foundation for risk assessments for funded innovation projects, as the research suggests that firms that exhibit lower abilities in these practices have lower innovation performance. In addition, this research highlights the role of information technology in influencing firms' innovation activities. This provides insights for IT-solution providers regarding the shift of requirements for firms that seek innovation. It further provides a foundation for how cloud computing might provide smaller firms with better support for their innovation activities.

1.6 Thesis Outline

Chapter 1: This chapter includes an introduction to the research and its scope. It also comprises the motivation of this research, the aims, objectives, and research questions.

Chapter 2: This chapter includes the literature review of this research. It follows a thematic style and aims to explore relevant scholars' works in the areas of systems of innovation, dynamic capabilities, and information technology, with an aim to construct the theoretical model for this research.

Chapter 3: This chapter links the key elements that emerge from the literature review and states the hypotheses of this research. It further comprises the research model that will be tested and revised in the later chapters.

Chapter 4: This chapter refers to the methodology of this research. It starts by reviewing research paradigms and different methods. It also shows the research plan of this research. The chapter also includes data-screening and filtration processes in order to prepare data for analysis.

Chapter 5: This chapter includes the reliability and validity analysis, which aims to prepare variables for hierarchical regression analysis. The chapter also covers the empirical research findings and portrays the findings of the survey, using charts and diagrams related to the factors hypothesised. This chapter also covers the t-test, ANOVA and regression analysis, and the validation interviews of the research finding.

Chapter 6: This chapter discusses results and links findings to other studies. It further links the finding of this research with gaps highlighted by other scholars.

Chapter 7: This chapter summarises the research findings, the significance of the research findings and the uniqueness of this research. The chapter also highlights the theoretical contributions and practical implications of this research, commenting on the research limitations, and recommendations for future research, closing with a brief conclusion.

Chapter 2: Literature Review

The previous chapter presented this research through a brief introduction to the firms' innovation phenomenon, which is the objective and motivation of this research. This chapter attempts to establish the theoretical foundation of this research through a literature review. The first part of the literature review involves recent studies regarding firms' innovation in order to identify the research gap. It is found that there is a lack of knowledge regarding the factors that affect innovation at the firm level (Gupta et al., 2006; Keupp et al., 2012). Furthermore, research in the field of capabilities and innovation lacks empirical data (Wang & Ahmed, 2007). More specifically, Shin et al. (2012) highlight the need for further studies of Saudi firms due to a lack of empirical data as this may have significant practical implications for Saudi knowledge-based economy. Such research will portray the innovation practices that might be targeted to enhance the firms' innovation performance. The second part of the literature review is associated with firms' dynamic capabilities theory. The researcher adopted the dynamic capabilities theory to identify firm-level factors that may influence innovation performance. The last part of the literature review focuses on the impact of information technology on the innovation process within a firm. This chapter is an attempt to review literature in the area of firms' innovation at the firm level in a thematic approach to identify the capabilities that enable firms to achieve higher innovation performance.

2.1 Introduction

Understanding innovation at the firm level is part of the complexity of the innovation research (Keupp et al., 2012). Most of the previous studies that focus on analysing innovation as an outcome fall into three categories: measures of patents as a proxy for innovation outcome, new-product development (NPD), or financial performance measurement. Patenting may be a result of licensing negotiations; hence it may not be directly associated with a firm's ability to innovate (Blind et al., 2006). Other scholars stressed that innovation must incorporate an element of success and that it must be able to generate economic advantage; hence they consider the ability of innovation to generate sales as an appropriate proxy. This view is well established and widely adopted in previous research (Kirner et al., 2009; Serrano-Bedia, et al., 2012).

More important is to understand how firms pursue innovation and what factors affect their success. Gupta et al. (2006) highlighted that many scholars have attempted to

understand the innovation processes. They added that proposed models for the process of innovation and its management, however, are still not clear. Gupta et al (2006) also stated that the majority of previous work in research on innovation falls into three categories: (a) the effect of the organization's networking on the different kinds of organizational innovation; (b) a focus on antecedents that stimulate the degree of an organization's prosperity in technical innovation; and (c) research into new product development within the organization's boundary with a focus on innovation strategy, such as ambidexterity. Yet this fragmentation of views is not useful in explaining the relationship between innovation, resources, and performance (Keupp et al., 2012). Keupp et al. (2012) highlighted that analysis at an organizational level requires more attention.

At the inter-organizational level, a number of studies have stressed the importance of inter-organizational linkages in innovation performance. For instance, the work of Duysters and de Man (2005) showed that 73% of the quantitative research data concerning strategic alliances indicated a positive impact with innovative performance, whilst 10% of the data indicated a significant negative relationship.

However, mixed findings exist. For instance, Pullen et al. (2012) showed that small and medium enterprises (SMEs), with a focus on goals complementary with their NPD partners, have higher innovation performance than other SMEs. On the other hand, Sadowski and Duysters (2008) found a high rate of termination of strategic-technology alliances and a negative attitude toward joint benefits and the existence of win-win relationships. Firm knowledge capability may be an answer for the way a firm fails to benefit in its technological alliances (Sadowski & Duysters, 2008).

The antecedents of innovation at the organizational level, the internal practices of the organization, how resources are used, the structure of communications, and the flow of information are examples of factors that affect an organization's overall efficiency (Karim, 2009; Keupp et al., 2012). Martınez-Roman et al. (2011) studied the importance of a number of factors, such as knowledge capabilities, human capital, and organizational structure, and their impact on the innovation outcomes of SMEs in Spain. It is critical to be aware that innovation requires an integral effort to achieve prosperity. For instance, Khilji et al. (2006) found that biotech entrepreneurs who do not pay attention to commercialisation of knowledge affect their own ability to fully benefit from their invention potential. They suggested that developing effective collaboration and

organizational capabilities is crucial for successful entrepreneurial activities, although their study lacked strong empirical support for their arguments. Inauen and Schenker-Wicki (2011) found in their empirical study that openness of R&D activities of stock-listed companies in Germany, Switzerland, and Austria toward customers, suppliers, and universities has a positive impact on their innovation output.

Lichtenthaler and Lichtenthaler (2009) identified six theoretical capabilities that affect organizations' open innovation and suggested that inventive, absorptive, transformative, connective, innovative, and desorption capacities are knowledge capabilities that enable an organization's dynamism. Their work proposed that multiple organizational capabilities are required for firms to take advantage of external knowledge sources. Yet their proposal lacked empirical data to confirm their proposition. Serrano-Bedia et al. (2012) analysed whether there is an existing relationship between innovation activities - including internal innovation activities, external innovation activities, and cooperative R&D - and innovation performance. They found that Spanish firms struggled to manage both internal and external innovation activities simultaneously and that firms showed better results when focusing on one of them. This added to the importance of understanding how firms manage their internal practices so that they are able to absorb external knowledge and integrate it with existing knowledge for better competitive advantage (Lichtenthaler & Lichtenthaler, 2009; Teece, 2007).

Leiponen and Helfat (2010) found in their empirical work that, in a wider respect, knowledge sources and innovation objectives (introducing new products, enhancing quality, or increasing flexibility of production) are linked to innovation prosperity. Chang et al.'s (2012) work examined the effect of certain organizational capabilities. They examined the participation with external entities (openness capability), technology-renewal strategy (autonomy capability), integration of previous and new knowledge (integration capability), and experimentation capability of 112 Taiwanese manufacturing firms. They found that these capabilities have positive impacts on radical innovation performance. Using a sample from a large data set from a U.K. innovation survey, Laursen and Salter (2006) examined the effects of having larger breadth- and depth-of-knowledge sources at different levels upon innovation radicalness. They found that it is important for firms to deepen their understanding of different users, technologies, and markets, and that firms that are too internally focused may miss opportunities.

Clearly, innovation of firms at the firm-level requires a holistic lens that incorporates the organization's internal capabilities with external factors that affect market and technology status. The above studies are fragmented in regard to how firms may successfully utilise new knowledge and cooperate with external partners. In the current state of shorter product life cycles, market globalisation, fast-moving technologies, and high competitiveness, it is difficult to assume that firms may rely solely on their internal capabilities in isolation from such critical external factors. The following section reviews the concept of innovation and then moves on to theories regarding systems of innovation that place emphasis on the impact of inter-organizational interaction on a firm's innovation performance.

2.2 Innovation Theories and a Review of the Concept

2.2.1 Definitions of Innovation

The word innovation is derived from the Latin word *nova*, which means "new" (Smith, 2010, p. 9), carrying an element of novelty at its core. A recent review by Baregheh et al (2009) identified about 60 definitions in various disciplines including business and management, economics, organization studies, innovation and entrepreneurship technology, science and engineering, knowledge management, and marketing. For instance, Rogers (1995) defined innovation as "*an idea, practice or object that is perceived as new by an individual or other unit of adoption*" (p. 11). With regard to competitive advantage, innovation refers to a firm's embrace of new products and/or processes to improve performance and competitiveness (O'Regan et al., 2006). Beije (1998) attempted to capture the definition in the context of firms' innovation as: "*Innovations are new things applied in the business of producing, distributing and consuming products or services*" (p. 1). It is crucial to indicate that not all novel ideas can be successfully implemented to lead to successful innovation. In this regard, the Department of Trade and Industry (2004) defined innovation as "*the successful exploitation of ideas*" (p. 5). More relevant to the context of firms, Freeman and Soete (1997) defined innovation as "*the first commercial application or production of new process or product*" (p. 1). Similarly, Becker and Whisler (1967) distinguished between innovation and invention. They stressed the following: "*Innovation is a process that follows invention, being separated from invention in time. Invention is the creative act,*

while innovation is the first or early employment of an idea by one organization or a set of organizations with similar goals" (p. 463). Baregheh et al., (2009) attempted to integrate various definitions of innovation as "*the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace*" (p. 1,334).

Therefore, it is clear that a line must be drawn between novel ideas (inventions) and innovation (Smith, 2010). To be more practical, innovation includes stages or processes that comprise different activities, such as research and development, financing, and marketing. Innovation has three fundamental stages: invention, commercialisation, and diffusion (Smith, 2010). Each stage requires different capabilities that handle the knowledge transformation and progression toward final innovative products and services.

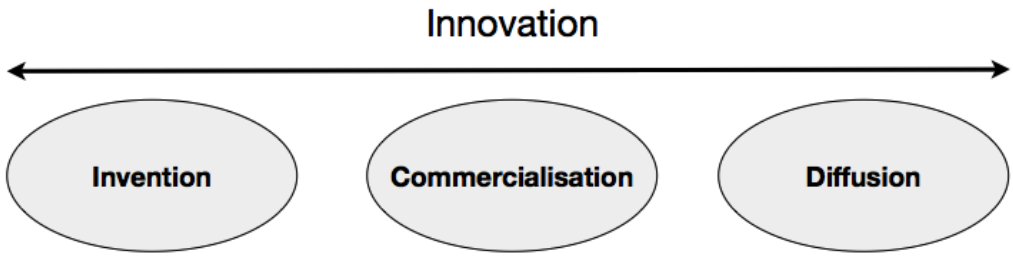


Figure 2.1: Innovation stages
Source: Smith (2010, p. 9).

2.2.2 Models of Innovation

Innovation has been modelled from many different perspectives. For instance, the static model views innovation from the perspective of organizational capability (referred to as "*organizational view classification*") (Afuah, 2003). In this model, innovation is viewed as *radical* when the knowledge required is totally different from the knowledge in the market (Afuah, 2003). Radical innovations are competence destroyers, since they cause a dramatic shift in the technologies used in the markets (Afuah, 2003). On the other hand, *increment* innovation is based on knowledge existing in the markets. Such innovations are said to be competence enhancers (Afuah, 2003).

Abernathy and Clark's (1985) model categorised innovation based on firms' market and technological capabilities. A firm's technological capability may be outdated

yet still compete, based on its market capability. Abernathy and Clark's model results in a matrix of four classes of innovation based on preservation or distortion of market and technological capability: (a) regular innovation is based on existing technological capabilities and market knowledge; (b) niche innovation is based on technological capabilities, while market knowledge is obsolete; (c) revolutionary innovation makes technological capabilities obsolete while preserving market knowledge; and (d) architectural innovation renders both technological and market capabilities obsolete (Popadiuk & Choo, 2006).

Table 2.1: Abernathy and Clark's model (1985)
Source: Popadiuk & Choo (2006)

Market Knowledge	Technical Capabilities	
	Preserved	***Destroyed***
Preserved	Regular innovation	Revolutionary innovation
Destroyed	Niche innovation	Architectural innovation

Henderson and Clark's (1990) model suggested that product innovation requires two types of knowledge: knowledge of a product's components, and knowledge of the integration between components (architectural knowledge). Architectural knowledge *"... changes the way in which the components of a product are linked together, while leaving the core design concepts (and thus the basic knowledge underlying the components) untouched"* (Henderson & Clark, 1990, p. 10).

The combination of component and architectural knowledge creates four classes of innovation: (a) incremental innovation, in which both architectural and component knowledge are improved; (b) radical innovation, in which both types of knowledge have a major shift of development or are "destroyed"; (c) architectural innovation, in which component knowledge is enhanced but architectural knowledge is destroyed; and (d) modular innovation, in which component knowledge is destroyed but architectural knowledge is enhanced.

Table 2.2: Henderson and Clark's (1990) model

Source: Popadiuk & Choo (2006)

Component Knowledge	Architectural Knowledge	
	Enhanced	***Destroyed***
Enhanced	Incremental innovation	Architectural innovation
Destroyed	Modular innovation	Radical innovation

Tushman et al.'s (1997) model also suggested four classes of innovation: (a) architectural innovation, in which new markets are formed with an incremental improvement in technology; (b) incremental products, service, or process innovation, with incremental improvement in technology in existing markets; (c) major product or service innovation, a radical development in technology, and the formation of new markets; and (d) major process innovation, a radical development in technology in the existing market. Generational innovation, a fifth class of innovation, characterises an intermediate phase, at which market and technology are in continuous changes. This class is represented in Table 2.3 by the circle in the middle.

Table 2.3: Tushman et al.'s (1997) model

Source: Popadiuk & Choo (2006)

Market	Technology – (R & D)	
	Incremental	***Radical***
New	Architectural innovation	Major product, service innovation
Existing	Incremental product, service, process	Major process innovation

Chandy and Tellis' (1998) model portrayed two classes of innovation. The first class is based on the degree to which the technology used in a product is new or different from previous technologies, whilst the second is based on the degree to which the new product satisfies key customer requirements better than existing

ones. This results in a matrix of four kinds of innovations: (a) incremental innovation, which is based on new technology, while customer need fulfilment per currency is low; (b) market breakthrough, which is based on low novelty of technology and high customer fulfilment per currency; (c) technological breakthrough, which is based on high novelty of technology and low customer fulfilment per currency; and (d) radical innovation, which is based on the combination of high novelty of technology and high customer need fulfilment per currency.

Table 2.4: Chandy and Tellis' (1998) model
Source: Popadiuk & Choo (2006)

Newness of technology	Customer need fulfilment per dollar	
	Low	***High***
Low	Incremental innovation	Market breakthrough
High	Technological breakthrough	Radical innovation

However, it is challenging for an organization to innovate in isolation (Dahlander & Gann, 2010). At the firm level, innovation may be a result of research-and-development activities (closed model of innovation) or acquired from external sources, such as through collaboration with a customer or supplier or by accessing patents through universities or other organizations (modelled as open innovation) (Tidd & Bessant, 2011). Involvement of several types of partners to gain external ideas and resources is crucial to sustain competitiveness (Chesbrough, 2003; Laursen & Salter, 2006). In contrast to the closed model of innovation, Chesbrough (2003) coined the term "open innovation" and defined it as *"a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology"* (p. XXIV).

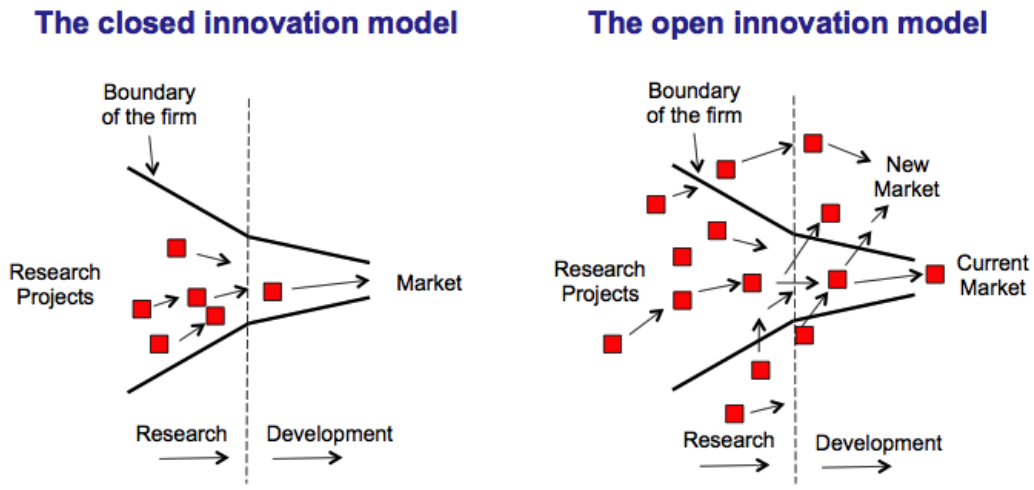


Figure 2.2: Open innovation and closed innovation paradigms

Source: Chesbrough (2003)

Successful innovations diffuse throughout the market. Innovation diffusion represents the rate of adoption of innovation by consumers or organizations. Innovation diffusion can be defined as *"the process by which an innovation is communicated through certain channels over time among the members of the social group that adopt it"* (Goffin & Mitchell, 2005, p. 62). According to Geroski (2000), innovation diffusion rarely follows a steady linear pattern; instead it can usually be represented by a bell curve.

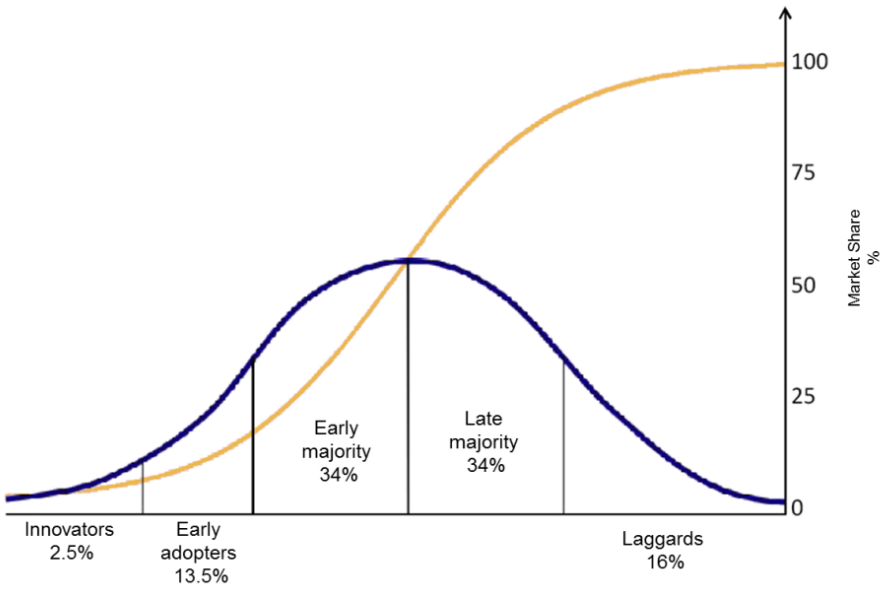


Figure 2.3: Innovation diffusion curve

Source: Goffin & Mitchell (2005, p. 62)

Rogers (1995) explained that the diffusion curve is probably a result of social factors which influence consumers' adoption behaviour. Researchers classify innovation adopters into innovators (who represent about 2.5% of the market share) and early adopters (representing 13.5% of the market share) who are highly esteemed and have the capability to influence others' opinions and increase awareness at an early stage. Gradually, the adoption rate accelerates, the popularity level increases, and the late majority adopt the product (with 34% of the market share) until market saturation has been reached and laggards finally adopt the product (Goffin & Mitchell, 2005, p. 62). At this stage, the laggard adopters, individuals who are pushed to adopt by forces, such as lack of alternative, probably signal an end to the diffusion phase (Smith, 2010, p. 17).

The innovation life cycle follows what is called the "Foster S-Curve". At the early stage of the S-curve, innovation development is highly risky and lacks understanding and standardising of the technology used. Incrementally, the technology understanding advances as it diffuses the market. Technology, however, is bounded by physical limits, represented by the far edge of scientific knowledge. If a new technology breaks through, it will restart the S-curve again (Westland, 2008, p. 37), signalling discontinuance of the old technology.

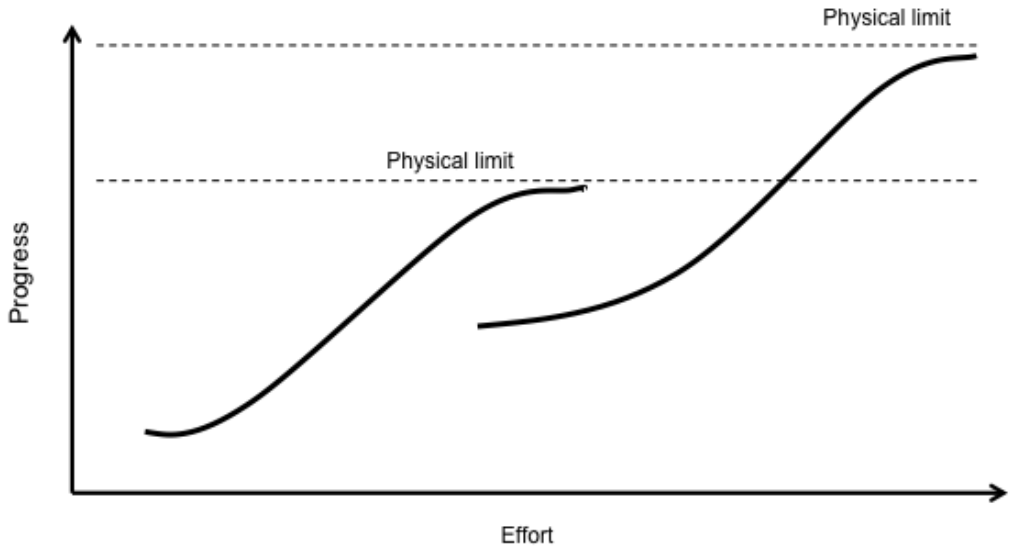


Figure 2.4: Foster S-curve for technology lifecycle

Source: Westland (2008, p. 37)

Both Rogers' (1995) diffusion theory and the technology life cycle highlight the importance of the influence of external factors on innovation success. In order for firms to increase their chances for successful innovation, they should get closer to their customers

and external knowledge sources. The next section discusses how firms' macro-environment affects their innovation success. It also highlights the role of inter-organizational relationships, and how it constructs a system of innovation that evolves through better knowledge communication.

2.2.3 Systems of Innovation

Carlsson et al. (2002) viewed innovation systems, in a national context, as a *"set of interrelated components working toward a common objective"* (p. 234), believing that systems consist of components, relationships, and attributes. In the context of innovation, components can take the form of individuals, enterprises, or any other private or public organization: the characteristic of the behaviour of one of the components of the system influences the characteristics of the behaviour of the whole system. This mutual interrelationship results in the fact that the system as a whole is beyond being represented by the sum of its components. Relationships representing the links between components and technology transfer or acquisition are crucial in an innovation system (Carlsson et al., 2002). The interaction between the innovation system components might occur intentionally, as in technology acquisition, or unintentionally, as in technology spillover. Interactions make the system dynamic, and the system's dynamism has a direct relationship with the level of interaction between its components (Carlsson et al., 2002). The attributes of a system are the characteristics of the components and the relationships between them. The attributes are crucial to comprehend, as they are associated with the function and objectives of the system. The objective of innovation systems is to generate, diffuse, and utilise technology that has economic value (Carlsson et al., 2002). According to Carlsson and Eliasson (1994), economic competence is defined as, *"the ability to identify and exploit business opportunities"*. Economic competence relies on four forms of capability: strategic capability, organizational (integrative or coordinating) ability, technical or functional ability, and learning (or adaptive) ability (Carlsson et al., 2002).

Strategic capability is the ability to perform innovative adoptions of markets, products, technologies, and organizational structures that include entrepreneurial activities and utilisation of distinctive human capital, and the acquisition of key resources and novel competences. This capability is all about ensuring that the progress of the innovation activities is in the right direction. It further requires the ability to correctly monitor and assess market opportunities, relevant technologies, and the economic situation.

Carlsson et al. (2002) elaborated this by stating that the organizational ability (integrative or coordinating ability) is primarily the role of middle-level management in an organization that aims to align all efforts and resources in order to achieve the overall objectives. This includes the creation and development of new technology through optimising compositions of knowledge and skills. The technical or functional ability is concerned with the efficiency and performance of different activities in implementing technologies with effective market application. The learning and adaption abilities are crucial in protecting the organization from disaster scenarios in the long-run.

2.2.3.1 Early Innovation System Views

One of the first attempts to model innovation as a system was the input/output analysis by Leontief (1941), which is governed by the circulation of goods and services throughout the system in the economy corresponding to a specific point in time. Carlsson et al. (2002) advocated that this system is static since its components and relationships are viewed from the industry level (meso-level) and the links between the components are one-way.

Another approach is the "development blocks" system, which was defined by Dahmén (1988) as *"sequences of complementarities which, by way of a series of structural tensions, i.e. disequilibria, may result in a balanced situation"* (p. 111). In this concept, opportunities created by an innovation might not be conceived and transformed from added-value activities into economic activities without the existence of all necessary inputs, such as resources and skills. He introduced the concept of "structural tension", whereby an innovation generates a tension event. If this tension is positively processed, it will possibly lead to progress and new tension events; however, if it becomes an obstacle, it may cause progress to subside. According to Carlsson et al. (2002), Dahmén's concept is dynamic, as it pays attention to the uneven distribution of the performance of the system's actors and focuses on the role of entrepreneurship.

2.2.3.2 The Diamond Model

Porter (1990) introduced the diamond model in his book, 'The Competitive Advantage of Nations'. He attempted, through his model, to explain why certain companies in certain nations are able to create innovative products with a better competitive advantage in terms of technology, quality, and features. The diamond model that he constructed is based on four attributes: (i) factor conditions such as skilled employment or infrastructure that are necessary to compete in a given industry; (ii)

demand conditions that represent the home-market demand for the industry's product or service - especially technically advanced markets; (iii), related and supporting industries that represent the presence or absence of the nation's competitive supplier industries and other related industries that are nationally competitive; and (iv) firm strategy, structure, and rivalry that indicate the conditions in the nation governing how companies are created, organized, and managed, as well as the nature of domestic rivalry.

The diamond model views the innovation system as a cluster of related activities (industry focus) and other agents that break the system's isolation. Competition is the main driver of the system's performance. According to Carlsson et al. (2002), the diamond model represents a narrower system compared to a national system of innovation approach. This is due to its major focus on competition between actors within the industries and its neglect of the impact of exogenous factors such as interactions with actors outside of the industry.

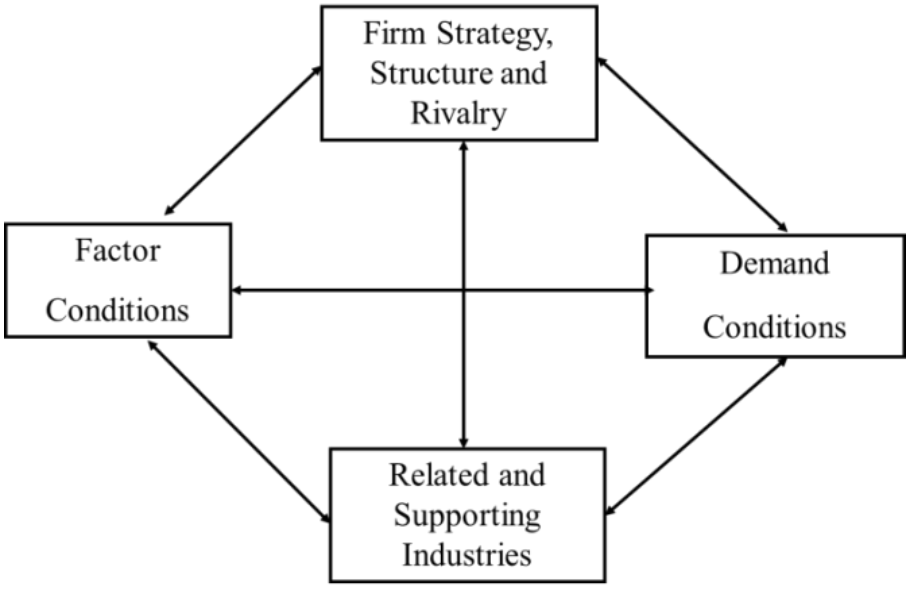


Figure 2.5: The diamond model
Source: Porter (1990)

2.2.3.3 National Systems of Innovation

In the late 19th century, a broader concept of innovation systems had emerged through the work of Freeman (1987), Lundvall (1992), and Nelson (1993). In the national system of innovation, additional actors and organizations, primarily in science and technology, are included, as is the rising importance of technology policy. The analysis of such systems includes a broader set of factors viewed on a national level. The system is

comprised of a complex set of elements and relationships, such as research and development (R&D), universities, research institutions, business entities, government agents, and government policies. The system's complexity has influenced the studies to move toward an empirical analysis that mainly carries out an analysis of statistics and comparative studies (Carlsson et al., 2002).

According to Uyarra (2010), **"***National systems of innovation (NSI) approaches view innovation as systemic and dynamic, emerging from interactive learning processes among firms and other organizations (such as universities, business support, research centres, etc.)"* (p. 119).

2.2.3.4 Regional Systems of Innovation (RSI)

Lagendijk (1999) recognised two general understandings of RSI in the literature: namely, as subsystems of national or sector-based systems exhibiting specific spatial characteristics, or as mini-versions of national system of innovation. Cooke and Schienstock (2000) stated that RSI is a *"geographically defined, administratively supported arrangement of innovative networks and institutions that interact regularly and strongly to enhance the innovative outputs of firms in the region"* (p. 273). According to Edquist (1997), the RSI approach is associated with broader theories of systems of innovation. Hence, it has inherited the evolutionary and institutional principles. *"Institutional differences in the mode of importing, improving, developing and diffusing new technologies, products and processes"* (Freeman, 1995, p. 20) result in an uneven distribution of innovation performance across different regions or nations.

2.2.3.5 Technological Systems of Innovation

According to Carlsson (2002), there are several technological systems in each country. The system components and its relationship density and nature change over time, causing the system to evolve. The system focuses on *generic technologies* and their application over several industries and is not bound by national boundaries. The interactions within the system exist in three types of networks: buyer-supplier relationships, problem-solving networks, and informal networks. Therefore, the system comprises market and non-market interactions. Buyer-supplier linkages influence the system's characteristics. Active linkages between buyers and suppliers result in effective technical information circulation. The other sources of technical information come from problem-solving networks such as universities and research institutions. Moreover, informal networks (face-to-face, professional networks, publications, and others) are

considered active channels of information. Carlsson et al. (2002) highlight that the technological systems approach relies on five fundamental assumptions: First, the focus is on the holistic view of the system rather than its individual components. Second, the system evolves and is dynamic; hence, it is crucial to consider the feedback in the system as critical points of the analysis. Third, globalisation has ultimately increased technological opportunities. Fourth, the system-performance assessment should focus on its "*absorption capacity"* (identify, absorb, and exploit the global technological opportunity), which may be more important than the generation of new technology. Finally, the system components are constrained by their limitations of capabilities, information, and other constraints that affect the ability to take advantage of the enormous global opportunities.

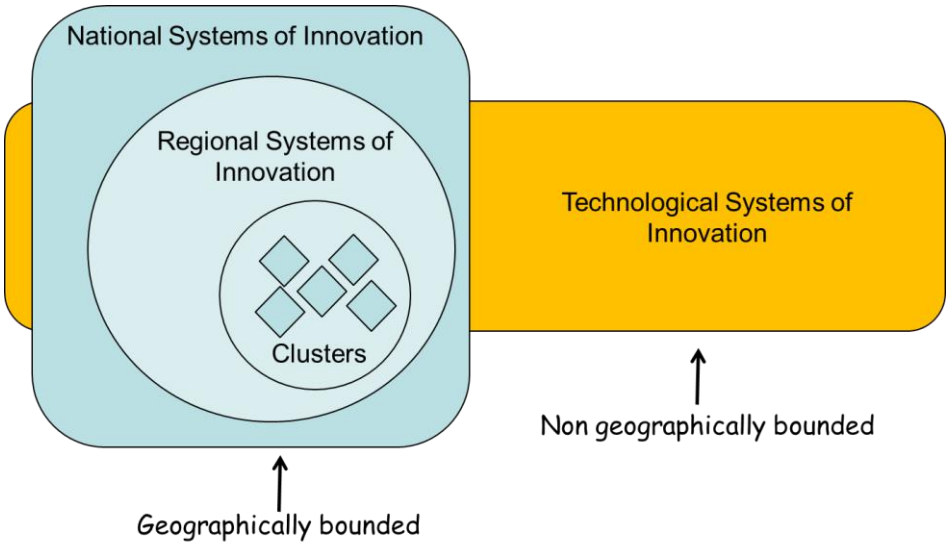


Figure 2.6: Approaches of systems of innovation

Source: Self elaboration based on the analysis of Carlsson et al. (2002)

It can be concluded from the above review that firms are highly dependent on the other components of the innovation system as sources for technology and knowledge in general. Hence, if the innovation system's (national or technological) knowledge is underperforming, firms are unlikely to achieve better innovation performance unless they break this geographical constraint, seeking technology and knowledge on a global scale, and from better sources. This is especially crucial in developing countries if their systems of innovation have less contribution to the advancement of knowledge and technology. Therefore, a firm's abilities to maintain global-technology access and to develop a sensing capability of the market trend and changes to detect opportunities on a global scale represent crucial capabilities that influence the firm's innovation performance.

Figure 2.7: Innovation performance of firms depends on their internal capabilities of taking advantages from external sources of knowledge.

The next section focuses on firms' dynamic capabilities that enable them to interact with other components in the innovation system and seize opportunities through the exploitation of innovative products and services.

2.3 Firms' Dynamic Capabilities

The previous section highlighted the importance of interaction between entities in the innovation systems. This raises the question of what the capabilities are that enable firms to be dynamic and interact with other organizations to generate successful innovations. This section is related to dynamic capabilities theory which suggests that firms' internal practices have an impact on their ability to sense market changes, seize emerging opportunities by absorbing and utilising new knowledge, and continuously reconfigure their resources through a balanced innovation strategy to sustain a competitive advantage in the long and short terms.

In a globally competitive environment, windows are open for newcomers, as are market dominators risking existing profit streams (Teece, 2007). At the core of the resource-based view (RBV) is an emphasis on resources and heterogeneous capabilities (Barnett et al., 1994; Mahoney & Pandian, 1992) in which 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 an 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 theory emerged to overcome this static nature of the RBV and embed an evolutionary nature in a firm's resources and capability (Eisenhardt & Martin, 2000; Teece, 2007; Teece et al., 1997; Zahra & George, 2002).

Scholars have proposed a number of definitions for firms' dynamic capabilities (Wang & Ahmed, 2007). Teece et al. (1997) defined the term 'dynamic' as *"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"* (p. 515).

According to Eisenhardt and Martin (2000), 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 argued 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"* (p. 1107). 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 may not be able to sustain a competitive advantage in a dynamic market (D'Aveni, 1994; Eisenhardt & Martin, 2000), dynamic capabilities are built on all efforts 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, which theorizes innovation as an association with a firm's internal R&D effectiveness, is not sufficient to comprehend the volatility and velocity of the markets (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, all pressure organizations to think and act outside their boundaries, where external sources of knowledge and innovation have become imperative (De Backer & Cervantes, 2008; Gassmann, 2006; Porter & Stern, 2001).

Dynamic capabilities are of a higher-order level that shape operational capabilities at a 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) suggested that dynamic capabilities are more associated with changes that include the development of a new product, process, or market (p. 992), which is consistent with Schumpeter's (1934) view of innovation. Eisenhardt and Martin (2000) suggested that dynamic capabilities are the

ability to acquire, shed, integrate, and reconfigure resources. Verona and Ravasi (2003) took a knowledge-based perspective in which dynamic capabilities are advocated as the creation and absorption of knowledge and the capability to integrate and reconfigure. Zott (2003) suggested that dynamic capabilities are variation, selection, retention, and reconfiguration, as well as competition with rivals. Wang and Ahmed (2007) classified dynamic capabilities as adapting, absorbing, and innovating. Identification of opportunities is associated with two forces: Schumpeter's (1934) entrepreneurship force in which new internal and external knowledge and information creates an opportunity to innovate, and Kirzner's (1978) force in which 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 are relevant in today's economy (Baumol, 2005).

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 organization'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 (Schreyogg & Kliesch-Eberl, 2007; Teece, 2007; Wang & Ahmed, 2007; Zahra et al., 2006). A recent conceptualisation by Lichtenthaler and Lichtenthaler (2009) argued that firms' open innovation can be better understood with the theory of dynamic capabilities and knowledge management. In their work, they suggested a matrix of six firm capabilities based on internal and external knowledge management.

Table 2.5: A Framework for Open Innovation

Source: Lichtenthaler and Lichtenthaler (2009)

	Knowledge exploration	**Knowledge retention**	**Knowledge exploitation**
Internal (Intrafirm)	Inventive capacity	Transformative capacity	Innovative capacity
External (Interfirm)	Absorptive capacity	Connective capacity	Desorptive capacity

Teece (2007) held a holistic view of dynamic capabilities, suggesting that sensing and seizing opportunities, as well as reconfiguring capabilities, are the core of sustainable competitive advantage. Sensing enables the firm to scan the market for emerging opportunities and to increase its awareness of emerging technologies. The seizing capability develops the firm's internal capability to capture the opportunity that emerges. The reconfiguring capability represents the strategic mind-set that configures, and reconfigures, resources to balance between the stabilized short-term profitable practices that tend to maximize profit from existing products and services and the costly long-term practices that search for innovative products to sustain a competitive advantage for the long-term.

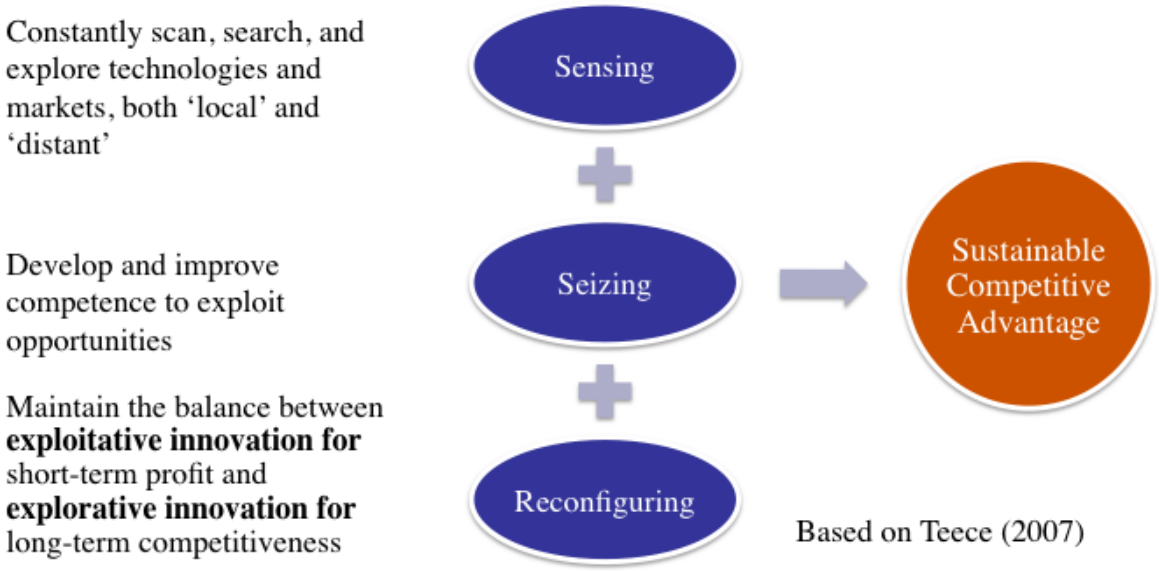


Figure 2.8: Dynamic capabilities model

Source: Teece (2007)

The recent conceptualization of Teece (2007) is of a high order, and it is comprehensive enough to be a powerful lens that allows for an understanding of dynamic capabilities and innovation performance using multi-approaches, such as the knowledge-based, network approach and organizational theories. Although different scholars have different views of dynamic capabilities, they share the importance of awareness of external knowledge and the capability of absorbing and exploiting it to capture new market opportunities.

Teece's (2007) model of dynamics capabilities may be utilised to describe the knowledge flow from external sources into firms, the transformation of such knowledge, and the exploitation of innovative products and services. In this regard, the following section identifies the innovation dynamic capabilities that may help firms to achieve better innovation performance. In the figure below (2.9), the researcher breaks down Teece's (2007) model into more practical factors by using three disciplines in the innovation studies: networking theories, knowledge absorptive capacity, and innovation strategy.

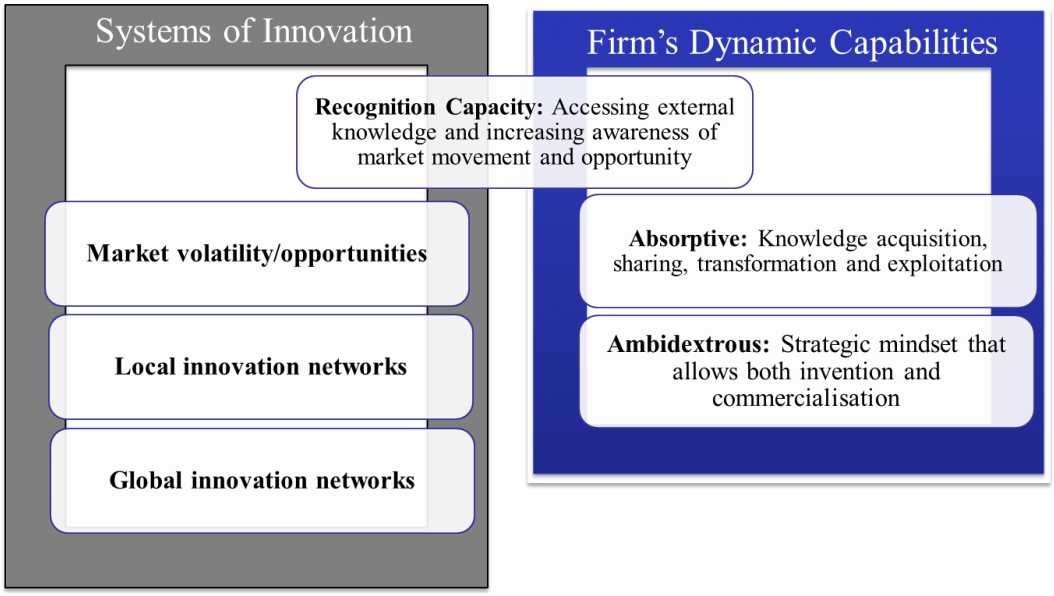


Figure 2.9: Innovation dynamic capability model (theoretical integration model)

In the context of innovation, the sensing capability may be interpreted in the following ways: market intelligence generation, breadth-of-knowledge sources, and internationalization. These three capabilities help firms to be more connected with their system of innovation with a higher ability to detect any emerging opportunity or technology. Absorptive capacity helps firms develop their internal capabilities of acquiring, assimilating, transforming, and exploiting new knowledge into innovative products and services. Ambidextrous capacity represents the innovation strategy that strikes a balance between explorative (radical-oriented innovation strategy) and exploitative (incremental-oriented innovation strategy). Both strategies are important in the commercialisation stage of an innovation. All these capabilities are discussed in more detail in the following section. Figure 2.10 represents a conceptual model that maps literature from networking theory, absorptive capacity, and ambidextrous capacity into Teece's (2007) view of dynamic capability.

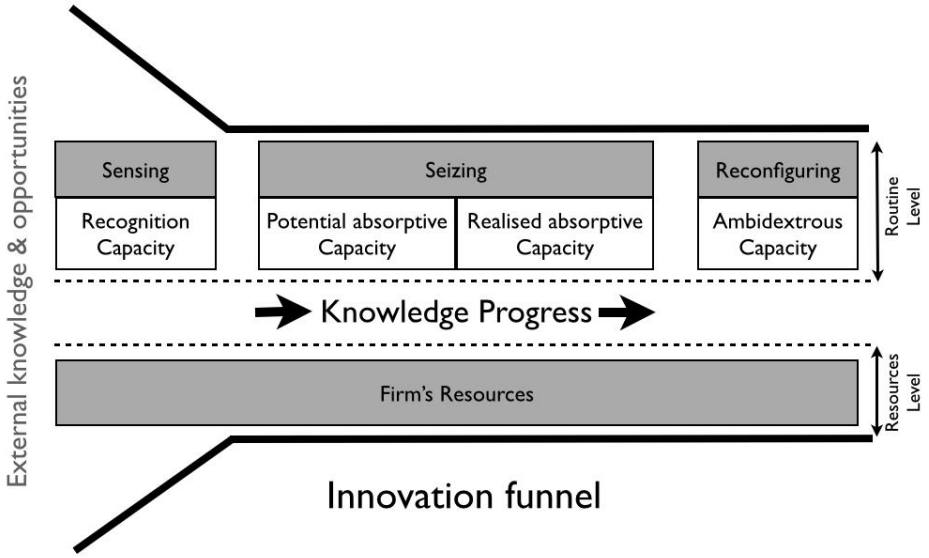


Figure 2.10: Conceptual model of dynamic capabilities that facilitate flow and progress of knowledge inside firms

The following section reviews each dimension of Teece's (2007) model, and how it links with each of the related three theories: recognition of opportunities, absorptive capacity (with its two components, potential and realised), and ambidextrous capacity.

2.3.1 Firms' Recognition Capacity of External Knowledge

There is wide acknowledgement that innovation is essential to organizational growth and survival (Aloini & Martini, 2013; Gnyawali & Srivastava, 2013). However, organizations commonly find innovation problematic (Ahuja & Lampert, 2001), which may be due in some degree to the inadequacy of their capabilities and resources to conduct technological exploration and make use of various resource combinations (Fleming, 2001). Accordingly, organizations commonly seek to make use of resources made available through strategic-alliance networks (Ahuja, 2000; Collins & Hitt, 2006; Phelps, 2010; Srivastava & Gnyawali, 2011) and geographic clusters (Ketelhohn, 2006; Pouder & St. John, 1996; Whittington et al., 2009), both of which are regarded as essential and valuable sources of external resources (Tallman et al., 2004).

Teece (2007) labelled the term "sensing opportunities". He explained that this capability comprises activities such as scan, search, and explore. This requires access to a knowledge infrastructure that includes both "local" and "distant" (Nelson & Winter, 1982)

information about technologies, markets, current customer 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 internal and external R&D activities as well as knowledge of current customer needs) is imperative for unlocking a wider range of commercialisation opportunities (Teece, 2007). Henderson (1994) advocated that companies might face the risk of being prisoners of their own strategies and definitions of change and improvement. Successful commercialisation of innovation is highly associated with the developer's understanding of customer needs. Alertness to opportunities and changes in the whole ecosystem has become vital, especially since a significant percentage of new products are introduced by external sources (Teece, 2007).

The concept of open innovation embraces this by embedding linkages with external sources in the innovation strategy in order to benefit from the current high velocity of the market (Chesbrough, 2003, p. 24). Open innovation is not only about acquiring new knowledge from external sources but also represents a means of invention commercialisation via selling/licensing or even joint venturing (Gassmann, 2006). Therefore, linkage of a firm with its surrounding entities is core for stronger access to knowledge and provides the firm with alternative paths for capturing opportunities. Porter and Ketels (2003) advocated the vital role of interorganizational networks in an organization's innovation capability. Perez and Sanchez (2002) defined networking as *"a firm's set of relationships with other organizations"* (p. 263). Firms are recognising the importance of collaborating with other firms (Fischer & Varga, 2002), whereby innovation is becoming the result of a value network as a whole, rather than that of an individual or firm (Bougrain & Haudeville, 2002; Powell et al., 1996). Ahuja (2000) and Powell et al. (1996) highlighted that networking is key to innovation and competitiveness in a variety of industries. Pittaway et al (2004) reviewed firms' networking and highlighted the following benefits as found in the literature: (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 (De Coster, & Butler, 2005; Liebeskind et al., 1996); and (6) access to external knowledge infrastructure (Cooke, 1996; Powell et al., 1996).

Lichtenthaler and Lichtenthaler (2009) defined connective capacity as a *"firm's ability to retain knowledge outside its organizational boundaries"* (p. 1320) and highlighted it as a crucial capability in maintaining access to external knowledge (Table 2.3). This capability comprises the process stages of increasing and maintaining the portfolio of external knowledge privileges in inter-organizational relationships (Lichtenthaler & Lichtenthaler, 2009) and is then transformed to capture an emerging opportunity (Garud & Nayyar, 1994; Grant & Baden-Fuller, 2004). This complements the elements of absorptive capacity (another critical dynamic capability discussed in the next section) by having a breadth of knowledge that is evaluated at the acquiring stage of absorptive capacity.

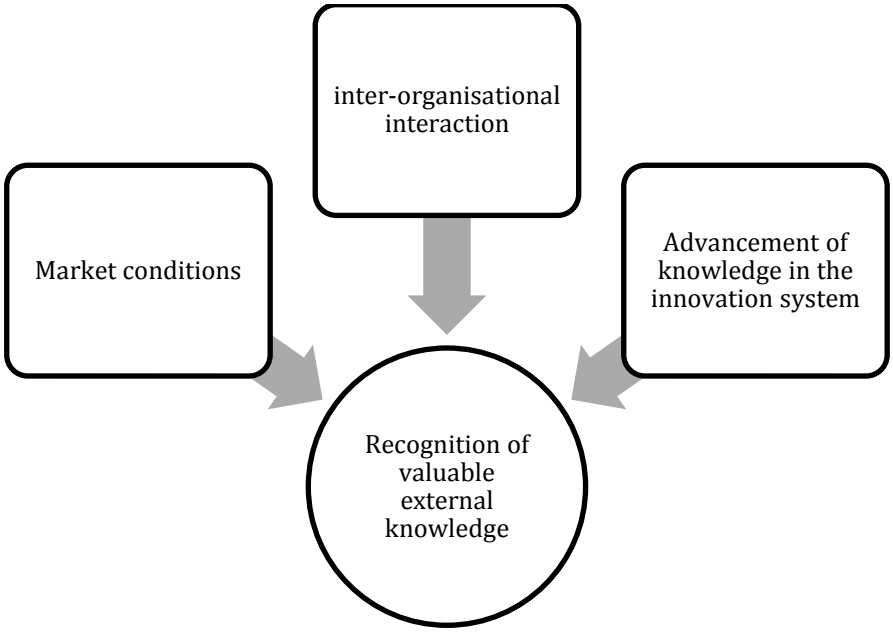


Figure 2.11: Factors affecting the ability of firms to recognise valuable external knowledge

Scholars in the arena of alliance-network research highlight that an organization's formal cooperative alliances, or relationships with other organizations, add to innovation (Ahuja, 2000; Baum et al., 2000; Powell et al., 1996). The alliance network of an organization, along with its size (i.e. the number of partners involved), acts as an indicator of the network's overall inventiveness, which has been seen to have positive effects on the output of innovation (Ahuja, 2000).

Studies carried out recently have considered different types of sources and have further highlighted the firms' quality and diversity of alliance-network sources and how they can improve the capacity of an organization to create and adopt innovation (Phelps,

2010; Srivastava & Gnyawali, 2011). Moreover, it has been established by Whittington et al. (2009) that the position of an organization within the local and global network has a somewhat substitutive impact on the innovation of the organization.

Partners gaining access to a multitude of diverse resources may also prove beneficial in overcoming obstacles arising from more rigid processes and systems (Gnyawali & Srivastava, 2013). As opposed to striving to incorporate changes in terms of internal processes and systems, managers should perhaps choose to sidestep them instead (Gnyawali & Srivastava, 2013). Essentially, novel solutions may be achieved through the establishment of formal between-firm partnerships which further facilitate the avoidance of internal obstacles (Gnyawali & Srivastava, 2013). Focal organizations may utilise the processes and systems of partners with the aim of pursuing innovative projects, or they could otherwise establish new approaches and systems together, as opposed to fighting to make changes to internal ones. Essentially, both situations would mean that internal rigidity would be less prevalent when pursuing innovation (Gnyawali & Srivastava, 2013).

2.3.1.1 The Role of Breadth of Knowledge Sources

According to Aloini & Martini (2013), previously conducted studies in relation to firms' external knowledge sources recognise two different standpoints - namely, where to search and how to search. With regard to the former, four dimensions are recognised by scholars: knowledge boundary (internal and external); knowledge domain (market and technology); knowledge proximity; and search intensity and scope (depth and breadth). The knowledge boundary takes into account whether or not the firm is able to utilise either external or internal knowledge sources (Aloini & Martini, 2013). Internal sources are individuals who are able to act as boundary-spanning champions, gatekeepers, idea generators, and scouts (Reid & De Brentani, 2004). In this regard, a number of elements - incentives, idea-generation, and knowledge management (KM) - all have a significant impact (Aloini & Martini, 2013).

External knowledge sources in the context of innovation are customers (Faems et al., 2005), competitors (Dussauge et al., 2000), research centres (Link et al., 2006), consultants (Tether & Tajar, 2008), and suppliers (Nieto & Santamaria, 2007). In consideration of the knowledge domain, it references the search source (Sofka & Grimpe, 2010) in order to differentiate between market-driven, supply-driven, and science-driven sources. The knowledge proximity refers to whether the organization is searching for new

knowledge (close to that which is pre-existing), or novelty, which signals that the organization is moving away from its existing practices (Katila & Ahuja, 2002).

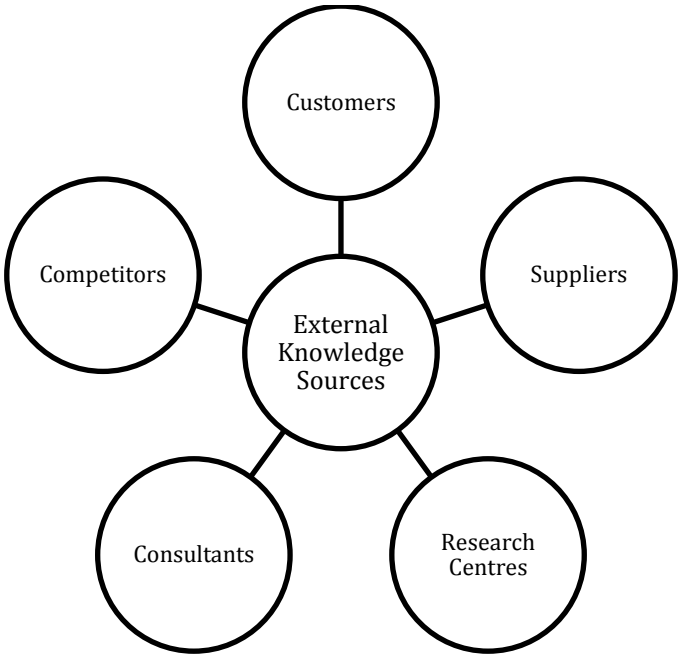


Figure 2.12: Firms' external knowledge sources

With regard to search intensity and scope, openness has been described in breadth and depth in relation to an external knowledge search (Aloini & Martini, 2013). The breadth of knowledge sources is calculated through external input diversity, which signifies the way in which an organization scans external knowledge (Aloini & Martini, 2013). On the other hand, depth has been explained by scholars in different ways. For instance, depth was explained by Katila & Ahuja (2002) as the extent to which there is the reuse or exploitation of existing knowledge, whereas for Laursen & Salter (2006) it was seen to represent the depth to which an organization garners knowledge through the use of external sources. In this same way, Sofka and Grimpe (2010, p4) acknowledge that organizations are required to specialise their search approaches, establishing equilibrium between the efficiency of accessing knowledge and beneficial diversity in potential knowledge impulses.

The above review of literature in the area of networking and knowledge scanning suggests that the higher the networking activity of a firm, the higher the chance of recognising valuable external knowledge and opportunities (Aloini & Martini, 2013).

Networking activities might be analysed by examining usage of the firm's knowledge channels, such as customers, suppliers, research institutes, competitors, and consultants. Moreover, scholars argue that networking activities should not be limited to local markets. The search for valuable external opportunities should take place on a global level (Carlsson, 2006; Ernst, 2002; Komninos, 2008), indicating the importance of internationalization as a critical capability in sensing innovation opportunities.

2.3.1.2 Global Innovation Networks and Firms Internationalization Orientation

A knowledge-based economy has been highly associated with the global stream of good and knowledge-intensive services, the global supply chain, global research networks, and breakthroughs in information technology. It seems that in almost any sector in the economy, research and development takes place in developed countries, whereas mass production is processed in developing countries (Komninos, 2008, p17). This internationalization of firms' activities signifies the importance of the global inter-organizational interaction.

Scholars have shown that internationalization (such as outward market seeking or inward foreign resource acquisition) is an imperative strategy, even for small and medium-scale enterprises (SMEs), which enables the enterprises to sense and seize massive global opportunities (Knight & Cavusgil, 2004; Madsen & Servais, 1997). Internationalization can be defined as *"a dynamic process through which internationally oriented firms are engaged in a diverse range of cross-border network relations and exchanges"* (Zhou et al., 2007, p674). The current internationalization literature identifies two types of orientation: outward internationalization (e.g. seeking and selling in foreign markets and developing alliances with foreign businesses) and inward internationalization (e.g. utilising management skills, new technology, and direct investment from foreign countries) (Welch & Luostarinen, 1993).

The outward internationalization orientation influences firms to recognise valuable opportunities, such as emerging technologies and the opening of the global markets (Francis and Collins-Dodd, 2000; Zahra et al., 2000; Ireland et al., 2001). Moreover, it increases the chances for maximising the scale of the market to a global level (Kogut, 1985). On the other hand, inward internationalization orientation enables firms to access foreign knowledge, skills, and capital investments, and consequently enhances firms' performance (Buckley et al., 2002). This might be of special interest to firms in developing countries, as this complements the local resources and enhances their competitive

advantage (Zhou et al., 2007).

2.3.1.3 Market Intelligence Generation

Awareness, in the context of innovation, makes reference to the recognition of an organization with regard to new technological developments and the emergence of market trends that commonly result in new initiatives being undertaken by competitors and other organizations (Chen et al., 2007; Chen, 1996). This is related to Teece's (2007) sensing capability and represents a dynamic capability that helps firms to recognise opportunities. A company would be in a good position to recognise and acknowledge the need for innovation and to take the appropriate actions when they have achieved an understanding of, and insight into, the nature of new technologies developed by other organizations and competitors (Gnyawali & Srivastava, 2013).

Improved awareness in this arena would ultimately cause the firm to act in a more driven and aggressive way (Chen, 1996) in terms of launching and initiating promising innovation projects that meet market and competitive conditions (Gnyawali & Srivastava, 2013). Recognising new concepts or establishing a new opportunity may ultimately encourage innovation attempts and would further enable organizations to utilise capabilities and resources for the generation of innovation, which could subsequently provide development and access to new capabilities (Gnyawali & Srivastava, 2013).

Gnyawali and Srivastava (2013) suggested that awareness is the first stage in the development of technological innovations. Essentially, there is a need for the organization to familiarise itself with appropriate and suitable technological forces and trends; this helps to establish whether there are any valuable opportunities available (Gnyawali & Srivastava, 2013). The generation and management of ideas are important to the innovation process (Aloini & Martini, 2013). The generation of ideas is highly dependent on environmental scanning, opportunity identification, and idea seeding (Aloini & Martini, 2013). Under discontinuous conditions (such as a radical shift in technology), firms must be capable of recognising emerging weak signs by improving their search processes (Day & Schoemaker, 2006) - although scholars suggest that organizations can better manage innovation in a steady-state environment (Aloini & Martini, 2013).

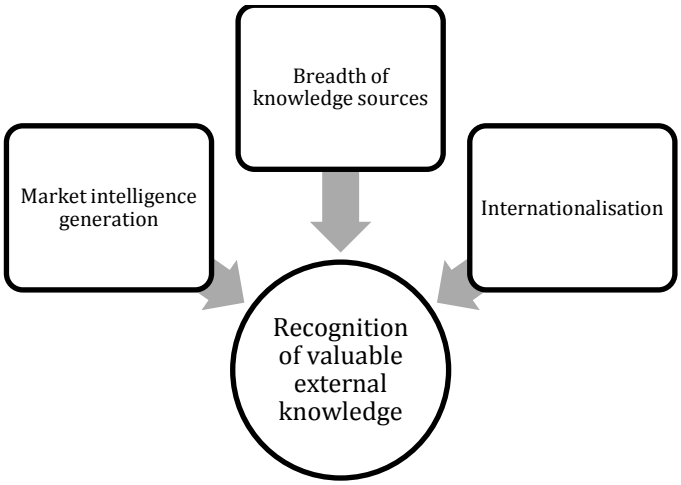


Figure 2.13: Factors that enable firms to recognise valuable external knowledge

Therefore, from the above review, three capabilities are identified that may fit with Teece's (2007) sensing capabilities: breadth of knowledge sources, internationalization, and market intelligence generation. These three capabilities help firms recognize valuable external knowledge and facilitate the acquisition of such knowledge.

The next section attempts to identify the practices that enable firms to absorb and utilise recognised external knowledge in order to exploit innovative products or services. This may contribute to Teece's (2007) seizing capability and represent the second logical step in the knowledge flow path.

2.3.2 Firms' Absorptive Capacity

When an opportunity is identified, it must be 'seized' in a new product, process, or service (Teece, 2007). Addressing opportunities is associated with the retention and development of technological competence and complementary assets (Teece, 2007). Wang and Ahmed (2007) recognise absorptive capacity (ACAP) as a key dimension of their dynamic capability framework. Cohen and Levinthal (1990) define absorptive capacity as the *"firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends"* (p128). Scholars have shown that absorptive capacity impacts innovation (Tsai, 2001) and organization performance, triggers knowledge transfer at an intraorganizational level (Gupta & Govindarajan, 2000; Szulanski, 1996), and influences interorganizational learning (Lane & Lubatkin, 1998; Lane et al., 2001).

Woiceshyn and Daellenbach (2005) explained in their studies how a company with higher absorptive capacity also 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 and Ravasi (2003) show 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.

The concept of absorptive capacity is believed to be derived from the view that investments within R&D not only establish new organizational investment, but also enhance the overall capacity to internalise technology and knowledge from external sources (Cohen & Levinthal, 1989, 1990). Newly absorbed knowledge is applied by organizations in numerous ways and for various reasons, such as to predict technological patterns (Cohen & Levinthal, 1994), to reconfigure present abilities (Pavlou & El Sawy, 2006), to establish and develop innovative services and products, and to replenish their knowledge (Van den Bosch et al., 1999). For example, the value of developments made in the arena of a semi-conductor technology cannot be gauged accurately by the organization if there is no minimum level of knowledge in the appropriate domains (Roberts et al., 2012). In the same vein, it is also stated that absorptive capacity is domain-specific (Roberts et al., 2012).

A large wealth of literature has established that absorptive capacity adds to the performance of an organization, both indirectly (Lane et al., 2006) and directly (Lichtenthaler, 2009). A number of academics in the field have utilised the original work of Cohen and Levinthal (1989) - carried out on absorptive capacity - in a number of different ways. For instance, absorptive capacity has been examined previously in relation to new product development (Pavlou & El Sawy, 2006), in R&D (Cohen & Levinthal, 1990), and in software development (Tiwana & McLean, 2005). The application of absorptive capacity in a number of different arenas: namely, innovation, inter-organizational learning, mergers and acquisitions, and new product development, all emphasise the key contributions to organizations' performance through enabling competitive advantage (Lane et al., 2006).

According to Schildt et al. (2012), such studies have established that the similarities between organizations' culture and areas of technology facilitate organizations' gaining and utilising knowledge from one to the other (Lane & Lubatkin, 1998). Yet, others

suggest that negative results arise from excessively similar knowledge of partners functioning in the same field (Schildt et al., 2012). Others suggest that the mode of governance and the novelty of technologies developed by the organization all effect the advantage of the knowledge absorbed (Nooteboom et al., 2007; Sampson, 2007).

According to Volberda et al. (2010), the stream of literature in the area of absorptive capacity can be characterised by six main fields: learning, innovation, managerial cognition, knowledge-based view of the firm, dynamic capabilities, and coevolution. Other insights put an emphasis on individual-level social practices (Hotho et al., 2010), as well as triggers that could impact the absorptive capacity Volberda et al. (2010).

2.3.2.1 Different Models of Firm's Absorptive Capacity

Cohen and Levinthal (1989) theorise absorptive capacity as the firm's ability to identify, assimilate, and exploit knowledge absorbed from external sources. According to Flatten et al. (2011), external knowledge-exploiting requires transforming its nature into a practical form. Zahra and George (2002) expanded the model from the original three dimensions (identify, assimilate, and exploit) to four dimensions (acquire, assimilate, transform, and exploit). In this view, acquisition and assimilation represent the firm's potential absorptive capacity, and transformation and exploitation represent the firm's realised absorptive capacity.

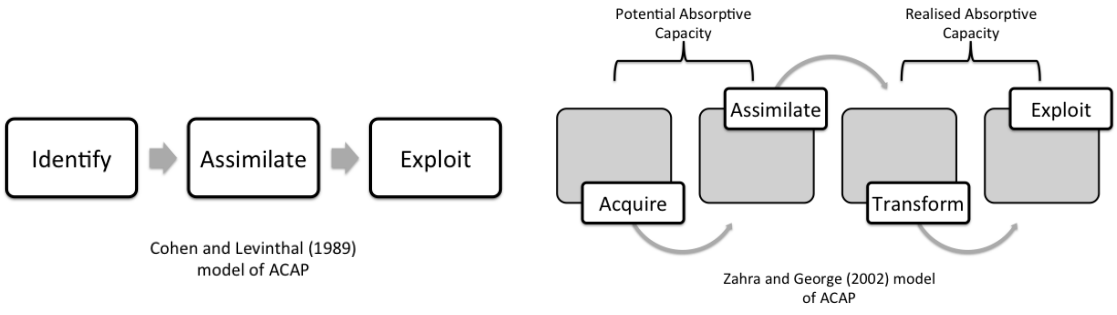


Figure 2.14: The original (on the left) and the expanded model (right) of absorptive capacity

The notion of absorptive capacity is recognised as referring to the capacity of an organization to understand and acknowledge external knowledge value, and accordingly to acquire such knowledge within the context of the business and utilise it to its greatest capacity (Cohen & Levinthal, 1990; Todorova & Durisin, 2007; Zahra & George, 2002). Thus, it may be stated that the concept comprises a number of different organizational

characteristics and knowledge management practices that can result in learning ability (Schildt et al., 2012). Owing to the fact that absorptive capacity is viewed as a complicated phenomenon that cannot be observed directly, a great deal of the studies carried out in this field place emphasis on measurable determinants and results of absorptive capacity, which are highly associated with empirical observations (Schildt et al., 2012).

Todorova and Durisin (2007, p. 776) have proposed a model (Figure 2.14) that conceptualises antecedents of absorptive capacity at the organizational level. In their model, the authors suggest that value recognition takes place as a predecessor of the classical four dimensions of absorptive capacity (i.e. acquire, assimilate, transform, exploit). Thus, this view is in alignment with Cohen and Levinthal's (1990) statement that the ability to absorb new knowledge depends largely on the ability to assess such knowledge.

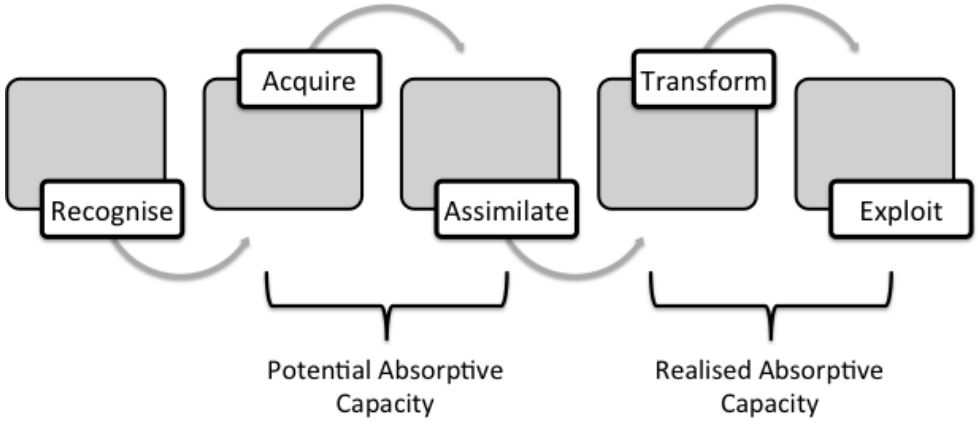


Figure 2.15: Todorova and Durisin (2007) model of ACAP

Todorova and Durisin (2007) stress that exposure to a knowledge source is crucial to the antecedent of absorptive capacity. In Zahara and George's (2002) model, acquisition represents the first stage of the absorptive capacity. Although this contradicts the Todorova and Durisin (2007) model, where value recognition is the first stage of absorptive capacity, Zahara and George's (2002) model suggests that acquisition and assimilation represent an important dimension of absorptive capacity, which they labelled as Potential Absorptive Capacity (PACAP). The other stage of absorptive capacity is labelled Realised Absorptive Capacity (RACAP), comprising the transformation of knowledge and exploiting it to the

final product/service.

Scholars suggest three characteristics of absorptive capacity. First, the absorptive capacity of a firm may be seen as dependent on prior related knowledge, as recognised by Cohen and Levinthal (1990). Hence, without the presence of prior related knowledge, an organization will not be in the position to sufficiently establish the possible value associated with external knowledge (Roberts et al., 2012). Secondly, absorptive capacity of an organization relies on its individual members, although it is not only the total of absorptive capacity held by members; in actuality, this rests *"on the links across a mosaic of individual capabilities"* (Cohen & Levinthal, 1990, p. 133). Accordingly, the absorptive capacity of a company is established as a result of the various shifts of knowledge across and within organizational units, as well as through the overlap in the knowledge structures of individuals. This suggests that absorptive capacity may be recognised as organization-specific, and thus it cannot be easily and quickly introduced and integrated within the firm (Roberts et al., 2012). Lastly, it is known that absorptive capacity is path-dependent where, during the course of one period, the accumulation of absorptive capacity will enable a greater degree of effective accumulation during subsequent periods (Roberts et al., 2012).

2.3.2.2 Absorptive Capacity as a Dynamic Capability

Absorptive capacity has been commonly viewed by organizational scholars from two different standpoints: namely, as an ability to absorb knowledge and as a stock of prior related knowledge (Roberts et al., 2012). In particular, the conceptualisation and measurement of absorptive capacity attempts by scholars have viewed absorptive capacity as an asset, a dynamic capability, and a substantive (ordinary) capability (Lane et al., 2006).Generally, the term "asset" may be described as anything that is controlled or owned, or which can be accessed, and may be tangible or intangible (Helfat & Peteraf, 2003). When considered as an asset, absorptive capacity is generally conceptualised as the amount of relevant prior knowledge held by the focal unit (Roberts et al., 2012). This knowledge-centred viewpoint, which considers such information as an object, considers absorptive capacity as equal to the knowledge-base of the firm (Roberts et al., 2012). Accordingly, absorptive capacity is operationalised with variables that act as proxies for the knowledge base: namely, patents and R&D intensity (Mowery et al., 1996; Tsai, 2001).

The influential work of Cohen and Levinthal (1989, 1990, and 1994) places emphasis on absorptive capacity determinants, and analyses the path dependent and the

role of prior knowledge elaborated as a learning capacity determinant. With this in mind, scholars recognise that R&D investment establishes a diverse knowledge base, which aids knowledge absorption from several external sources (Schildt et al., 2012). A more practical view of absorptive capacity as organizational capability is a set of high-level practices for creating a particular type of significant outputs (Winter, 2003). As a substantive organizational capability, absorptive capacity takes into consideration the various approaches and routines adopted by organizations when seeking to establish, integrate, transform, and adopt external knowledge (Roberts et al., 2012).

The term 'dynamic capability' has been described by Helfat et al. (2007) as, *"the capacity of an organization to purposefully create, extend, or modify its resource base"* (p. 4). Dynamic capability is further differentiated from substantive capability in the sense that dynamic capability considers the potential to change or otherwise reconfigure present substantive capabilities (Roberts et al., 2012). Accordingly, the term 'dynamic' distinguishes one type of ability (e.g. the substantive ability to develop new services) from another type of ability (e.g. the ability to reform the way the firm develops new service) (Roberts et al., 2012). Therefore, it should be taken into account that there are differences between absorptive capacity as a capability and absorptive capacity as an asset (Roberts et al., 2012). The prior related knowledge of an organization is clearly distinguished from absorptive capacity by Van den Bosch et al. (1999), with other scholars in the field stating that, *"possessing relevant prior knowledge is a necessary but not sufficient condition for a firm to have absorptive capacity"* (Lane et al., 2006, p. 852). It is acknowledged that the conceptualisation of absorptive capacity as equivalent to relevant prior knowledge is not effective in capturing the routines of assimilation, identification, transformation, and exploitation that the firm utilises to renew its knowledge base (Roberts et al., 2012).

2.3.2.3 Absorptive Capacity and Innovation Strategy

Absorptive capacity is strongly linked with organizational learning (Lane et al., 2006), although this particular link remains unclear (Roberts et al., 2012). In order to highlight how absorptive capacity can make a unique contribution to studies in this field, an understanding of the way in which it relates to organizational learning and its more wide-ranging theories is essential (Roberts et al., 2012).

Organizational learning theory is centred on achieving developments with regard to the associations, insights, and knowledge of both past and future actions, as well as the

effectiveness of such actions (Huber, 1991). Despite the fact that the organizational learning literature is wide-ranging, in-depth reviews carried out by (Bapuji & Crossan, 2004; Gupta et al., 2006) highlight that exploration and exploitation (March, 1991) have become recognised as the twin pillars of research in organizational learning (Roberts et al., 2012). Exploration refers to learning achieved through various approaches of concerted change and organizational experimentation with new alternatives, and aims to achieve and garner knowledge relating to unknown market opportunities, whilst exploitation refers to the learning garnered through experiential refinement, local search, and the utilisation of existing competencies, knowledge and technologies. Scholars in the field of organizational learning acknowledge that the continued success of an organization ultimately rests on its capacity to become involved in exploitation, to ensure the viability of the organization in the short term, with long-term sustainability further ensured through adequate exploration (Levinthal & March, 1993).

Lane et al. (2006) carried out a review of the literature on the subject of absorptive capacity and accordingly positioned it within an expanded exploration/exploitation learning model. In particular, these provide a link between three processes of absorptive capacity (identify, assimilate, and apply external knowledge) to three learning processes (exploratory, transformative, and exploitative learning). Exploratory learning is implemented with the aim of acknowledging and comprehending new external knowledge, with transformative learning integrating new knowledge with current knowledge (Roberts et al., 2012). Although Lane et al. (2006) have delivered an instinctive and attractive conceptualisation of absorptive capacity in the context of an organizational learning model, fundamental issues remain (Roberts et al., 2012). In one respect, absorptive capacity may be considered as a construct comprising various assumptions, boundary conditions, and dimensions (Roberts et al., 2012), whereas exploration and exploitation are both considered to be wide-ranging concepts that comprise a number of different activities (Gupta et al., 2006). Moreover, the aspect of prior related knowledge alongside absorptive capacity is believed to inherently bias absorptive capacity toward exploitation (Roberts et al., 2012). Hence, a lack of understanding regarding the link between exploration and absorptive capacity remains (Roberts et al., 2012).

It can be concluded from the literature review in the area of absorptive capacity that it represents a vital dynamic capability in organizational learning. As stated above, absorptive capacity has two main components: potential absorptive capacity (acquire and

assimilate knowledge) and realised absorptive capacity (transform and exploit knowledge). These components reflect the organization's capacity of renewing its knowledge base and introducing innovative products and services. However, the literature stresses that recognising valuable external knowledge is also imperative for absorptive capacity to take place. This logically matches the dynamic capability model suggested by Teece (2007), which suggests that the firms' sensing capability of trends in technologies and opportunities enhances the firms' chances to seize these opportunities. In the previous section, the researcher identified three factors that represent the firm's sensing capability: breadth of knowledge sources, internationalization orientation, and market intelligence generation. This section argues that the two components of absorptive capacity represent dynamic practices that match the sizing capability in Teece (2007).

The next section discusses the last component in Teece (2007) - the ambidextrous capacity that represents the reconfiguring capability in the context of innovation.

2.3.3 Firms' Ambidextrous Capacity

With the emphasis on sustainable competitive advantage in a turbulent environment, an underlying question is how an organization can 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 estimated 30 years in 2005 (Foster & Kaplan, 2001). Another study of 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 organizations intrinsically suffer from inertia and inability to change (O'Reilly & Tushman, 2008). Yet these studies do not explain why other companies still have a strong position and a long record of survival, such as IBM, GKN, Harris Corporation, and B.F. Goodrich (O'Reilly & Tushman, 2008; Carroll et al., 1996).

This requires more than static theories of strategy that emphasise position or resource advantages (Barnett et al., 1994; Porter, 1980) to better understand such phenomena (O'Reilly & Tushman, 2008). Dynamic capabilities theory considers sustainable competitive advantage at its core, and highlights the central role of strategic leadership to adapt, integrate, and reconfigure organizational 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 and Tushman (2008), exploration and exploitation are two distinctive activities that require particular practices, processes, and skills. Mastering these two paradoxical capabilities is labelled 'ambidexterity', and it is probably the key capability that separates firms that survive from those that fail as environments rapidly change (Lubatkin et al., 2006; O'Reilly & Tushman, 2004; Rivkin & Siggelkow, 2003). There are a variety of interpretations of organizational 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 exploitation and exploration 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 both organizational 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).

An ambidextrous organization is capable of simultaneously handling two conflicting modes of the knowledge management process to exploit current competencies and explore critical new domains (Lubatkin et al., 2006). Scholars on the subject of innovation management emphasise that successful organizations show efficiency in terms of utilising their present competencies, whilst simultaneously investigating and identifying new technologies and skills to establish explorative advanced innovations (Levinthal & March, 1993; Floyd & Lane, 2000; Gibson & Birkinshaw, 2004; He & Wong, 2004). The work of He and Wong (2004) empirically demonstrates that a firm's growth rate is positively associated with interactions of both explorative and exploitative innovation strategies. Research emphasises that an organization must first learn how to establish equilibrium between explorative and exploitative innovation activities (Chang et al., 2011); this will aid the firm in attaining significant levels of performance (Burgelman, 1991;

Tushman & O'Reilly, 1996; Volberda, 1996; Eisenhardt & Martin, 2000; Benner & Tushman, 2003). Importantly, if an organization is unsuccessful in establishing such equilibrium, there is the potential to decline and be in a position of weakness (March, 1991). A number of activities are seen as linked with exploitation: efficiency, improvement, refinement, and selection. On the other hand, exploration may be linked with discovery, experimentation, search, and variation (March, 1991).

In greater depth, it is seen that exploitative innovations react to the present environmental conditions through making changes to present technologies and efficiency improvements in outputs and approaches (Harry & Schroeder, 2000). Such incremental innovations are geared towards fulfilling the requirements of present markets or customers (Benner & Tushman, 2003; Danneels, 2002). Established designs are improved and present services and products enhanced. With such an aim taken into account, knowledge is utilised in the application of exploitation (Nonaka, 1998).

On the other hand, exploratory innovations react to and even drive new markets through the establishment of new products/services and innovative technologies (Lubatkin et al., 2006). These radical innovations are geared towards fulfilling emerging consumers' requirements or markets, as highlighted by Benner and Tushman (2003) and Danneels (2002).

Figure 2.16: Explorative and exploitative strategies

Furthermore, scholars suggest that a number of elements applicable to the external environment - namely, degree of competitiveness and environmental dynamism - are putting pressures for ambidexterity in innovation (Levinthal & March, 1993; Auh & Menguc, 2005; Jansen et al., 2005). Competitive environments that are dynamic in nature

may still require organizations to pursue different kinds of innovation at one time. If this is not the case, such organizations risk failure (Benner & Tushman, 2003). A competitive environment may also push organizations towards exploitative innovations as a result of the requirement to keep up with rivals (Jansen et al., 2005).

In consideration of the literature in this arena, strategic ambidexterity is classified in relation to two complementary and orthogonal dimensions, making reference to exploitative and exploratory behaviours. With this noted, exploration is described by March (1991) as, *"things captured by terms such as search, variation, risk taking experimentation, play, flexibility, discovery, innovation"* (p. 71), whilst exploitation, on the other hand, is described as *"such things as refinement, choice, production, efficiency, selection, implementation, execution"*. Considering the work of March (1991), a number of recent studies recognise flourishing firms as having the capacity to pursue incremental and radical innovation (Tushman & O'Reilly, 1996), preservation and change (Volberda, 1996), adaptability and alignment (Gibson & Birkinshaw, 2004), or exploitative and exploratory innovations (Jansen et al., 2005).

Placing emphasis on exploitation alone - excluding the development of new opportunities - could provide, in theory, benefits in the short-term, such as minimal product costs, yet it may put firms at risk of inertia in the long-term (Smith & Tushman, 2005). Emphasis on exploitation alone is seen to prevent the firm from adopting and implementing the required changes upon the shifting of the environment (Tushman et al., 1997). On the other hand, focusing on exploration alone, as has been highlighted by March (1991, p. 71), may result in losses associated with the costs of experimentation, through which advantages may not be achieved. Therefore, placing emphasis on only one aspect of ambidexterity may result in one of two outcomes as stated by Kollmann et al. (2007), *"either suffocate in conservatism or drown in chaos"*.

Therefore, the above literature shows how ambidexterity increases the firm's chances of successful invention and of maximising its economic advantage. The term 'reconfiguring', as suggested by Teece's (2007) model, is associated with the strategic mind-set that enables firms' use, and reuse, of their valuable resources. As an innovation strategy, the utilisation of knowledge and resources must take into account both exploration and exploitation activities, as each of them represent a crucial dimension in firms' sustainable competitiveness. With higher absorptive capacity, firms may be able to

utilise knowledge in both directions in order to achieve ambidexterity. This assists firms in maximising the benefits from their knowledge base in existing products and markets, as well as increasing their chances of achieving more radical innovation, which helps to protect their long-term competitiveness.

In this part of the literature review, a review of the dynamic capabilities theory was conducted in parallel with networking theory, absorptive capacity, and ambidextrous capacity. The aim of this part was to identify factors that might be reflected in Teece's (2007) theory of dynamic capability. The review proposes that, at the recognition stage of external knowledge and opportunities, the firm's breadth of knowledge sources, market intelligence generation, and internationalization orientation are crucial factors that may stimulate the firms' ability to recognise, absorb, and use knowledge. Potential absorptive capacity and realised absorptive capacity comprise the practices that help firms acquire, assimilate, transform, and exploit absorbed knowledge into innovative products and services. Ambidextrous capacity stimulates the firm to pursue both incremental and radical innovation (through exploitation and exploration innovation strategy) in order to maintain both long-term and short-term competitive advantage.

2.3 The Impact of Information Technology in Firms' Innovation

Resource picking and capability building have been viewed as strategic enablers for sustainable competitive advantage (Makadok, 2001). Within the information technology (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 complements other organizational capabilities in an integrative way (Dale Stoel & Muhanna, 2009; Melville et al., 2004), proposing an indirect relationship with a firm's performance (Ravichandran & Lertwongsatien, 2005).

Figure 2.17: IT has an indirect relationship with the firm's competitive advantage through other capabilities.

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 organizational capabilities mediates this relationship (D'Aveni, 1994). Strategically, competitive actions are encapsulated in the organization's capabilities of taking a step ahead of existing market modes of delivering value through innovation in products/services or channels (Ferrier et al., 1999). Sambamurthy et al (2003) argue that IT affects the organization's dynamic capabilities by influencing its agility, entrepreneurial alertness, and by enhancing its knowledge, processes, and richness through digitisation. Koellinger's (2008) work highlights the importance of IT as a key influencer of a firm's innovation performance.

Although there is vast literature on the ways in which IT may be utilised in order to assist organizations in developing new products for achieving success, fewer studies have centred on dealing with more critical considerations. These considerations include whether or not the provision of IT-centred support, in the context of product innovation, actually has the capacity to achieve superior organizational performance and a competitive edge (Zhang, 2011). According to Zhang (2011), some previous empirical research examining the performance effect of IT support on product innovation has been more concerned with assessing the operational benefits associated with the project or department-level support of IT, such as decreasing new product development costs and times (Laurindo & Carvalho, 2005; Durmusoglu et al., 2006; Pavlou & El Sawy, 2006). This consideration subsequently causes the question to be posed in terms of whether or not the operational advantages achieved through IT-related support would ultimately achieve a competitive edge at an organizational level (Zhang, 2011). Essentially, owing to the declining costs of software and hardware, as well as the accessibility and easy imitation of such components during modern times (Zhang, 2011), IT is questioned regarding its ability to establish and maintain its competitive advantage (Mata et al., 1995; Carr, 2003).

Yet combining IT with other firm-specific resources may establish a complex set of complementary resources that cannot be simply or seamlessly replicated by rivals (Zhang, 2011). Tarafdar and Gordon (2007) highlighted the importance of IT in the innovation process, while Pavlou and El Sawy (2006) illustrated the impact of IT on new product development, using the dynamic capability approach. Additional research was carried out with the aim of providing a link between the interactions of innovation and IT capital for achieving organization-level profitability (Huang & Liu, 2005). Accordingly, how IT capital achieves or aids product innovation remains unclear (Zhang, 2011).

Figure 2.18: Can IT influence firms' innovation capability to achieve better innovation performance?

Previous studies regarding product innovation, and IT applications in particular, highlight that there may be a link between the development and implementation of IT and the improvement of overall effectiveness and efficiency of new product development (Sanchez, 1995; Nambisan, 2003; Pavlou & El Sawy, 2006; Alonso et al., 2010) and thus, profitability enhancements (Henard & Szymanski, 2001; MacCormack et al., 2001). For instance, IT facilitates concurrent engineering (i.e. computer aided design [CAD], computer aided engineering [CAE], and computer aided manufacturing [CAM]) in the design and development process. IT has been recognised as a valuable instrument in terms of improving collaboration and communication across cross-functional product teams, thus decreasing the costs and times associated with new product development (Sanchez, 1995; Pavlou & El Sawy, 2006). In addition to achieving cost and time-related benefits, the application of IT may be adopted in order to establish and generate various individual opportunities for product innovation (Zhang, 2011).

Other empirical research has emphasised that effective IT implementation shows a significant impact with regard to product development and cost reductions, as well as aiding production flexibility and innovativeness (Corso & Paolucci, 2001; Laurindo & Carvalho, 2005; Durmusoglu et al., 2006; Pavlou & El Sawy, 2006; Barczak et al., 2007). The research conducted by Pavlou & El Sawy (2006) on the role of IT, in the context of new product development, shows that IT positively influences an organization's dynamic capabilities through cooperative work systems and knowledge management systems, and significantly affects the new product development process overall. While previous empirical studies have assessed the effects of IT support with regard to product innovation, mainly in relation to the operational advantages (Zhang, 2011), Huang and Liu (2005) recognised that IT capital (as measured by IT intensity) interacted with innovation capital (as measured by R&D intensity). Huang and Liu (2005) note that this interaction is apparent in its effect on both returns on sales (ROS) and returns on assets (ROA). Despite the fact that the specific types of support delivered by IT in the study were neglected by the

researchers, the results nevertheless suggest that higher profitability levels might be derived from IT in relation to innovation-centred investment (Zhang, 2011). Consequently, it is interesting to highlight the IT capabilities that are critical for the firms' innovation process and competitive advantage. In consideration of the work of Wade and Hulland (2004), IT capabilities might be classified into three different classes: outside-in, inside-out, and spanning.

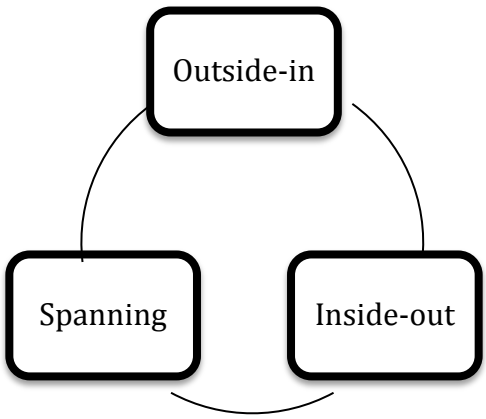


Figure 2.19: IT capabilities classification as suggested by Wade & Hulland (2004)

First, outside-in IT capabilities are outward facing, meaning that organizations are able to collect data from the external environment and develop external links (Roberts et al., 2012). Inter-organizational electronic business interfaces are acknowledged as improving the overall capacity of an organization to both recognise and exchange important data through the partners of its supply chain (Roberts et al., 2012). Accordingly, outside-in IT capabilities facilitate the knowledge identification potential of the organization (Roberts et al., 2012). Inside-out IT capacities are inward facing. For example, capacities regarding IT skills and technology platforms are inside-out as they are able to improve the capacity of an organization to take advantage of market opportunities, with immediate access to standardised information across units of the organization, facilitated by integrated information systems. Subsequently, the firm is able to utilise new data more willingly and freely in order to devise services and products for adoption. Accordingly, the knowledge application capacity of a firm increases through the use of inside-out IT capabilities (Roberts et al., 2012). The firm's outside-in and inside-out capabilities are integrated through spanning IT capacities (Roberts et al., 2012).

Nevertheless, the impact of IT capabilities on another firm's innovation capabilities remains lacking in research, both empirically and theoretically (Joshi et al., 2010).

However, a few pieces of conceptual research (e.g. Holsapple & Singh, 2003; Davenport et al., 2008; Leonard-Barton, 1995) and even fewer empirical research projects (e.g. Tippins & Sohi, 2003; Sabherwal & Sabherwal, 2005) have analysed this link.

With this taken into account, this gap in the literature should be addressed through the clear and distinctive analysis of relationships between various innovation and IT-facilitated knowledge capabilities in the context of the innovation pathway (Joshi et al., 2010). When reviewing the literature, mixed findings have been garnered in relation to the link between organizational performance and IT (Kohli & Devaraj, 2003), with emergent empirical evidence more frequently showing the lack of a significant, direct link between the organizational performance outcomes and IT investment (e.g. Powell & Dent-Micalef, 1997; Kohli & Devraj, 2003; Tippins & Sohi, 2003). With this in mind, in order to garner value from IT, organizations must actively encourage and support IT-enabled knowledge capacities that improve the performance of the organization (Joshi et al., 2010). Such a link is still in need of examination (Joshi et al., 2010).

The next section reviews, in detail, the IT capabilities that facilitate firms' innovation dynamic capabilities as identified in previous sections.

2.4 The Role of IT in Firms' Dynamic Capabilities

2.4.1 The Role of IT in Recognising External Knowledge

In research centred on IT and its competitive impacts on the retail industry of the United States, a number of retailers were found to have improved their performance through coupling IT resources and human resources (Powell & Dent-Micallef, 1997). Moreover, it is also acknowledged in the literature of product innovation that knowledge and information relating to customers, internal processes, and suppliers is fundamental in the context of new product development, as highlighted by various scholars (Sanchez, 1995; Hong et al., 2004). Hong et al. (2004) state that, in this regard, new product development comprises a core concerned with the alignment of customer requirements and the manufacturing and engineering capacities of both an organization and its suppliers. Thus, the information relating to the requirements of customers and the capabilities of an organization in terms of design, production, and the capacities of its suppliers are all

pivotal elements for the efficiency and effectiveness of the new development process (Zhang, 2011).

Moreover, the knowledge and information relating to an organization and its customers, internal capabilities and suppliers, and their respective features, all play a role in adding value to the IT support of the firm (Zhang, 2011). Stated otherwise, proprietary knowledge adds a greater degree of importance and value to an organization through planting obstacles in the paths of rivals. This is achieved through making it difficult for other companies to garner the same advantages and competitive edge from the IT support utilised by the organization (Feeny & Ives, 1990). In this same vein, inter-organizational interpretation systems aid firms in the manipulation and interpretation of knowledge garnered through partners, subsequently improving the absorption of knowledge (Roberts et al., 2012).

This means that the knowledge accumulation and transformation capacities of a firm are facilitated by IT capabilities (Roberts et al., 2012). IT has been studied in relation to knowledge management as well. For instance, the archiving, storing, retrieving, and sharing of data are activities enabled through knowledge management systems, all of which help to achieve a deeper understanding in terms of how new external knowledge is linked with the knowledge already possessed by members (Roberts et al., 2012). It is recognised that, when aiming to foster innovation and support knowledge management initiatives, IT is fundamental (Alavi & Leidner, 2001) owing to its capacity to create, disseminate, and utilise knowledge (Davenport et al., 2008), therefore significantly improving and facilitating the knowledge capabilities of organizations (Joshi et al., 2010).

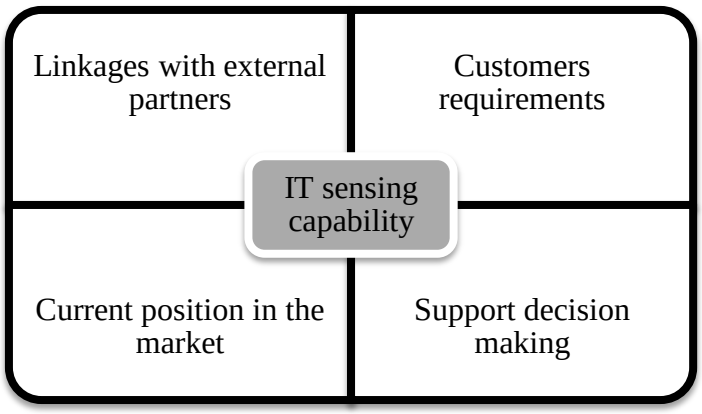


Figure 2.20: IT sensing capabilities

Therefore, organizations' absorptive capacities can be further enhanced through IT, which is able to examine and transform significant volumes of data gathered from various sources and in different forms that otherwise may not be able to be managed or handled (Scott, 2000; Alavi & Leidner, 2001). Essentially, the capacity of organizations to identify and renew their knowledge can be increased by IT through highlighting competitors' moves in their external environment, customer interests, industry trends, and storing data in the IT systems - all of which assist in the acquiring, storing, and utilising of knowledge in a quick and cost-efficient manner (Joshi et al., 2010).

2.4.2 The Role of IT in Absorptive Capacity

Absorptive capacity has two distinct dynamic capabilities: potential absorptive capacities and realised absorptive capacities (Zahra & George, 2002). The former comprises the practices related to acquisition and assimilation of knowledge, meaning that the organization is made flexible and open to attaining and distributing knowledge (Lane & Lubatkin, 1998; Zahra & George, 2002). Realised absorptive capacity refers to knowledge transformation and utilisation practices. Importantly, both potential absorptive capacity and realised absorptive capacity are vital and complementary, each having their own distinct roles (Joshi et al., 2010). Potential absorptive capacity can be stimulated by those information technologies that are able to assist and support the acquisition and assimilation of knowledge (Joshi et al., 2010). The acquisition of knowledge requires organizations to establish and garner knowledge considered fundamental to their functioning (Joshi et al., 2010). There are numerous information technologies available to facilitate, support, and improve the knowledge acquisition capacities of organizations through improving the directionality, intensity, and speed of knowledge identification and selection (Joshi et al., 2010). For example, data management systems, databases, and data warehouses all facilitate organizations' gathering and distributing of new knowledge across various unstructured and structured forms, such as audio, data, images received, and video, through diverse sources, such as supply chain partners (Malhotra et al., 2005).

Organizations that make use of such technologies are likely to improve their capability to attain and gather valuable information, as highlighted by Tippins and Sohi (2003). The gathering of knowledge involves the incorporation and integration of knowledge within organizations - thus, firms must have this capacity (Holsapple & Joshi, 2002). This capacity enables the understanding and integration of new information within

organizational knowledge resources (Zahra & George, 2002). Recently acquired data commonly adopts forms and types that cannot be internalised immediately (Leonard-Barton, 1995), although the understanding and internalisation of such information is further aided by the assimilation practices (Joshi et al., 2010). With this noted, it is emphasised by Alavi and Leidner (2001) that IT has the ability to improve the assimilation potential of organizations by establishing organizational memory, such as through electronic repositories. Through the application of organizational learning, firms are able to accumulate and utilise important information that should be stored and kept for future use (Tippins & Sohi, 2003). In this regard, it is acknowledged that the tools and instruments necessary for storing such information can be delivered by IT, which can store information in formats that facilitate access by company staff, enabling them to interpret knowledge consistently, and subsequently incorporating these data as part of the company's overall memory (Joshi et al., 2010).

The transformation of knowledge involves the organization developing, synthesising, and refining information through the addition, deletion, and reinterpretation of the data (Joshi et al., 2010). Firms' knowledge transformation practices may be improved or facilitated through the application that is able to assist in the creation of new knowledge by categorising, merging, reclassifying, and synthesising present knowledge (Joshi et al., 2010). A number of information technologies are known to help provide support and improvement regarding the firm's knowledge transformation practices. For example, analytical software and data mining are business intelligence tools that provide firms with the ability to transform existing knowledge and data with the aim of establishing deeper understanding and insight (Sabherwal & Becerra-Fernandez, 2010).

Moreover, IT can also improve knowledge utilisation through enabling and supporting the application of knowledge - notably maintained and embedded within IT systems - with the aim of carrying out organizational functions (Josh et al., 2010; Alavi & Leidner, 2001; Gold et al., 2001; Sabherwal & Sabherwal, 2005). There are numerous information technologies that are known to encompass different types of knowledge - namely, directives, instructions, routines, rules, and standards - all of which have the potential to assist individuals in the completion of their knowledge-related work (Alavi & Leidner, 2001) without entirely comprehending the knowledge that has been embedded (Joshi et al., 2010).

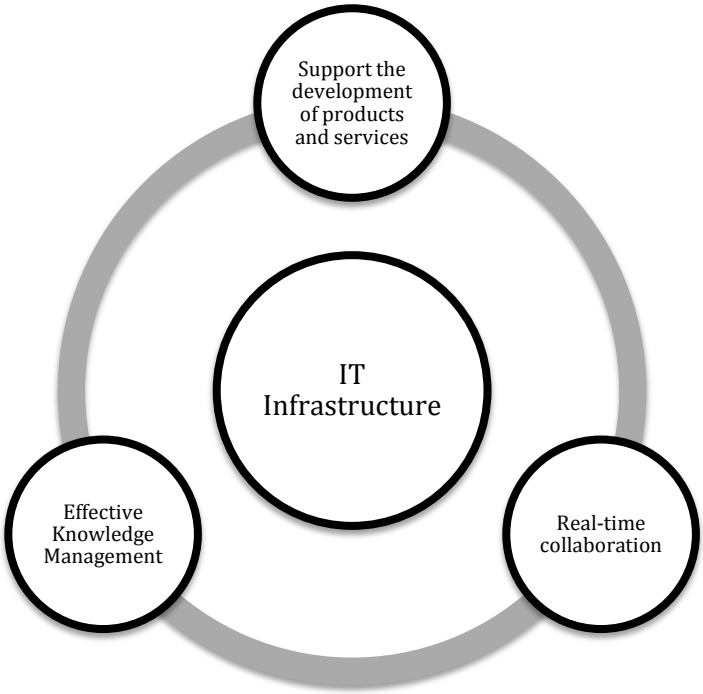


Figure 2.21: IT infrastructure capabilities in knowledge development

Social integration tools are information technologies that can enable and encourage communication, connectedness, coordination, and interaction amongst organization members through establishing seamless networks of devices, knowledge, and people (Joshi et al., 2010). Jansen et al. (2005) further state that such tools are antecedents to potential and realised absorptive capacity, although Todorova and Durisin (2007) state that social integration mechanisms may either negatively or positively affect both potential and realised absorptive capacity, as well as organizational innovation. Nevertheless, IT can help foster knowledge synergies and deliver support in this area by establishing electronic networks of collaborators and alliances (Joshi et al., 2010), all of which can move towards facilitating the much-needed components of knowledge integration and cross-firm socialisation (Tippins & Sohi, 2003).

2.4.3 The Role of IT in Ambidextrous Capacity

Besides the ability of IT to facilitate absorptive capacity, it is probably important to understand how IT may influence ambidexterity (balancing both explorative and exploitative innovation). As described in detail in the previous sections, exploitative innovation strategy is associated with incremental innovation and maximising benefits from existing products. This requires higher effectiveness through better alignment of

available resources, including IT, to better achieve current objectives (Gibson & Birkinshaw, 2004). On the other hand, explorative innovation strategy is associated more with extermination and radically oriented innovation (Gibson & Birkinshaw, 2004). This demands greater flexibility of IT in order to be agile enough to react to changes in the markets and capture emerging opportunities.

2.4.3.1 IT Flexibility

With the significant increase in volatility within the market, unstable consumer demands, and swift product obsolescence, organizations are forced to reconsider their capacity to react to change (Tallon & Pinsonneault, 2011). When experiencing quick and commonly unexpected changes, it is important for the firms' IT to be flexible in order to be agile (Tallon & Pinsonneault, 2011). Agility is recognised as the capacity to identify and react to both threats and opportunities with dexterity, ease, and speed (Tallon & Pinsonneault, 2011).

Agility requires IT flexibility to meet changes in requirements, as argued by Tiwana and Konsynski (2010) as they define agility as *"the capacity of the IT function to rapidly adapt to changing line function demands and opportunities"*. The line function IT requirements may change quickly, owing to fluctuations in firm processes, competitive pressures, organizational priorities and user expectations, which may subsequently induce new opportunities (Prahalad & Krishnan, 2002). Flexibility in the arena of IT is a fundamental predecessor for two key reasons. Primarily, it enables the quick modification of amendments to the misalignments of line function demands and IT activities (Prahalad & Krishnan, 2002). Owing to the fact that a number of firm processes in line functions depend significantly on IT applications, changes in firms' processes may be hampered if IT lacks the ability to quickly adapt to such changes (Tiwana & Konsynski, 2010). Secondly, the IT requires responsiveness to new market opportunities that may profoundly affect the requirements of the line functions (Hagel, 2002). Changing interconnected and customised IT applications, however, are recognised as being both time-consuming and commonly complex (Marwaha & Willmot, 2006).

The work of Tallon and Pinsonneault (2011) empirically demonstrates that flexible IT infrastructure has a positive effect on an organization's agility. Having IT that is sufficiently flexible to compensate for the firm's changing requirements is crucial (Saraf et al., 2007). According to Saraf et al (2007), IT flexibility represents the capability to rapidly and economically adjust IT to meet changing firm requirements. Nelson and Ghods (1998)

specifically define IT flexibility as *"the ability of the IT assets to adapt to both incremental and revolutionary changes in the business or business process with minimal penalty to current time, effort, cost, or performance"* (p. 233).

A flexible IT infrastructure is recognised as having two fundamental elements: adaptability and scalability (Tallon & Pinsonneault, 2011). Adaptability refers to the degree to which different IT requirements can be facilitated through IT infrastructure, whilst scalability signifies the degree to which IT capacity may increase or contract (Tallon & Pinsonneault, 2011). In actuality, scalability means that an organization may enhance or remove hardware capacity (CPUs, routers, servers, storage), network bandwidth, and software licenses easily and quickly (Tallon & Pinsonneault, 2011). In addition, scalability may also be attained through two key approaches: either by acquiring or creating additional resources such as servers, or through the utilisation of more recent technologies, such as grid computing or software-as-a-service (Tallon & Pinsonneault, 2011). Therefore, IT flexibility increases the ability of the organization to support its different modes of operation. The ability of an organization to pursue explorative innovation and, at the same time, exploit current opportunities requires different sets of processes. Higher IT flexibility of an organization supports and even helps govern during the changing requirements of users, and hence facilitates the likelihood of achieving higher innovation performance.

2.4.3.2 IT Effectiveness

Wade and Hulland (2004) highlight that IT effectiveness is an imperative IT capability that helps firms develop a competitive advantage if it is properly aligned to support business functions. IT alignment remains a key consideration for both industry and research in the field (Tallon & Pinsonneault, 2011), prompting organizations to consider efforts to further enhance the fit between organizational strategy and IT (Chan et al., 2006; Oh & Pinsonneault, 2007; Preston & Karahanna, 2009; Tallon, 2008). A better fit results in higher IT effectiveness, thus leading to better performance, as IT alignment may be recognised as enhancing overall performance (Bergeron et al., 2004; Oh & Pinsonneault, 2007). There are also advantages in particular key areas, such as financial performance, innovation, market growth and reputation (Chan et al., 1997), growth, and income (Croteau & Bergeron, 2001), as well as cost control (Oh & Pinsonneault, 2007).

During recent times, IT that increases process effectiveness has been analysed at the process level (Tallon, 2008). Effective IT results from higher alignment between the IT

resources and the firms' goals, and can be defined as *"the degree to which the IT function supports the goals and priorities of an organization's line functions"* (Tiwana & Konsynski, 2010). However, IT fit may be a continuously shifting target (Hirschheim and Sabherwal, 2001). Therefore, maintaining IT effectiveness necessitates the ability to flexibly and quickly adapt to developing changes regarding business requirements (Tiwana & Konsynski, 2010). Therefore, both IT effectiveness and IT flexibility are critical capabilities that help to ensure better support for various organizations' functions.

In sum, four IT capabilities are identified as important for innovation dynamic capabilities: IT sensing capability, IT infrastructure, IT effectiveness, and IT flexibility. IT sensing capability enables the firm to generate and interpret data about market intelligence, to further facilitate better linkages with the firm's partners, and to enhance the flow of external knowledge. The IT infrastructure increases the firm's capacity for acquiring, storing, and multiplying new knowledge in conjunction with existing knowledge towards improving existing products and services or introducing a higher level of product/service novelty. IT effectiveness increases the firm's performance by increasing efficiency and productivity, as well as by ensuring better value provision. Lastly, IT flexibility increases the firm's IT adaptability to meet new requirements resulting from changes in market conditions or from modifications to the firm's practices during exploratory innovation mode.

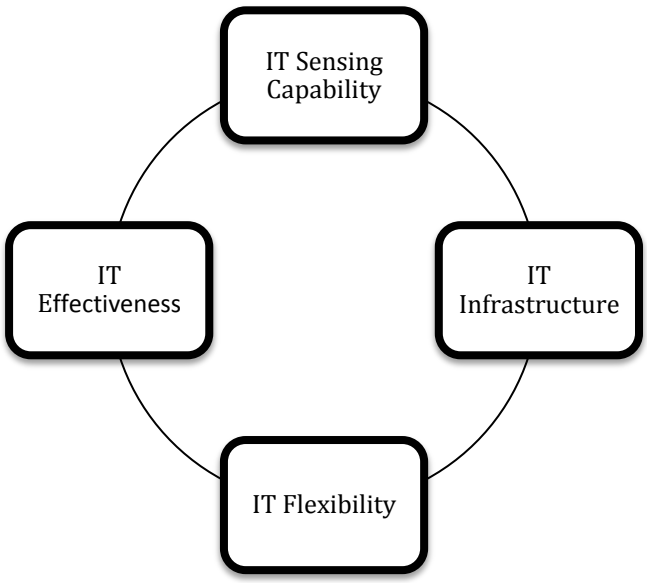


Figure 2.22: IT capabilities that may facilitate the firms' innovation performance

2.5 Conclusion

Innovation is a complex phenomenon and requires a holistic approach in order to understand how firms may enhance their innovation performance. In the current knowledge-economy era, firms can no longer work in isolation, as external parties (such as customers, suppliers, consultants, competitors, and research institutes) are critical for the innovation processes and represent cornerstones in systems of innovation. Advancement of knowledge might take place outside the firm's boundaries and may result in a radical shift in the market, where current values of products and services are destroyed and replaced by new ones.

Therefore, firms must be dynamic and develop capabilities that increase their ability to understand and interpret opportunities and threats in the market. Hence, the ability to perform networking activities with external parties and the generation of market intelligence are imperative to recognise valuable external knowledge that might aid the innovation process. The search for valuable external knowledge should not be limited to local markets as the current globalisation of markets takes rivalry and competitiveness to an international level. In the case of developing countries, internationalization of the searching process for knowledge and opportunities is of high importance as the local system of innovation might not be mature enough to support the development of innovative products and services.

As the external valuable knowledge has been identified, it is critical to absorb such knowledge and apply it to the commercial end. The firm's absorptive capacity represents the practices that focus on the acquisition, assimilation, transformation, and exploitation of external knowledge through multiplication with existing knowledge. Innovation has two modes: exploitative and explorative. Exploitative innovation is associated with improving existing products and services to maximise the economic advantage of an existing opportunity. On the other hand, explorative innovation is long-term oriented and involves experimentation and development of more radical innovation. Both strategies are vital in order for firms to sustain a competitive advantage for both the short and long-term. Therefore, the application of acquired knowledge should maintain a balance between these two strategies. An exploitative innovation strategy will attempt to use the acquired knowledge for improving existing products to maximise current benefits, while an explorative innovation strategy will attempt to utilise the knowledge to create new

opportunities through entirely new products and services.

Information technology (IT) may assist firms in their innovation process by its capability of handling knowledge effectively and by improving efficiency and adaptability. The literature of IT capabilities, in the context of innovation, highlights its role in facilitating capturing market intelligence, enhancing firms' linkages with external partners, and providing stronger analytical ability for the data that flow into the organization. IT also provides the internal infrastructure required to share knowledge, encourage collaborative working, as well as support product development. In the same vein, IT increases overall efficacy and productivity, and helps firms to be flexible enough to react quickly to changes in the workplace resulting from fluctuations in market conditions. The next chapter will discuss the development of the conceptual research framework and will state the related hypotheses arising from this research.

Chapter 3: Conceptual Model and Hypotheses Development

This chapter integrates the findings from the literature review chapter into a conceptual research model. The chapter further states the hypotheses of this research in order to test the research model empirically. The chapter begins with practices related to recognising external knowledge and opportunity, and then it moves on to the absorptive capacity practices that handle the knowledge inside the firm. In addition, the chapter covers the role of balanced innovation strategy (ambidexterity) in improving firms' innovation performance and the effect of information technology on the factors identified.

In the previous chapter, a literature review was conducted in three main areas. At first, a review of the innovation literature with regard to existing theories and recent studies was explicated to provide a better picture of the existing gaps. It was found that there is a lack of understanding of the factors which enhance innovation performance at the firm level (Gupta et al., 2006). Moreover, scholars highlighted a lack of empirical data regarding firms' capabilities to achieve better innovation performance (Wang & Ahmed, 2007), especially in Saudi Arabia (Shin et al., 2012). Therefore, we have adopted a firm-level theory (i.e. dynamic capabilities, by Teece (2007)) and used it as a lens to identify factors that stimulate firms' abilities to identify, absorb, and utilise knowledge towards introducing innovative products/services.

The literature review in the previous chapter revealed a number of factors that fall into Teece's (2007) three dynamic capabilities. Each factor comprises practices that firms' may use to improve their knowledge utilisation. Furthermore, the literature review attempted to understand how information technology might enhance the factors identified. Figure 3.1 shows that factors identified as a result of using Teece's (2007) model as a guideline for literature review.

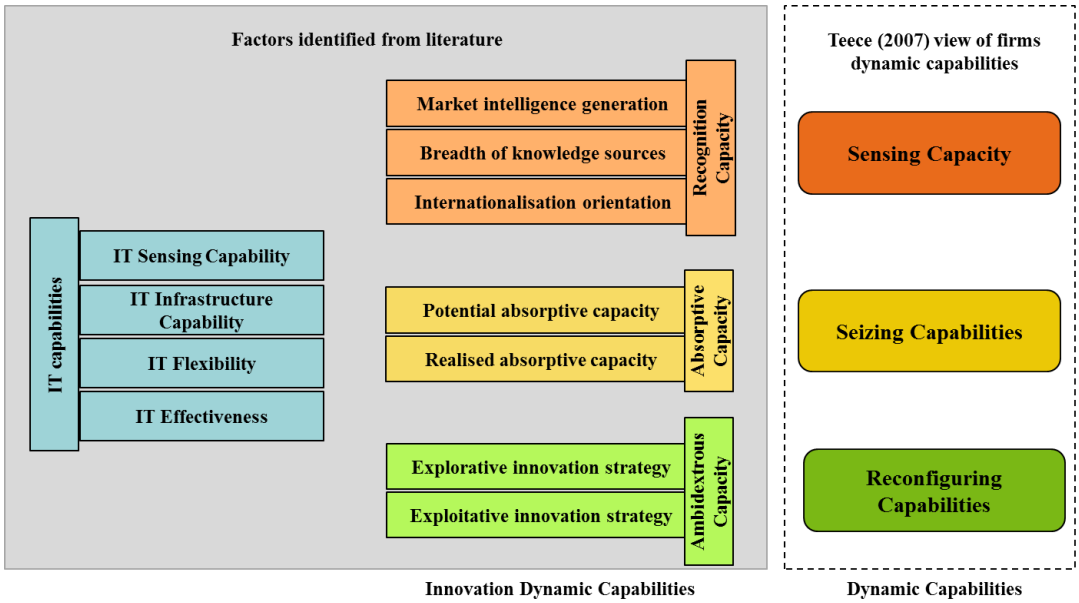


Figure 3.1: Factors identified from literature review that are proposed to enhance firms' innovation performance.

3.1 The Firms' Innovation Dynamic Capabilities

3.1.1 Firms' Recognition Capacity of External Knowledge

Three factors identified from the literature are hypothesised as critical for recognising valuable external knowledge, which may result in a greater ability of external knowledge acquisition (potential absorptive capacity). These capabilities are market intelligence generation, breadth of knowledge sources, and internationalization orientation.

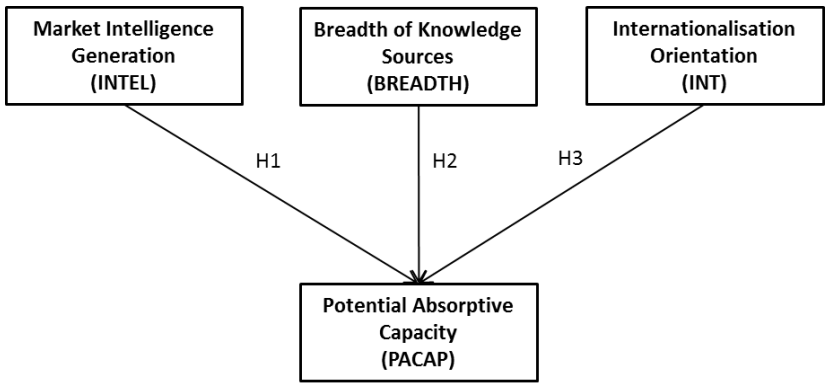


Figure 3.2: Hypotheses related to recognising opportunities.

Market intelligence generation is an essential part of a firm's market orientation. Information, 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 & Ketchen, 2001; Jaworski & Kohli, 1993). Han et al.

(1998) found that effective utilisation of market intelligence affects organizational innovativeness in both the technical and administrative dimensions. Vázquez et al. (2001) found that the ability of a firm to grasp market intelligence influences its willingness to innovate and commercialise. However, to have an effective influence on radical and incremental innovation prosperity, market intelligence generation requires strong usability of other capabilities (Baker & Sinkula, 2005). Therefore, it is hypothesised that:

H1: The firm's market intelligence generation (INTEL) has a positive effect on the firm's potential absorptive capacity (PACAP).

The literature highlights the impacts of an organization's networking capability and management on its innovation performance (Pittaway et al., 2004). Firms can differ significantly in their competence in managing networks to meet their innovation requirements (Pittaway et al., 2004). According to Gemünden et al. (1992), who studied 848 manufacturing firms in the Lake Constance region,:

"Firms which do not supplement their internal resources and competence with complementary external resources and knowledge show a lower capability for realizing innovations" (p. 373).

The intensity of linkage is vital for organizations' innovation performance. 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 greater 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 et al., 1997). Innovation that is more radical requires greater collaboration with universities (Häusler et al., 1994; Liyanage, 1995). Therefore, networking capability may represent an access point for the firm to substitute the limitations of its resources, which is essential to the innovation process (Chesbrough, 2003). Studies on the antecedents of absorptive capacity advocate the importance of elements such as exposure to an external environment, social relationships, and organizational structure (Sun & Anderson, 2010). For instance, Matusik and Heeley (2005) pointed out that the effectiveness of absorptive capacity depends on the level and density of contacts. Therefore, it is hypothesised that:

H2: The firm's breadth of knowledge sources (BREADTH) has a positive effect on its potential absorptive capacity (PACAP).

Chesbrough (2003) coined the term 'open innovation', advocating that firms must search outside their boundaries since bright ideas can exist outside the firm, and that a firm can use external routes to market. The current globalisation of markets seems to encourage firms to put an emphasis on the reach of their linkage. Carlsson (2006) highlights the importance of the globalisation of firms' R&D activities and internationalization of the innovation systems. Ernst (2002) argues that participation in a broader value chain opens new opportunities for the firm and helps integrate a variety of local and international knowledge, especially in developing countries. Therefore, it is hypothesised that:

H3: The firm's internationalization orientation (INT) has a positive effect on its potential absorptive capacity (PACAP).

3.1.2 Firms' Absorptive Capacity

Absorptive capacity is related to practices that handle knowledge inside organizations. The previous section argued three capabilities that may increase the firm's ability to recognise external valuable knowledge and opportunities that consequently enhance the firm's chance to acquire and assimilate knowledge inside their organization (potential absorptive capacity). As a result of higher potential absorptive capacity (more knowledge accumulated), the firm may have a greater chance to transform knowledge and exploit it into new or improved products/services (realised absorptive capacity), which therefore may enable them to pursue both explorative and exploitative innovations (ambidextrous capacity). The following discusses in detail the role of absorptive capacity practices in firm's innovation process.

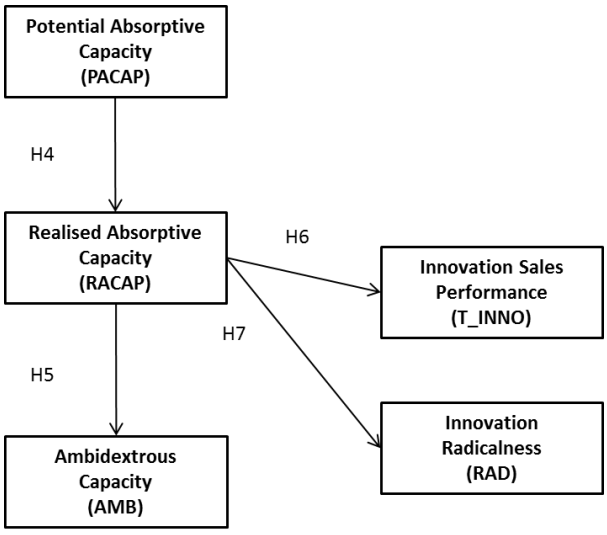


Figure 3.3: Hypotheses related to absorptive capacity

Inter-organizational networks, although they can complement the innovation process, cannot result in innovation alone (Harris et al., 2000). 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 realised 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 organization to perform in a changing and technologically fast-moving environment. The recent development of absorptive capacity emphasises how its dynamic nature is embedded in the routine and structure of an organization.

Lane et al., (2006) and Lichtenthaler and Lichtenthaler (2009) argue that the absorptive capacity dimensions are embedded in an organization's learning process. Absorptive capacity is viewed as strategic renewal for firms (Sun & Anderson, 2010) due to absorptive capacity dependency on the system, process, and structure of the organization (Todorova & Durisin 2007; Zahra & George; 2002). Absorptive capacity is also strategic renewal for firms due to its influence on the firms' development capability, by enabling it to generate and utilise knowledge necessarily to balance between continuity and change at an organizational level (Crossan et al., 1999). Zahra and George (2002) argue that firms are able to refresh their knowledge through emphasising the acquisition and assimilation of new external knowledge (i.e. potential absorptive capacity). Yet, emphasising potential absorptive capacity alone is costly and may not result in benefits equal to or exceeding the costs of such a process (Datta, 2012). Similarly, firms focusing on transformation and exploitation (realised absorptive capacity) may gain short-term advantages associated with the exploitation of existing knowledge, yet face difficulty sustaining competitive advantage over the long run (Ahuja & Lampert, 2001). This indicates that both dimensions are critical for the innovation process to sustain prosperity over both the short and the long run.

Therefore, it is hypothesised that:

H4: The firm's potential absorptive capacity (PACAP) has a positive effect on its realised absorptive capacity (RACAP).

Zahra and George (2002) and Jansen et al. (2005) theorised that the realised absorptive capacity influences a firm's products and process innovations and, hence, its

performance. It may enable, for example, the integration of knowledge and the development of new prototypes, applications, and modify existing products, processes, and technologies. The transformation and exploitation dimensions of realised absorptive capacity may contribute to extending existing knowledge and skills, and to improving efficiency (Jansen et al., 2005; Zahra & George, 2002). Hence, realised absorptive capacity may influence the organization's ability to incrementally improve existing processes (Zahra & George, 2002) and minimise related costs (Jansen et al., 2005; Zahra & George, 2002). Similarly, exploratory innovations rely on understanding, integration, and multiplication of existing and newly acquired external knowledge (Datta, 2012). Realised absorptive capacity may target development and application of newly gained external knowledge as part of exploratory innovations (Jansen, et al., 2005) and utilise knowledge in a novel way (Henderson & Clark, 1990; Kogut & Zander, 1992). This indicates that realised absorptive capacity is essential for a firm to achieve the necessary balance between exploitative and explorative innovations (ambidextrous capacity). Sun and Anderson (2010) highlight the case of Xerox, who pioneered the graphical user interface, but failed to capture its benefits in opposing both Apple and Microsoft. This demonstrates how the existence of prior knowledge is not enough for innovation success. An organization needs the ability to transform and exploit prior knowledge for commercial ends. Such ability to maintain the balance between exploration and exploitation is fundamental to firms' strategic renewal (Sun & Anderson, 2010). Therefore, it is hypothesised that:

H5: The firm's realised absorptive capacity (RACAP) has a positive effect on its ambidextrous capacity (AMB).

H6: The firm's realised absorptive capacity (RACAP) has a positive effect on its innovation sales performance (T_INNO).

H7: The firm's realised absorptive capacity (RACAP) has a positive effect on its innovation radicalness (RAD).

3.1.3 Firms' Ambidextrous Capacity

The previous section highlighted the importance of potential and realised absorptive capacity for knowledge acquisition, assimilation, transformation, and exploitation. Yet, it is important to fit the exploited knowledge in proper products/services

that match market needs. This highlights the important role of the innovation strategy in the firm's innovation success. Ambidextrous capacity refers to the ability of the firm to maintain a balance between the two necessary, yet paradoxical, innovation strategies (explorative and exploitative innovation). Exploitative innovation strategy is more incremental innovation oriented, and focuses on maximising benefits from existing technology through improving existing products/services. Such strategies assist firms in maximising the economic advantage of products/services offerings and in exploiting the opportunities of existing markets. Explorative innovation, on the other hand, is a more radical innovation oriented strategy, and focuses on developing new products/services that assist the firm to explore new markets and emerging opportunities. The explorative innovation strategy, although costly, is essential for sustaining competitive advantage in the long-term. Mastering both strategies is critical for innovation success in terms of achieving radical innovation and achieving higher innovation sales performance. The following section discusses in more detail the role of ambidextrous capacity in a firm's innovation process.

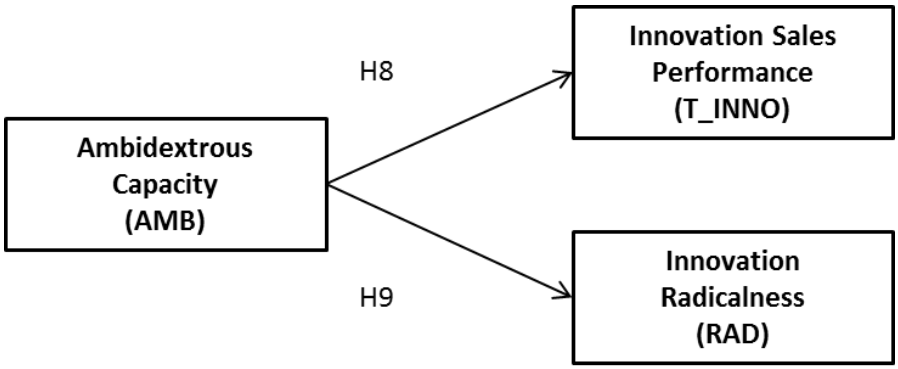


Figure 3.4: Hypotheses related to ambidextrous capacity

March (1991) relates innovation and knowledge management to activities associated with exploitation and exploration. Exploitation is based on product extending, which results in profit maximising 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 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 important for both successful

product development (Sheremata, 2000) and long-term performance (Tushman & O'Reilly, 1996). From a dynamic capability perspective, it is necessary to have an organization strategy that permits both exploitation and exploration modes (ambidextrous capacity) to take place internally, and in an integrated way (Gibson & Birkinshaw, 2004). Put clearly, the organization must have the capacity to be adaptive when responding to environmental changes (Teece, 2007; Wang & Ahmed, 2007) and to explore potential opportunities from new and existing knowledge (Wang & Ahmed, 2007; Zahra & George, 2002). An organization must also be able to align all capabilities to exploit realised knowledge (Teece, 2007) and to achieve a critical balance between short-term success and long-run survival (Gibson & Birkinshaw, 2004, O'Reilly & Tushman, 2008).

Vera and Crossan (2004) highlighted the importance of ambidextrous capacity for both kinds of leadership objectives, transactional (short-term profit oriented) and transformational (long-term competitiveness oriented), to enable the strategic advantage of organizational learning. The transactional leadership style helps to emphasise and stabilise useful practices, while the transformational style triggers routine change by challenging the redundant beliefs and assertions of the organization (Vera & Crossan, 2004). It is argued that ambidextrous firms are better at maintaining both long-term and short-term competitive advantages (Datta, 2012). Whereas incremental innovation enables firms to compete in mature markets (Teece, 2007), radical innovation helps organizations to compete in emerging markets (Burgelman et al., 2006; Christensen, 1992; Galunic & Eisenhardt, 1996; Henderson & Clark, 1990). Many scholars have found a positive link between ambidextrous capacity (balancing exploration and exploitation) and organizational continuous innovations (Nahapiet & Ghoshal, 1998; Volberda & Lewin, 2003; Hamel & Getz, 2004; and more recently, Li et al., 2010). Therefore, it is hypothesised that:

H8: The firm's ambidextrous capacity (AMB) has a positive effect on its innovation sales performance (T_INNO).

H9: The firm's ambidextrous capacity (AMB) has a positive effect on its innovation radicalness (RAD).

3.2 The Role of IT in Firms' Innovation Dynamic Capabilities

In the previous sections, hypothesis regarding the factors that facilitate firms' ability to recognise opportunities and external knowledge and capture emerging opportunities through knowledge absorption were identified. Furthermore, the impact of innovation strategy on product/service success was discussed. However, it is difficult to ignore the importance of information technology (IT) inside firms in facilitating processes, information flow, and management. At the firm level, information technology should work in synergy with other capabilities to induce the innovation process.

From the extant literature, four capabilities of information technology were identified which may assist the innovation process inside firms: IT sensing capability, IT infrastructure, IT flexibility, and IT effectiveness. IT sensing capabilities are associated with collecting and handling information regarding market intelligence, such as customers' requirements, including products' pricing and quantities. IT sensing capabilities may also aid in analysing current business situations and in supporting decision making. IT infrastructure is associated with the knowledge management and information flow inside the organization. IT flexibility represents the ability of the information technology inside the firm to be scalable and adaptive to changing requirements. IT effectiveness is associated with improving the overall productivity inside firms. Therefore, it is argued in this research that these four IT capabilities may facilitate the innovation process inside the firm, as shown in the figure below. This section discusses in detail the role of each capability in enhancing innovation capabilities inside the firm.

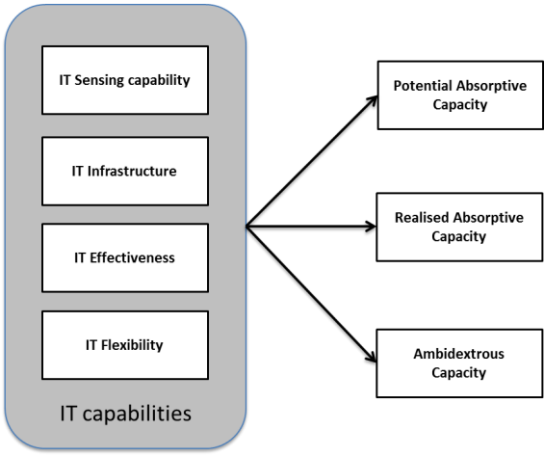


Figure 3.5: The impact of IT capabilities on absorptive capacity and ambidextrous capacity.

3.2.1 The Role of IT Sensing Capability

Information technology facilitates the linkage of an organization with its outer environment. Electronic data interchange (EDI) systems, or other electronic media, enhance the exchange of inter-organizational knowledge with key stakeholders, such as partners, customers, suppliers, or other entities (Konsynski & McFarlan, 1990; Zaheer & Venkatraman, 1994). Sambamurthy et al. (2003) touch on the value of information technology in helping Accenture to gain comprehensive access to codified knowledge from around the globe. Moreover, Srivardhana and Pawlowski (2007) argue that IT, such as enterprise resource planning (ERP), comprises the knowledge of industries and the best practices embedded in the information system by vendors, consultants, and other implementation partners. This leads to further exposure of a firm to other organizations' processes and practices. Additionally, by using the rapid capability of attaining and circulating information, Overby et al. (2006) suggest that the strategic use of IT can positively influence market orientation, and hence market intelligence generation. Min et al. (2002) argue that an organization could enhance the effectiveness and efficiency of its market orientation activity using IT. Empirically, Borges et al. (2009) found that IT has a strong influence on the firm's market orientation. Similarly, Bhatt et al. (2010) found that IT enhances 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 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 vendor-supplier relationships. Therefore, it is hypothesised that:

H10: The firm's IT sensing capability (IT SENS) has a positive effect on its potential absorptive capacity (PACAP).

H11: The firm's IT sensing capability (IT SENS) has a positive effect on its realised absorptive capacity (RACAP).

H12: The firm's IT sensing capability (IT SENS) has a positive effect on its ambidextrous capacity (AMB).

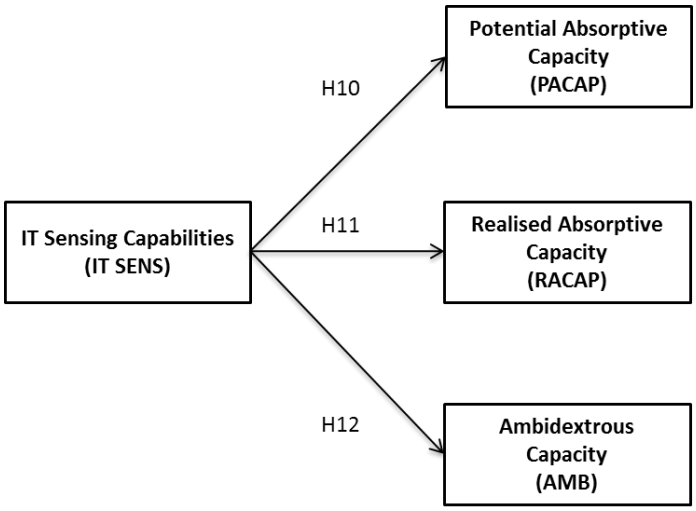


Figure 3.6: Hypotheses related to IT sensing capabilities

3.2.2 The Role of IT Infrastructure

According to Alavi and Leidner (2001), since a firm's ability to obtain new knowledge depends on prior existing knowledge, IT can *"increase the speed at which organizational memory can be accessed"* (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). Therefore, IT may improve the firm's potential absorptive capacity by enhancing the knowledge flow and exchanges across the organization, as well as by facilitating communication, coordination, collaboration, collective interpreting, and problem solving (Alavi & Leidner, 2001; Gold et al., 2001), which is key for assimilating acquired knowledge (Gold et al., 2001; Todorova & Durisin, 2007).

Pavlou and El Sawy (2006) show empirically that IT facilitates access to codified knowledge and enhances a firm's assimilation capability. In addition, they highlight that IT enhances problem solving capability and, therefore, a firm's ability to generate new knowledge, thereby enhancing its knowledge transformation capability. They add that IT contributes to the new product development stage by modifying processes and routines for knowledge exploitation.

Srivardhana and Pawlowski (2007) highlight the evolving nature of information technology, such as ERP, that is implemented by vendors and consultants, and undergoes in continues upgrades and modifications. Such upgrades and modifications are usually linked to current changes in industry practices, as vendors and consultants are usually aware of such changes. This positively affects an organization's absorptive capacity

through higher exposure to evolving processes and practices outside the organization's boundaries (Lee & Lee, 2000; Timbrell et al., 2001; Ko et al., 2005). A key dimension of absorptive capacity is realising its potential, which requires a higher level of knowledge sharing and understanding across the entire organization (Spender, 1996; Zahra & George, 2002). IT influences the content and structure of organizational knowledge (Baskerville et al., 2000; Lee and Lee, 2000), reducing the complexity of its users' jobs and facilitating a broader set of cross-functional knowledge (Baskerville et al., 2000; Robey et al., 2002), which influences knowledge exchange and understanding. In addition, IT facilitates access to common knowledge repositories by multiple business functions and departments (Gattiker & Goodhue, 2005), enhancing organizational memory (Goodman & Darr, 1996; Walsh & Ungson, 1991) and, in return, influencing a firm's ability to acquire, assimilate, transform, and exploit knowledge. Therefore, it is hypothesised that:

H13: The firm's IT infrastructure (INFRA) has a positive effect on its potential absorptive capacity (PACAP).

H14: The firm's IT infrastructure (INFRA) has a positive effect on its realised absorptive capacity (RACAP).

H15: The firm's IT infrastructure (INFRA) has a positive effect on its ambidextrous capacity (AMB).

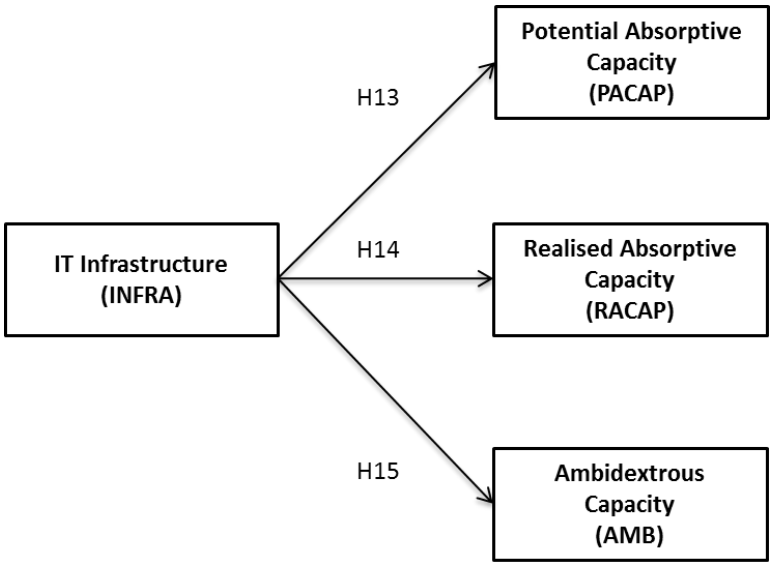


Figure 3.7: Hypotheses related to IT infrastructure

3.2.3 The Role of IT Effectiveness

From an organizational strategy perspective, a recent study by Tallon and Pinsonneault (2011) shows that IT can enable organizational ambidexterity. The effective alignment of IT with a firm's strategy positively affects profits, productivity and sales growth, which in turn enhances innovation exploitation (Bessant & Tidd, 2007; Chan et al., 2006; Preston & Karahanna, 2009; Tallon, 2007). With effective IT, users have improved ability to combine IT and non-IT resources in a novel way (Chan et al., 1997; Sabherwal et al., 2001; Sabherwal, & Chan 2001; Tallon, 2007), which is important for exploring innovative products and services (He & Wong, 2004; Pinsonneault & Rivard, 1998). Therefore, it is hypothesised that:

H16: The firm's IT effectiveness (ITE) has a positive effect on its potential absorptive capacity (PACAP).

H17: The firm's IT effectiveness (ITE) has a positive effect on its realised absorptive capacity (RACAP).

H18: The firm's IT effectiveness (ITE) has a positive effect on its ambidextrous capacity (AMB).

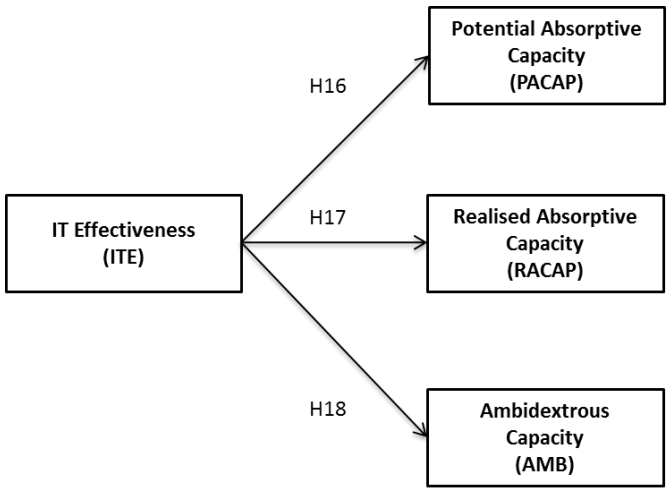


Figure 3.8: Hypotheses related to IT effectiveness

3.2.4 The Role of IT Flexibility

IT flexibility has two main dimensions, adaptability and scalability (Tallon & Pinsonneault, 2011), both of which have been highlighted as important in enhancing other organization capabilities (Byrd & Turner, 2000; Sambamurthy et al., 2003; Wade &

Hulland, 2004). Adaptability and scalability - both regarded as being foundations of IT flexibility - are associated with enabling organizations to maintain competitive advantage of their information technology capital (Sambamurthy et al., 2003).

IT flexibility creates more options, which subsequently assists in changing the way in which IT is aligned with firms' approaches, thus enabling firms to be more agile (Tallon & Pinsonneault, 2011). If two organizations are recognised as showing the same IT effectiveness levels, but illustrate differing degrees of IT flexibility, the one showing the greater IT flexibility will be seen to have greater digital possibilities, and thus achieve a more significant level of agility (Tallon & Pinsonneault, 2011). Exploration may be linked with discovery, experimentation, search, and variation (March, 1991). Exploitation, on the other hand, may be linked to efficiency, improvement, refinement, and selection. The explorative nature of innovation demands a high level of firm's agility (Gibson & Birkinshaw, 2004), which represents a cornerstone of ambidextrous organizations. Yet establishing an equilibrium between explorative and exploitative innovation activities (Chang et al., 2011) is what aids a firm in attaining significant levels of performance (Burgelman, 1991; Tushman & O'Reilly, 1996; Volberda, 1996; Eisenhardt & Martin, 2000; Benner & Tushman, 2003). If an organization is ineffective in forming such equilibrium, there is the potential to decline and move towards a position of weakness (March, 1991). Nelson and Ghods (1998) argue that IT flexibility *"enables the ability of the IT assets to adapt to both incremental and revolutionary changes in the business or business process with minimal penalty to current time, effort, cost, or performance"* (p. 233). Therefore, it is hypothesised that:

H19: The firm's IT flexibility (ITF) has a positive effect on its potential absorptive capacity (PACAP).

H20: The firm's IT flexibility (ITF) has a positive effect on its realised absorptive capacity (RACAP).

H21: The firm's IT flexibility (ITF) has a positive effect on its ambidextrous capacity (AMB).

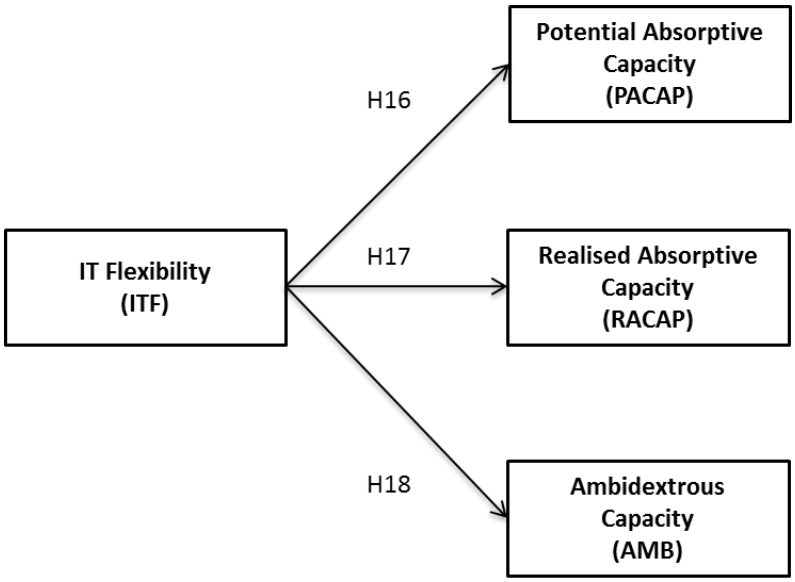


Figure 3.9: Hypotheses related to IT flexibility

3.3 Control Variables of This Research

Control variables (sometimes called moderating variables) refer to the factors that are likely to affect the research results. For instance, previous studies have suggested that the firm's size and age affect its ability to innovate, due to better access to resources and experience. Therefore, the factors of this study should be significant, regardless of the firm's size and age. This is achieved by including the control variables in the analysis to eliminate their effects. A number of control variables were included in this research, as suggested by scholars as follows. Firm size and R&D expenditure (as a percentage of sales) were included in a study by Chang et al. (2012). Firm age was included in a study by Chen and Huang (2009). The type of industry where the firm operates was included in a study by Serrano-Bedia et al. (2012). Environmental turbulence was also included in this study. It refers to how quickly the market changes, including changes in customers' preferences and the intensity of industry competitiveness (Sarkees et al., 2010). Firms that operate in environments with higher environmental turbulence are more pressured towards innovation compared to firms in lower environmental turbulence, as shown in a study by Sarkees et al. (2010). Other control variables are IT annual budget (Aral & Weill, 2007), sales turnover, growth and respondent position, as different senior positions could participate in the survey (Trkman et al., 2010).

3.4 Conclusion

In this chapter, the hypotheses of this research were stated. The chapter began with hypotheses related to market intelligence generation, breadth of knowledge sources, and internationalization orientation. Next, it moved to the role of potential and realised absorptive capacity and the impact of ambidextrous capacity, as well as their effects on the firm's innovation sales performance and innovation radicalness. In addition, hypotheses related to information technology's effects on the innovation process were stated. In this regard, four IT capabilities were proposed: IT sensing capability, IT infrastructure, IT effectiveness, and IT flexibility. Figure 3.10 represents the conceptual model for this research.

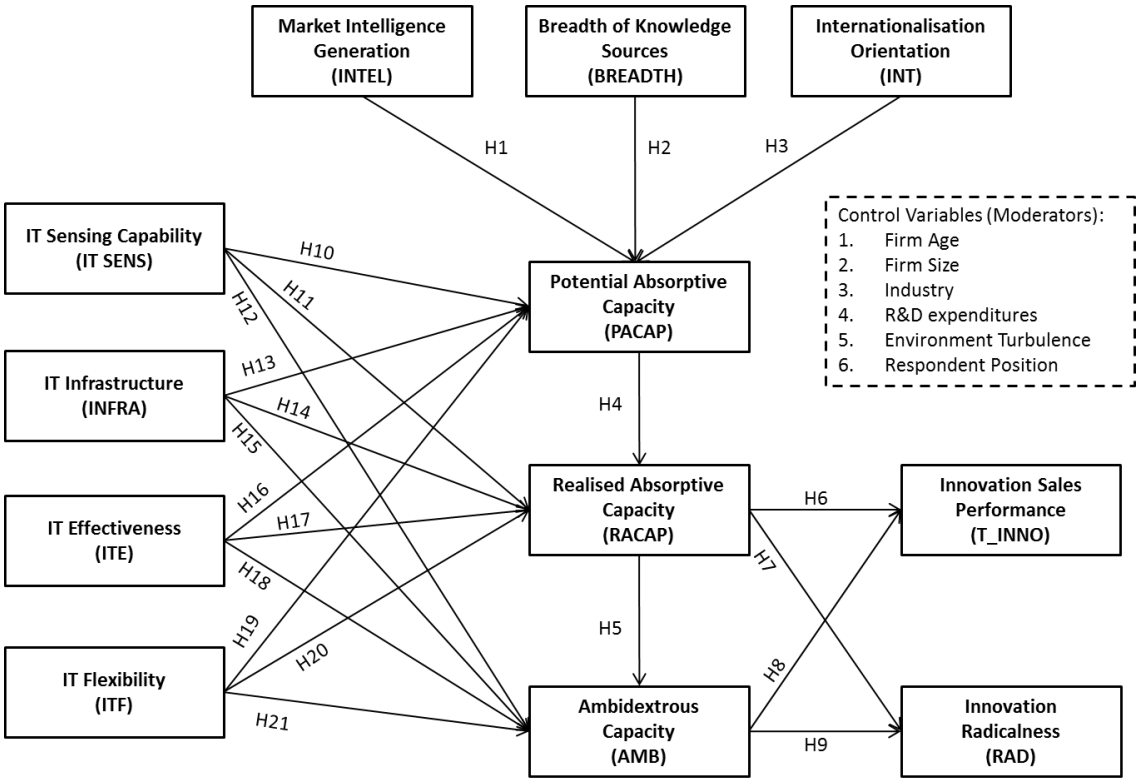


Figure 3.10: The conceptual research model of this research

The next chapter is related to research methodology. It starts by discussing different paradigms for research methodology and then develops the research design of this study in order to collect data and operate the research model.

Chapter 4: Methodology

This chapter will review some key paradigms of research approaches. This process will help to identify the appropriate approach for this research. The discussion covers research methods that are inherent in organizational research and information technology research. This chapter also discusses the study design including the development of the measurement instrument (survey) for the related hypothesis regarding the factors identified in Chapter 3 (innovation dynamic capabilities, and the information technology capability). In addition the approach to data collection, pilot study and the main data collection is covered in this chapter. The chapter further covers the data filtration process, including tests that are associated with data screening, such as missing data and outliers.

4.1 Research Approach Paradigms

Essentially, there are two key philosophical research paradigms: positivism and interpretivism (Saunders et al., 2007, p. 102). The former is centred on identifying the key links or patterns of the phenomenon being studied. It is associated with confirmatory research that attempts to confirm pre-specified relationships between factors (Hair et al., 2010) and is linked with quantitative approaches that are highly structured, such as questionnaires, surveys, and experiments. On the other hand, interpretivism argues that correlations or statistical patterns cannot be comprehended or fully understood alone; thus, there is a need to establish the meanings and values assigned by people to such actions that ultimately results in observed patterns. This latter approach is associated with exploratory research that attempts to identify the nature of relationships between factors (Hair et al., 2010) and is linked with qualitative techniques which are recognised as unstructured, such as in-depth interviews and participant observation studies (Blaikie, 2000).

Fundamentally, research stands on a set of ontological, epistemological, and methodological assumptions that help to establish a meaning for the results (Creswell, 2009, p. 5; Saunders et al., 2007, p. 102). The following table summarises the fundamental differences between the research paradigms and their associated assumptions.

Table 4.1: Research Paradigm and Assumptions

Assumption	Question	Positivism	Interpretivism
Ontology	What is the nature of reality?	Reality is singular, objective, and separate from the researcher. (Objectivism)	Reality is subjective and inseparable from the researcher. (Constructivism)
Epistemology	What do we accept as valid knowledge?	Knowledge is solely based on observable facts outside of the human mind.	Knowledge is determined by people rather than by objective external factors.
Methodology	How can research objectives be achieved?	• Confirmatory • Deductive approach • Theory testing • Cause and effect • Quantitative approach • Statistical analysis	• Exploratory Research • Inductive approach • Theory generation • Qualitative approach • Observation of individuals' interpretations of the phenomenon

Source: Developed from Bryman & Bell, 2007; Creswell, 2009; Saunders, Lewis, & Thornhill, 2007, p. 102; Collis & Hussey, 2003, p. 49

The ontological element of research is concerned with the nature of reality, and asks the question, *"What is the nature of reality?"* (Collis & Hussey, 2003, p. 49). There are two schools that attempt to answer this question: objectivism (realism) and constructivism (Bryman & Bell, 2007). Objectivism stresses that reality is a phenomenon that exists independent of individuals, while constructivism advocates for reality as a phenomenon that exits as a result of interactions among individuals (Bryman & Bell, 2007; Creswell, 2009). Epistemology explains what counts as acceptable knowledge in an area of study (Saunders et al., 2007, p. 102). There are two schools that propose different positions on epistemology: positivism and interpretivism (Collis & Hussey, 2003; Saunders et al., 2007, p. 103). Positivism is linked with the deductive theory of verification (Tashakkori & Teddlie, 1998) through hypothesis testing to confirm causal relationships as suggested in the literature (Bryman & Bell, 2007). Interpretivism, on the other hand, is linked with the observation of social phenomena through individual interpretation (Bryman & Bell, 2007) and against the idea of 'phenomena quantification' (Cassell & Symon, 1994, p. 4). Therefore, researchers observe the phenomena to study its characteristics and find any existing causal relationships through observation and interpretation of the progression of

the phenomena (Creswell, 2009). Interpretivists believe that the truth is the interpretation of the researcher regarding various phenomena, which is based on the lived experience of the researcher (Weber, 2004).

4.2 Qualitative, Quantitative, and Mixed Methods

4.2.1 Qualitative vs. Quantitative

Creswell (2009) defines quantitative research as a *"means for testing objective theories by examining the relationship among variables. These variables in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures"* (p. 4). Quantitative studies test theories deductively through present knowledge by creating and developing hypothetical relationships and suggested outcomes, all of which assist in finding scientific results. Qualitative research, on the other hand, can be defined as, *"a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem. The process of research involves emerging questions and procedures, data typically collected in the participant's setting, data analysis inductively building from particulars to general themes, and the researcher making interpretations of the meaning of the data"* (Creswell, 2009, p. 4). The table below provides insight into the main differences between quantitative and qualitative studies.

Table 4.2: A Comparison of Qualitative and Qualitative Research Methods

Qualitative Research	Quantitative Research
• Linked to interpretivism • Used to explore new phenomena • Inductive approach • Hypothesis emerges at the data-collection stage • Smaller sample size with in-depth orientation • Not viewed as scientific • Criticised as biased by researcher interpretation, difficult to repeat, and lacking results that can be generalised	• Linked to positivism • Used to confirm or reject theories • Deductive approach • Hypotheses are set prior to data-collection stage to describe a causal relationship • Depends on a relatively larger sample and uses statistical analysis • More associated with scientific research • Criticised for using artificial precision in analysis, neglecting the complexity of the social world

Source: Morse & Mitcham, 2002; Payne & Payne, 2004; Bryman & Bell, 2007; Creswell 2009, p. 4

Mixed-methods research is an approach that uses both qualitative and quantitative forms to research a phenomenon (Creswell, 2009, p. 4).

> *"Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration."* (Johnson et al., 2007, p. 123)

Johnson et al. (2007, p. 123) recognises that mixed methods vary in the degree of their utilisation of qualitative and quantitative approaches. Mixed methods may be purely quantitative, purely qualitative, or completely mixed. A researcher may also adopt a method that is qualitative-dominant, wherein the researcher believes that the qualitative method is most appropriate for the research but additional benefits might be achieved by adding quantitative data. Another researcher may adopt a quantitative-dominant method believing that the quantitative method fits the research project and adding qualitative data might provide more value to the research.

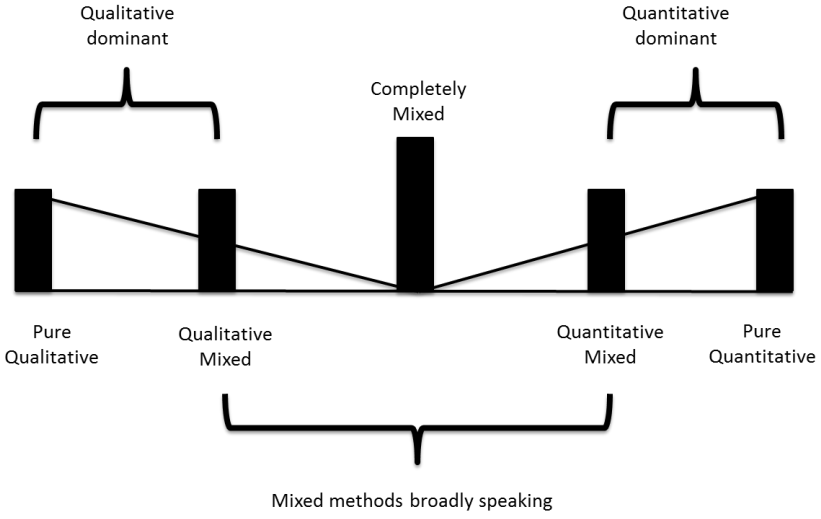


Figure 4.1: Graphic of the three major research paradigms, including subtypes of mixed methods research. Source: Johnson et al. (2007)

4.2.2 The Mixed Methods Approach

The use of both approaches results in a stronger study than the use of a solely qualitative or quantitative approach (Creswell & Clark, 2006). Owing to the fact that both single-methodology techniques have benefits and drawbacks, utilising both in the form of a mixed-method approach may be viable for strengthening research validity (Nau, 1995). This is highlighted by Jick's (1979) cross-validation tool and facilitates generating new

ideas and comparable data. Furthermore, a number of other scholars - Das (1983), Yin (2009), and Patton (2002), for example - suggest that triangulation can be considered a mixture of methodologies centred on examining the same phenomenon.

It has been suggested by Mingers (2001) that study results will be more in-depth and more accurate if multiple approaches are adopted, preferably from different existing frameworks. This view is further supported by Cornford & Smithson (1996), who suggest that the combination of qualitative and quantitative analyses should be viewed as complementary toolkits, with each comprising multiple instruments that may be considered relevant to a certain situation. Combining both quantitative and qualitative evidence induces two key benefits, as noted by Eisenhardt (1989). Firstly, there is an increase in the creative potential of the research, and secondly, the certainty associated with the findings and the validity is increased. Mixed methods might also allow for gathering diverse data on the same issue, utilising the benefits of each approach in order to overcome the drawbacks of the other, attaining a greater degree of reliability and validity, and overcoming the drawbacks associated with single-approach research (Blaikie, 1993)

4.3 Research Design

As discussed earlier, two key research paradigms dominate research methodology, positivism and interpretivism. The research paradigm influences the method used to collect and interpret data, as this process may be qualitative, quantitative, or a mixture of both. Bechara & Ven (2011) argue that, in organizational research, the mixed-methods approach is highly recommend and provides a better understanding of the phenomenon under study. However, in the field of information systems research many scholars suggest that positivist research is the most-used paradigm, while interpretivism is less frequently applied (Chen & Hirschheim, 2004; Weber, 2004). Due to the benefits of the mixed-methods approach (Bryman & Bell, 2007; Creswell, 2009), it is wise to adopt at least some degree of mixed methods in research. The researcher decided to adopt a mixed-method approach, whilst placing more weight on the quantitative method (quantitative-dominant mixed method). This is due to the calls for empirical studies in the area of dynamic capabilities in general (Wang & Ahmed, 2007; Volberda et al., 2010; Datta, 2012; Teece, 2007; Keupp et al., 2012; Gupta et al., 2006) and more specifically a lack of quantitative studies in the area of innovation in Saudi Arabia (Iqbal, 2011; Shin et al., 2012).

4.3.1 Research Plan

After a literature review, a conceptual model has been suggested to explain innovation performance at the firm level. The figure below shows the sequence of steps for this research. The first phase concerns a critical literature review in three main areas: systems of innovation, dynamic capabilities, and information technology. The theoretical foundation is based on multiple disciplines, such as firms' networking, market orientation, knowledge absorptive capacity, and innovation strategy.

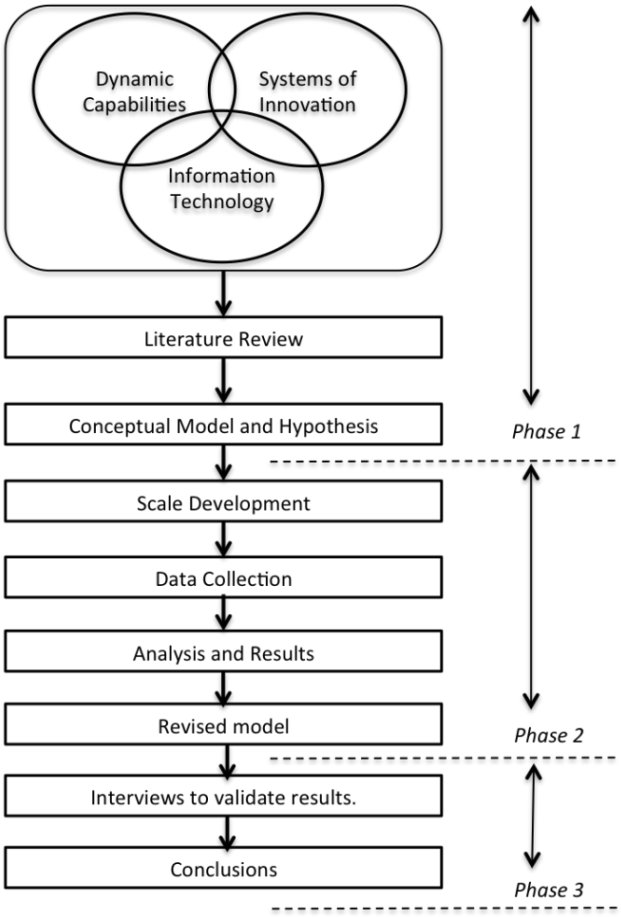


Figure 4.2: The research plan of this study

After the literature review, a conceptual model and related hypothesis was developed to explain innovation performance at the firm level. The second phase starts with the preparation of quantitative data collection. A survey was developed in the form of a questionnaire to target Saudi firms and gather the empirical data as part of this research. The decision to select a survey-based data collection was chosen after the evaluation of different research approaches to data collection. For instance, a survey-based research, compared to case studies, is more associated with scientific research due to the larger amount of data that requires the use of a number of statistics tools (Morse & Mitcham, 2002; Payne & Payne, 2004; Bryman & Bell, 2007; Creswell, 2009, p. 4). Furthermore,

case studies are more powerful to explore new phenomena where the relationships among factors are still not clear (Yin, 2009). Yet in the case of innovation research, scholars highlight the need for confirmatory style research that could confirm relationships already proposed, based on the number of case studies research and reviews in the field of firms' innovation performance. Moreover, survey-based research is cost effective (Bryman & Bell, 2007; Yin, 2009) and collects data from different organizations from a variety of industries, which provide less biased data compared to data from fewer case studies that might be specific to the organization under examination (Bryman & Bell, 2007; Creswell, 2009). In addition, survey-based data portray a better picture regarding regional or national firms' performance, which may be better to advance the research of dynamic capabilities and innovation (Wang & Ahmed, 2007; Volberda et al., 2010; Datta, 2012; Teece, 2007; Keupp et al., 2012; Gupta et al., 2006). In addition, it provides better value for governmental decision makers and business executives (Laursen & Salter, 2006). Therefore, the researcher has decided to adopt survey-based data collection as it seems more appropriate for achieving the aims and objectives of this research. Nevertheless, five interviews were conducted with an aim to validate the research results. Two interviews were related to explore a case of satellite technology transfer and a case of gaming technology transfer.

With regard to the measurements of the factors of this study, a dedicated section on their development will demonstrate each step in this process. After this, the main data is collected and analysed and a revised model emerges as result. The third phase includes discussion of the model emerging and validates the results from interviews. The following section will discuss in detail each stage and the related results.

4.3.2 Ethical Consideration

The data targeted in this research is from firms registered in the Riyadh Chamber of Commerce and Industry in Saudi Arabia's database. At first, the researcher obtained a letter (Appendix A) from the Riyadh Chamber of Commerce and Industry in Saudi Arabia stating their agreement to conduct research using their database and to distribute the survey. The research targets strategic practices and innovation performance of Saudi firms rather than employees' behaviour. The survey included a cover letter that explained the purpose of the study. The cover letter stressed that participation is strictly voluntary and that data will be anonymous, with no personal information published in any form. The contact details of the researcher and the name of the university were displayed. Further

ethical considerations were discussed with the supervisor to ensure that it satisfied the ethical requirements.

4.3.3 Translation

Saunders et al. (2007, p. 375) argue that *"translating questions and associated instructions into another language requires care if your translated or target questionnaire is to be decoded and answered by respondents in the way you intended".* Although the target respondents are key personnel and probably have good command of English, it is difficult to ignore the fact that the first language in Saudi Arabia is Arabic. The translation process should include close attention to *"the precise meaning of individual words, informal expression, grammar and syntax, and experiential meanings"* (Saunders et al., 2007, p. 377). To meet this demand for impeccable accuracy, the translation was conducted in two processes. First, the researcher translated the questionnaire into Arabic. Then, a professional translation service in Saudi Arabia was asked to translate the Arabic version back to the English. The three versions where examined with the help of two Saudi PhD participants to see how close the two English versions were to each other. The Arabic version was modified and sent again to a professional translation office. The newer English version was examined again and it satisfied the researcher and PhD participants. By doing this, the researcher took all available options to achieve high accuracy in the translation process.

4.4 Preliminary Research and Questionnaire Development

4.4.1 Questionnaire Development

The conceptual model of this research has been discussed in Chapter 3. In order to research the innovation performance of Saudi firms and test the conceptual model, a questionnaire was designed. A questionnaire is easy to distribute to several locations at the same time and is a cost-effective method (Bryman & Bell, 2007; Yin, 2009). The questionnaire's development was carried out based on research of the literature as presented in Chapter 2 in the area of systems of innovation, dynamic capabilities, absorptive capacity, ambidexterity, and IT capabilities.

The questionnaire was organized to achieve clarity and accuracy, and a brief cover letter was presented to give the respondent a better understanding of the nature and purpose of this research. A copy of the final survey is attached in Appendix B. The questionnaire is a composite of two kinds of questions. The first kind concerns the firm's

profile, whilst the second kind is based on questions that are used to measure the factors of the hypothesis. Table 4.3 shows the questions used to measures each factor, the code name for each, and the source the measures are adopted from. A previous version of the questionnaire has been pre-tested and discussed with industry experts: one key person from research and development at a major UK telecom company, and an IT manager of a retail company in Saudi Arabia. Their comments have been considered.

4.4.2 Operationalisation of The Research Model

Each factor represents a firm's dynamic capability and is measured using a number of questions. Each question is posed with Likert scales ranging from 1 to 7. The score '1' indicate low level of utilisation of the practice inside the firm and '7' indicate high utilisation of the practice inside the firms. Later, the mean of related questions is calculated to reflect the factor they measure, as discussed in the following section. Table 4.3 lists all the factors, related measures and their sources. Two measures (i.e. INTEL2 and INTEL3) are reversed scales. The Saudi PhD participants remarked that reverse scales usually cause problems in Arabic language.

Table 4.3: A list of all factors, questions used in the survey (measures), the unit used, their code name in the analysis and their sources. Most of the questions are Likert style, except for the firms profile as shown in appendix B

Factor	Code	Questions	Unit	Source
Internationalization Orientation (INT)	INT1	We utilise advanced and new knowledge from foreign countries.	Likert scale (1 to 7)	(Zhou et al., 2007)
	INT2	We develop alliances with foreign partners.	Likert scale (1 to 7)	(Zhou et al., 2007)
	INT3	We aggressively seek foreign markets.	Likert scale (1 to 7)	(Zhou et al., 2007)
	INT4	We utilise advanced management skills from foreign countries.	Likert scale (1 to 7)	(Zhou et al., 2007)
Market Intelligence Generation (INTEL)	INTEL1	We do a lot of in-house market research.	Likert scale (1 to 7)	(Jimenez-Jimenez et al., 2008)
	INTEL2	We are slow to detect fundamental shifts in our industry (e.g. competition, technology, regulation). *(R)**	Likert scale (1 to 7)	(Kohli et al., 1993)
	INTEL3	We are slow to detect changes in our customers' product preferences. *(R)**	Likert scale (1 to 7)	(Kohli et al., 1993)
	INTEL4	We periodically review the likely effect of changes in our business environment on customers.	Likert scale (1 to 7)	(Jimenez-Jimenez et al., 2008)
Potential Absorptive Capacity (PACAP)	PACAP1	The search for relevant information concerning our industry is everyday business in our organization.	Likert scale (1 to 7)	(Flatten et al., 2011)
	PACAP2	We have effective routines in identifying and acquiring information from sources within our industry.	Likert scale (1 to 7)	(Flatten et al., 2011)
	PACAP3	We are able to deal with information beyond our industry.	Likert scale (1 to 7)	(Flatten et al., 2011)
	PACAP4	We have effective routines to interchange new developments, problems, and achievements.	Likert scale (1 to 7)	(Flatten et al., 2011)
	PACAP5	In our organization, ideas and concepts are communicated cross-departmentally.	Likert scale (1 to 7)	(Flatten et al., 2011)
	PACAP6	In our organization, there is a quick information flow, e.g. if a business unit obtains important information, it communicates this information promptly to all other business units or departments.	Likert scale (1 to 7)	(Flatten et al., 2011)
Realised Absorptive	RACAP1	We can successfully integrate our existing knowledge with new information and knowledge acquired.	Likert scale (1 to 7)	(Flatten et al., 2011)

Capacity (RACAP)	RACAP2	Our employees have the ability to structure and use collected knowledge.	Likert scale (1 to 7)	(Flatten et al., 2011)
	RACAP3	Our employees successfully link existing knowledge with new insights.	Likert scale (1 to 7)	(Flatten et al., 2011)
	RACAP4	We are effective in exploiting internal and external information and knowledge into processes, products, or services.	Likert scale (1 to 7)	(Flatten et al., 2011)
	RACAP5	Our organization has the ability to work more effectively by adopting new knowledge and information.	Likert scale (1 to 7)	(Flatten et al., 2011)
	RACAP6	Our organization supports the development of prototyping and testing new processes or services.	Likert scale (1 to 7)	(Flatten et al., 2011)
Ambidexterity (AMB)	*Explorative Innovation Strategy*			
	EXR1	Introduce new generation of products/services	Likert scale (1 to 7)	(He & Wong, 2004)
	EXR2	Extend products/services range	Likert scale (1 to 7)	(He & Wong, 2004)
	EXR3	Open up new markets	Likert scale (1 to 7)	(He & Wong, 2004)
	EXR4	Enter new technology fields	Likert scale (1 to 7)	(He & Wong, 2004)
	Exploitative Innovation Strategy			
	EXP1	Improve existing product/service quality	Likert scale (1 to 7)	(He & Wong, 2004)
	EXP2	Improve production/processes flexibility	Likert scale (1 to 7)	(He & Wong, 2004)
	EXP3	Reduce production/processes cost	Likert scale (1 to 7)	(He & Wong, 2004)
	EXP4	Improve yield or reduce material consumption	Likert scale (1 to 7)	(He & Wong, 2004)
IT Infrastructure (INFRA)	INFRA1	The technology infrastructure needed for developing and tailoring products/services to match customers' needs is present and in place today.	Likert scale (1 to 7)	Adapted from (Ravichandran & Lertwongsatien, 2005).
	INFRA2	The organization's data is effectively protected from losses or any vulnerability through security and risk management services.	Likert scale (1 to 7)	Adapted from (Fink, 2011)
	INFRA3	Information is shared seamlessly across our organization, regardless of the location.	Likert scale (1 to 7)	(Kim et al., 2011)
	INFRA4	The technology infrastructure enables us to perform real-time collaborative work.	Likert scale (1 to 7)	(Pavlou & El Sawy, 2006)
IT Flexibility (ITF)	ITF1	Our information technology is highly scalable.	Likert scale (1 to 7)	(Saraf et al. 2007)
	ITF2	Our information technology can quickly accommodate changes in business requirements.	Likert scale (1 to 7)	(Saraf et al. 2007)
	ITF3	Functionality can be quickly added to critical applications based on end-user requests.	Likert scale (1 to 7)	(Tallon & Pinsonneault, 2011)
	ITF4	We have a climate that is supportive of trying out new ways of using information technology.	Likert scale (1 to 7)	(Lu & Ramamurthy, 2011)
IT Effectiveness (ITE)	ITE1	Our information technology is effective in reducing costs and improving labour productivity in our business operations..	Likert scale (1 to 7)	(Kim et al., 2011)
	ITE2	Our information technology improves the efficiency of our day-to-day business operations.	Likert scale (1 to 7)	(Sabherwal & Chan, 2001)
	ITE3	Our information technology is effective in supporting our marketing and sales processes.	Likert scale (1 to 7)	(Tallon & Pinsonneault, 2011)
	ITE4	There is integration of business strategic planning and information technology planning.	Likert scale (1 to 7)	(Zhang, et al., 2008)
IT Sensing (IT SENS)	ITSens1	The technology infrastructure needed to electronically link our organization with external business partners (i.e. customers, supplier, alliances) is present and in place today.	Likert scale (1 to 7)	Adapted from (Ravichandran & Lertwongsatien, 2005)
	ITSens2	Our information technology helps us in determining customer requirements (i.e. products, preferences, pricing and quantity).	Likert scale (1 to 7)	Adapted from (Ravichandran & Lertwongsatien, 2005)

	ITSens3	Our information technology enables us to develop detailed analyses of our present business situation.	Likert scale (1 to 7)	(Chan et al., 2006)
	ITSens4	Our information technology is effective in providing information that supports prudent decision-making.	Likert scale (1 to 7)	(Chan et al., 2006)
Environment Turbulence (ENV)	ENV1	There is intense competition for market share in this product market.	Likert scale (1 to 7)	(Tang & Rai, 2012)
	ENV2	In our business, forecasting demand for products/services is very difficult.	Likert scale (1 to 7)	(Tang & Rai, 2012)
	ENV3	In our business, the technology in our products/services is changing rapidly.	Likert scale (1 to 7)	(Sarkees et al., 2010)
	ENV4	In our business, customers' preferences change all of the time.	Likert scale (1 to 7)	(Sarkees et al., 2010)
Firm's innovation performance (T_INNO)	W_INNO	Fraction of sales related to products/services new to the world (as percent of total sales)	innovation sales/total sales	(Laursen & Salter, 2006)
	C_INNO	Fraction of sales related to products/services new to the country (as percent of total sales)	innovation sales/total sales	Adapted (Laursen & Salter, 2006)
	F_INNO	Fraction of sales related to products/services new to the firm (as percent of total sales).	innovation sales/total sales	(Laursen & Salter, 2006)
	IMP_INNO	Fraction of sales related to improved products/ services (as percent of total sales).	innovation sales/total sales	(Laursen & Salter, 2006)
Firm's breadth of knowledge sources (BREADTH)	SUPPLR	Level of usage of suppliers as a source for innovation activities	Likert scale (1 to 7)	Adapted from (Tsai, 2009)
	CONSLT	Level of usage of consultants as a source for innovation activities	Likert scale (1 to 7)	(Tether & Tajar, 2008; Zeng et al., 2010)
	RES	Level of usage of research institutes as a source for innovation activities.	Likert scale (1 to 7)	Adapted from (Tsai, 2009)
	CUSTMR	Level of usage of customers as a source for innovation activities.	Likert scale (1 to 7)	Adapted from (Tsai, 2009)
	COMP	Level of usage of competitors as a source for innovation activities.	Likert scale (1 to 7)	Adapted from (Tsai, 2009)
Firm's' Profile	SIZE	The firm size based on the number of employees.	Number of employee	(Chang et al., 2012)
	AGE	Firm age based on the number of years running.	Number of years	Chen and Huang, 2009)
	INDUSTRY	The sector of industry.	N/A	(Serrano-Bedia et al. (2012)
	R&D	Research and development expenditure as a percent of sale.	R&D spending/total sales	(Chang et al., 2012)
	POSITION	The position of the respondent of the survey.	N/A	(Trkman et al., 2010)
	IT_BUDG	Annual budget dedicated to information technology (IT), including outsourcing.	Currency	(Aral & Weill, 2007)
	GROWTH	Annual sales growth per year.	Rate	Self elaboration
	INCOME	Total annual turnover per year.	Currency	Self elaboration
	COVERAGE	Market coverage.	N/A	Self elaboration
Total number of measures				66

(R): Reversed scale*

4.4.2.1 Two Dimensional Approach for Measuring Innovation Performance

For the purpose of measuring the firms' innovation performance, two dummy variables are computed. The two dummy variables are used to reflect two important dimensions of firms' innovation performance: innovation radicalness and innovation sales performance. The innovation radicalness measure is derived from the work of Laursen and Salter (2006). They used three proxies: the fraction of firm's sales related to new-to-the-world products, new-to-the-firm products, and the fraction of firm's sales related to

improved existing products. This method captures the novelty of innovation as well as its ability to generate economic advantages (sales). Yet, Laursen and Salter's (2006) approach the analysis of each kind of innovation separately. This research has adopted and advanced Laursen and Salter's (2006) method and added 'new-to-the-country' as an extra dimension in accordance with the nature of developing countries. From these measures, a dummy variable is computed as an ordinal variable (RAD) ranging from 0 to 4. Zero indicates that the firm did not generate any sales from any kind of innovation; 1 indicates that sales were generated from improved products/services, 2 indicates that sales were generated from products/services new to the firm, 3 indicates that sales were generated from products/services new to the country, and 4 indicates that sales were generated from products/services new to the world.

Innovation sales performance (T_INNO), on the other hand, is another dummy variable that is basically the sum of the percentages of all four measures. This sum reflects the measurement method advocated by Chang et al. (2012). With these two dummy variables (RAD and T_INNO), innovation performance of the firms is measured in two dimensions: the radicalness of the innovation and the total economic advantage the firm achieved from their innovation activities.

Table 4.4: Method for measuring innovation performance.

Source: Self-derived from the work of Laursen and Salter's (2006) and Chang et al. (2012)

Dummy Variable	Description	Scale
RAD	Measures the radicalness of successful innovations. *if W_INNO > 0 then RAD = 4;* *else if C_INNO > 0 then RAD = 3;* *else if F_INNO > 0 then RAD = 2;* *else if IMP_INNO > 0 then RAD = 1;* *else RAD = 0.*	Ranges from 0 to 4
T_INNO	Sum of fractions of sales generated from all levels of innovation. *T_INNO= W_INNO+C_INNO+F_INNO+IMP_INNO*	Ranges from 0 to 100%

4.4.2.2 Other Derivative Measures

The other dummy variable is BREADTH, which captures the number of knowledge sources the firm uses **heavily** for innovation activities. The respondent is asked to rate how much these knowledge sources are used: customers, suppliers, competitors, consultants, and research institutes. The use level ranges from 1 (at which the source is not used) to 7 (at which the source is highly used). If the respondent scores 5 or higher, a binary value of

1 is assigned for this source, indicating high usage, but if the respondent scores 4 or below, a binary value of 0 is assigned, indicating low usage. A similar approach was used by Leiponen and Helfat (2010) and earlier by Laursen and Salter (2006). The last dummy variable is AMB, which reflects the firm's ambidexterity capacity. It is calculated by the simple addition of the two variables, explorative innovation strategy (EXR) and exploitative innovation strategy (EXP). The work of Jansen et al. (2009) shows that ambidexterity is best calculated by adding the scores of explorative and exploitative innovation strategies.

Table 4.5: Methods of measuring breadth of knowledge sources and ambidextrous capacity.
Source: Based on Leiponen and Helfat (2010) and Jansen et al. (2009)

Dummy Variable	Description	Scale
BREADTH	Total number of sources highly used for innovation activities. *Count sources with scores ≥ 5*	Ranges from 0 to 5
AMB	Sum of all measures related to explorative innovation strategy and exploitative innovation strategy. *AMB =* *mean(EXP1+EXP2+EXP3+EXP4) + mean(EXR1+EXR2+EXR3+EXR4)*	Ranges from 2 to 14

4.4.3 Pilot Study

In order to check if the measures, especially factors' measures, are consistent and suitable for the main data collection, a pilot study was conducted. The main aim of the pilot study was to determine whether or not the scale adopted was consistent enough to be used for the main data collection. The pilot data were collected in July 2012 in a conference arranged by the Riyadh Chamber of Commerce and Industry in Saudi Arabia. The Riyadh Chamber of Commerce and Industry sent an open innovation to all registered firms in their database to attend the Entrepreneurship and Business Leadership Conference with key speakers such as the Minister of Labour. The researcher distributed 100 printed surveys and collected responses, 32 of which were usable for data analysis. In order to test the measurements' consistency, the Cronbach alpha procedure is adopted (Wang et al., 2013). The acceptable cut-off point, according to Nunnally (1978) and Tomlinson (2010), is 0.7. The Cronbach alpha results of the 32 responses are shown in the following table. Two variables exhibit an alpha value lower than 0.7: namely, market intelligence generation with 0.63 and IT-sensing capability with 0.52. It is noted that the reversed scales for market intelligence generation (INTEL2 and INTEL3) are inconsistent with the

remaining scales. Hence, the reverse nature of these scales was corrected.

Beside the correction for the reversed scales, the researcher decided to proceed with the current measures for two reasons. First, the results of the Cronbach alpha test are based on only 32 responses and may actually improve with more data. Secondly, the researcher did not find better alternative measures with which to replace them. Therefore, the researcher was satisfied with the current measures and proceeded with the main data collection.

Table 4.6: The results of Cronbach Alpha test based on the pilot study (N=32)

Construct	Cronbach Alpha
Internationalization Orientation	0.82
Market Intelligence Generation	**0.63**
Potential Absorptive Capacity	0.81
Realised Absorptive Capacity	0.87
Explorative Innovation	0.82
Exploitative Innovation	0.86
IT Infrastructure Provision	0.83
IT Sensing Capability	**0.52**
IT Flexibility	0.79
IT Effectiveness	0.78
Environment Turbulence	0.72

4.5 Primary Quantitative Research

4.5.1 Research Data and Response Rate

The primary data of this research is based on the firms registered on the database of the Riyadh Chamber of Commerce and Industry in Saudi Arabia. Riyadh, the capital of Saudi Arabia, is one of the top cities for business activity in Saudi Arabia. The data provided by the Riyadh Chamber of Commerce and Industry covers all 4,500 active firms in Riyadh. The whole database was targeted and, therefore, there was no need for any sampling technique. The researcher used the Survey Monkey website to develop a web-based survey. According to Creswell (2009, p. 149), Survey Monkey provides researchers with speed and functionality and can be used as a mechanism to manage data collection. The survey was sent by e-mail to all 4,500 firms via the Riyadh Chamber of Commerce and Industry in September 2012. The actual survey, shown in Appendix B, is similar to the

survey structure used in the pilot study except for correcting the reverse nature for the market intelligence generation measures.

A week after the survey was distributed a reminder was sent, with a second reminder sent the week after. The final sample size was 225 responses. Figure 4.3 shows the steps followed for eliminating nonusable data and then checking missing data and outliers. These first three steps helped to prepare the data for analysis. After preparing the data, the measures used in the survey were examined. Cronbach alpha helped to determine if the measurements assigned to each factor were consistent (i.e. a reliability test). This was followed by exploratory factors analysis to check if any of the measures assigned to certain factors were cross loading on a different factor (i.e. a validity test). After the reliability and validity test, the final measures for each factor were reached and the variable of each factor was computed by taking the mean of its measures. Consequently, the computed variables were examined to see if they satisfied the regression requirements by doing the normality, homoscedasticity, and multicollinearity tests. With these steps, the variables and their data were ready for descriptive and regression analysis.

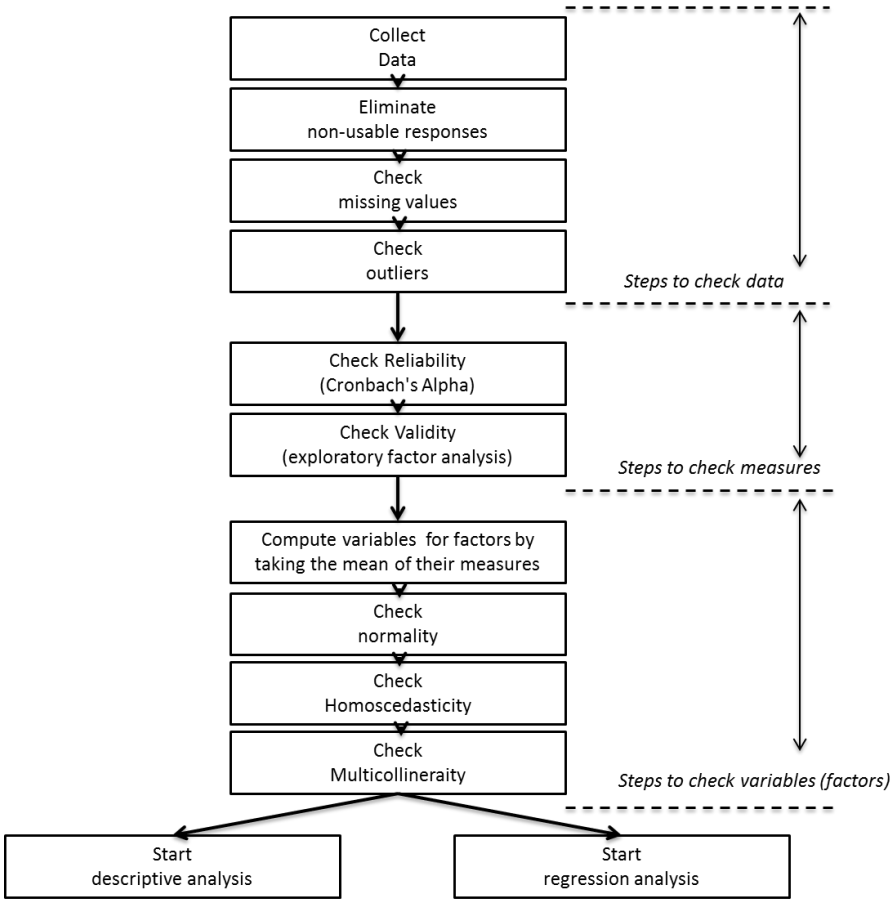


Figure 4.3: Steps for data screening in preparation for descriptive and regression analysis

The elimination of nonusable responses (39 responses) reduced that data from 225 firm responses to a total of 186, which were then added to the pilot data (32 responses) because the pilot and main data were drawn from the same population. To make sure that there was no duplication between the pilot data and the main data, the researcher used the e-mail domain of the respondent to check whether a similar domain existed in both the main and pilot data. If so, the response from the pilot study was excluded. Any pilot data without an e-mail address were also excluded. Based on this method, 11 responses were excluded. Six of them had an e-mail domain that was similar to that in responses from the main data, and five had missing e-mail addresses. Ultimately, 21 responses from the pilot data were added to the 186 usable responses from the main data, leading to a final dataset of 207 available for analysis. Four responses were eliminated later in the screening process (as shown in later section), leading to a total of 203 firms' responses used in the reliability, exploratory factor analysis, and regression analysis. Hence, the response rate for the survey is 4.51% of the total 4,500 firms targeted in this research. This is an adequate size based on the suggestion by Bartlett et al. (2001), as shown in Table 4.6.

Table 4.6: Determining minimum sample size for a given population size for organizational research

Source: Bartlett et al. (2001)

	Sample size					
	Continuous data (margin of error=.03)			Categorical data (margin of error=.05)		
Population size	alpha=.10 t=1.65	alpha=.05 t=1.96	alpha=.01 t=2.58	p=.50 t=1.65	p=.50 t=1.96	p=.50 t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

In their work, they suggest that sample sizes of 198 and 209 are adequate for populations of 4,000 and 6,000, respectively. These limits are set for a significance level of (p=.01) and a marginal error of .03. In this study, the sample size of this research is 203 firms, which is very close to the sample size required for a population size of 6,000 firms. Thus, we felt comfortable to proceed with the analysis, based on this sample size rule.

It is important to achieve a high level of credibility for data under analysis by eliminating any possibility of violating requirements for regression analysis. (Hair et al., 2010). Hair et al. (2010) and Tabachnick and Fidell (2007) suggest a number of tests that help achieve more accurate results from the regression analysis, such as the test of missing values and the test of outliers. Table 4.7 describes each test and the related threshold.

Table 4.7: Summary of tests required to prepare data for analysis

Test Name	Description	Threshold
Missing values	Non-random missing values may affect the ability to generalise results (Tabachnick and Fidell 2007). To check missing value randomness, the Little's MCAR test is employed.	15% in total and 10% for each individual response (Hair et al., 2010, p. 48). The Little's MCAR test should be non-significant to indicate random patterns of missing data.
Outliers	Reponses largely different in magnitude from the rest may lead to a significant distortion of statistical tests (Hair et al., 2010, p. 48).	±4 of the standardised scores of the variable (Hair et al., 2010, p. 48).

Each of these tests was performed using IBM SPSS software. The following sections show and discuss the results of the analysis and subsequent actions taken.

4.5.2 Test of Missing Values

The analysis for missing data involved two procedures of assessment: the amount of missing data and the randomness of the pattern of the missing data (Tabachnick & Fidell, 2007). Missing data that occurred in a non-random pattern could affect the ability to generalise the results (Tabachnick & Fidell 2007).

According to Hair et al. (2010), all variables should be listed with their corresponding missing data. This helps to identify any variable with a high amount of

missing data. It also helps to have an overall picture of the amount of missing data in the sample. The following table lists all variables with related amounts of missing data.

Table 4.8: Variables with their amount of missing data

Question number in the in survey	Measure Code Name	Missing Count	Missing Percent
44	INCOME	128	61.8%
45	GROWTH	120	57.9%
32	IT_BUDG	47	22.7%
34	CONSLT	15	7.2%
34	RES	10	4.8%
34	COMP	10	4.8%
34	SUPPLR	8	3.9%
34	CUSTMR	7	3.4%
35	INTEL3	3	1.4%
33	C_INNO	3	1.4%
33	F_INNO	2	1%
35	INTEL4	2	1%
37	PACAP1	2	1%
37	PACAP2	2	1%
37	PACAP3	2	1%
38	PACAP4	2	1%
38	PACAP5	2	1%
38	PACAP6	2	1%
38	RACAP1	2	1%
38	RACAP5	2	1%
39	ENV4	2	1%
40	INFRA1	2	1%
40	INFRA2	2	1%
40	INFRA3	2	1%
40	INFRA4	2	1%
41	ITSENS1	2	1%
42	ITF2	2	1%
42	ITF4	2	1%
33	W_INNO	1	0.5%
33	IMP_INNO	1	0.5%
35	INTEL2	1	0.5%
38	RACAP2	1	0.5%
38	RACAP3	1	0.5%
38	RACAP4	1	0.5%
38	RACAP6	1	0.5%
39	ENV1	1	0.5%
39	ENV2	1	0.5%
39	ENV3	1	0.5%

36	EXR1	1	0.5%
36	EXR2	1	0.5%
36	EXR3	1	0.5%
36	EXR4	1	0.5%
36	EXL1	1	0.5%
36	EXL2	1	0.5%
36	EXL3	1	0.5%
36	EXL4	1	0.5%
42	ITE2	1	0.5%
42	ITE4	1	0.5%
42	ITF1	1	0.5%
42	ITF3	1	0.5%
Total (excluding the first three factors)			55.90%
Percentage of missing data for the entire set (55.9/66)			0.85%

This study is based on 66 factors (variables) including control variables such as firm age, firm size, industry, R&D expenditure, environment turbulence, growth, and income. Out of the 66 variables, 50 had missing data ranging from 0.5% to 61.8%. Clearly from the table above, there were three variables with significant missing data: IT_BUDG, INCOME, and GROWTH. According to Hair et al. (2010, p. 48), *"variables with as little as 15% percent missing data are candidates for deletion"*. Therefore, the researcher eliminated them from this study. Most of the remaining variables have missing values below 4.8%, and only one variable, CONSLT, has 7.2% missing data. The total sum of percentages for the remaining inventory of variables is equal to 55.9%. The percentage of missing data for the entire set can be calculated by dividing the sum of percentages by the number of variables (Hair et al., 2010, p. 43), resulting in 0.88% as shown in Table 4.6.

The next step is to analyse missing data per case to check for candidates for deletion. According to Hair et al. (2010), *"missing data under 10 percent for an individual case or observation can generally be ignored, except when the missing data occurs in a specific non-random fashion"* (p. 47). As shown in Table 4.8, there are three cases that violate this rule of thumb: namely, case number 73, 180, and 111, which had missing data of 26%, 20.5%, and 19.2% respectively. Hence, these three cases were excluded. Therefore, the sample size is reduced from 207 to 204 responses.

Table 4.8: Missing data per case

Case ID	# Missing	% Missing
73	19	26
180	15	20.5
111	14	19.2

The last step in analysing missing data is the assessment of its pattern to evaluate how randomly the missing data occur. Little's MCAR is employed to assess the randomness of the missing data pattern. According to Hair et al., (2010), *"this test analyzes the pattern of missing data on all variables and compares it with the pattern expected for a random missing data process"* (p. 51). If the test reveals a non-significant level (p-value is greater than 0.05) then we may conclude that the missing data occur in a random fashion (Tabachnick & Fidell, 2007). Using IBM SPSS, Little's MCAR test reveals Chi-Square = 1385.310, DF = 1409, and Sig. = .669. Thus, there is no significant difference between the pattern of the data and the pattern expected for random missing data. Therefore, it is acceptable to use any type of remedy to treat missing data (Hair et al., 2010).

Three alternative treatments for missing data are available: list-wise deletion, pair-wise deletion, and imputation methods (Hair et al., 2010). In the list-wise approach, the whole case is excluded from analysis if it includes any missing values. In pair-wise deletion, the case with missing data is excluded from a specific analysis where the analysis encounters missing data, yet the case will be available for other analysis that comprises a variable with no missing data. In the imputation method, missing data is treated using different techniques, such as replace with mean, replace with expectation maximization (EM), regression imputation, and multiple imputation (Hair et al., 2010; Tabachnick & Fidell, 2007).

These techniques each have different impacts on the analysis. The list-wise technique is the most common approach in handling missing data, yet this approach results in a significant amount of data exclusion. In the pair-wise technique, because the remaining data of a case with missing values is still available for analysis, this approach retains more data compared with the list-wise approach. However, the pair-wise approach may lead to inconsistency of correlation or a covariance matrix (Roth, 1994, p. 553). In the imputation technique, missing data is simply replaced with an appropriate value, such as a mean or expectation maximization (EM) value. EM is based on the maximum likelihood

approach (Von Hippel, 2004), which produces a less-biased value and more accurate estimates in comparison to both list-wise and pair-wise techniques (Roth, 1994). Therefore, based on the previous arguments, this research proceeded with expectation imputation (EM) to replace all missing data with the maximum likely values using the Missing Value Analysis (MVA) function in IBM SPSS 18 software.

4.5.3 Test of Outliers

Outliers may lead to a significant distortion of statistical tests (Hair et al., 2010). They can be defined as *"observations so different in magnitude from the rest of the observations that the analyst chooses to treat it as a special case"* (Churchill, Jr. & Iacobucci, 2004, p. 677). According to Tabachnick and Fidell (2007), outliers limit the generalisation of the analysis results, which can only be generalised to other samples that have similar outliers.

The assessment of outliers involves three kinds of analysis: univariate detection, bivariate detection, and multivariate detection tests (Hair et al., 2010). In univariate detection, all variables are examined individually to identify observations that fall at the outer ranges, i.e. outside the upper and lower thresholds (Hair et al., 2010). In order to identify the upper and lower thresholds, all variable values should be transformed to standard scores with a mean and standard deviation of 0 and 1 respectively. This standardising of variables makes interpretation much easier (Hair et al., 2010). Using IBM SPSS software, all standardised variables are created. According to Hair et al. (2010, p. 67), the threshold for outliers in a sample larger than 80 observations is 4 and higher.

Table 4.9: Observation with standardized scores beyond ±4 (ordered based on highest deviation)

Variable	Case ID
W_INNO	56, 35, 11, 107, 47, 18
IMP_INNO	95
T_INNO	95

From Table 4.8 there are eight cases identified as outliers. The variables in the table represents the innovation performance measures (percentage of sales related to innovative products/services) ranging from 0-100%. In this study, the final measure of innovation performance involved in the analysis (T_INNO) is equal to the total sum of its components: W_INNO, C_INNO, F_INNO, and IMP_INNO. Therefore, it is important to assess the variable T_INNO for outliers as well. Case 95 appears to be common with the

variable IMP_INNO as well. Therefore, it is important to assess the case impact on the mean and standard deviation of the related variables.

Table 4.10: The influence of case 95 on the mean and standard deviation of related variables

Variable code	Including Case 95		Excluding Case 95		Difference	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
IMP_INNO	3.33	5.00	3.22	4.77	0.11	0.23
T_INNO	9.32	10.02	9.08	9.44	0.24	0.58

Table 4.10 shows that the difference in mean is 0.24 and standard deviation is 0.58 between cases of including and excluding case 95 for the variable T_INNO. Therefore, and for the sake of accurate analysis, it is probably a good practice to eliminate case 95, especially as it is only one case. Therefore, the sample size is reduced from 204 to 203.

4.6 Conclusion

In this chapter, different paradigms of research have been discussed. The chapter highlighted the plan and related procedures adopted to collect and analyse data. The responses totaled 203 after eliminating all nonusable responses or those that might have affected the quality of the analysis results. The next chapter will show and discuss the findings of the survey. The chapter starts with reliability and validity analysis to confirm that the questions used to measure factors in the survey were adequate for this purpose. The chapter further portrays the Saudi firms' innovation practices and compares differences in their capabilities based on their size and innovation performance. The next chapter will also covers data analysis using t-test ANOVA (analysis of variance) and the regression analysis.

Chapter 5: Empirical Study

As stated earlier, this research adopts a quantitative method as the main research approach. The data set is collected from the data of the Riyadh Chamber of Commerce and Industry in Saudi Arabia. The data covers all 4,500 active firms in Riyadh. The final sample size, after the screening processes discussed earlier, is 203 responses. Therefore, the response rate for this research is 4.51%, which is consistent with the adequate size suggested by Bartlett et al. (2001). Their work provides a table for the size of a population and the corresponding adequate sample size for organizational research. Therefore, the sample size for this research (N = 203, from a population of 4,500 population) falls within a population of 6,000 organizations which, according to Bartlett et al. (2001), requires a sample of 209 organizations. This chapter will start by validating the measures used in the survey using the reliability of validity test. Then the chapter will check the regression assumptions in preparation for performing the regression analysis. Later, the chapter will show the empirical findings from the survey and the case studies of this research

Table 5.1: Tests used to validate the survey measures and prepare data for regression analysis

Test Name	Description	Threshold
Scale Validation		
Reliability Test (Cronbach's alpha)	Assesses the extent to which a set of questions, which is supposed to reflect a certain factor, has high inter-correlation (share high inter-consistency) (DeVellis, 2003).	The acceptable cut-off point is 0.7 (Nunnally, 1978; Hair et al., 2010; Tomlinson, 2010; Bryman and Cramer, 2011).
Validity Test (Exploratory factor analysis)	Identifies the number of factors that could be extracted from a list of questions and decreases the number of questions used to measure factors by removing the less significant ones for more accuracy.	Loading should exceed 0.45 (Cua et al., 2001). The technique used is principle component analysis with varimax rotation.
Regression Assumptions		
Normality	The distribution of a variable (factor) should follow a normal distribution, (Hair et al., 2010, p. 71).	± 1 of the skewness and kurtosis scores (Aluja et al., 2005).
Homoscedasticity	The dependent variable has equal levels of variance across predictor variables (Hair et al., 2010, p. 74) to avoid weakening analysis (Tabachnick and Fidell 2007, p. 85).	Leven's test should be non-significant (p>0.5) (Field, 2009).
Multicollinearity	Examine the correlation between independent variables, as high correlation affects the regression coefficient and their statistical significant (Hair et al., 2010, p. 165)	Correlation coefficient between variables should be less than 0.9 and VIF less than 10 (Hair et al., 2010, p. 200).

5.1 Reliability Test

When measuring a factor through a set of questions, it is important that they exhibit a high level of homogeneity in order to have a measure that is internally consistent (Hair et al., 2010; Peter, 1979). Internal consistency, which is a measure of reliability, assesses the extent to which a set of measures designed to capture a certain factor have high intercorrelation (i.e. share high similarity) (DeVellis, 2003). The Cronbach's alpha is a very common test that helps to assess the internal consistency of a measurement set (Hair et al., 2010; Wang, et al., 2013). The minimum acceptable cut-off point, according to Nunnally (1978) and Tomlinson (2010), is 0.7.

The result of the reliability analysis is presented in Table 5.2. The table indicates an acceptable level of internal consistency, in general (Nunnally, 1978; Hair et al., 2010; Tomlinson, 2010; Bryman and Cramer, 2011). The table also shows if the internal consistency may improve if one measure is deleted from the set. For example, if INT3 is removed, the internal consistency for the measurement set will improve from 0.743 to 0.78. The results of the Cronbach test support most of the factors measurement set. However, few measures, especially related to information technology, seem not to pass this test. All measures related to IT sensing failed to exhibit internal consistency with a total Cronbach alpha of 0.402. This suggests that the IT sensing capability factor is a candidate for exclusion from this research. Moreover, the measures ITF4 and ITE4 impact negatively on the total Cronbach alpha of their factor. The test suggests that, by removing ITF4, the Cronbach alpha level for the factor ITF will improve from 0.758 to 0.908. Also, by removing ITE4, the level of Cronbach alpha for the factor ITE will improve from 0.805 to 0.881. Therefore, the measures ITsens1, ITsens2, ITsens3, ITsens4, ITF4, and ITE4 are deleted. In addition, one measure related to international orientation (INT), namely INT3, reduces the Cronbach alpha score. Hence, INT3 is removed to improve the Cronbach level alpha from 0.743 to 0.780.

Table 5.2: Results of Cronbach Alpha test for the measures based on primary data

Factor	Code	Item	Alpha if deleted	Cronbach Alpha (α)
Internationalization Orientation	INT1	We utilise advanced and new knowledge from foreign countries.	0.653	0.743
	INT2	We develop alliances with foreign partners.	0.634	
	INT3	We aggressively seek foreign markets.	0.78**	
	INT4	We utilise advanced management skills from foreign countries.	0.653	
Market Intelligence Generation	INTEL1	We do a lot of in-house market research.	0.761	0.798
	INTEL2	The fundamental shifts in our industry (e.g. competition, technology, regulation) are periodically analysed.	0.731	
	INTEL3	We frequently review changes in our customers' product/service preferences.	0.753	
	INTEL4	We periodically review the likely effect of changes in our business environment on customers.	0.745	
Potential Absorptive capacity	PACAP1	The search for relevant information concerning our industry is everyday business in our organization.	0.765	0.869
	PACAP2	We have effective routines in identifying and acquiring information from sources within our industry.	0.717	
	PACAP3	We are able to deal with information beyond our industry.	0.704	
	PACAP4	We have effective routines to interchange new developments, problems, and achievements.	0.65	
	PACAP5	In our organization, ideas and concepts are communicated cross-departmentally.	0.60	
	PACAP6	In our organization, there is a quick information flow, e.g. if a business unit obtains important information, it communicates this information promptly to all other business units or departments.	0.576	

Realised Absorptive capacity	RACAP1	We can successfully integrate our existing knowledge with new information and knowledge acquired.	0.843	0.917
	RACAP2	Our employees have the ability to structure and use collected knowledge.	0.822	
	RACAP3	Our employees successfully link existing knowledge with new insights.	0.803	
	RACAP4	We are effective in exploiting internal and external information and knowledge into processes, products, or services.	0.801	
	RACAP5	Our organization has the ability to work more effectively by adopting new knowledge and information.	0.77	
	RACAP6	Our organization supports the development of prototyping and testing new processes or services.	0.671	
Explorative Innovation (Objectives for undertaking innovation projects)	EXR1	Introduce new generation of products/services	0.79	0.846
	EXR2	Extend products/services range	0.787	
	EXR3	Open up new markets	0.78	
	EXR4	Enter new technology fields	0.654	
Exploitative Innovation (Objectives for undertaking innovation projects)	EXP1	Improve existing product/service quality	0.803	0.869
	EXP2	Improve production/processes flexibility	0.794	
	EXP3	Reduce production/processes cost	0.774	
	EXP4	Improve yield or reduce material consumption	0.747	

IT Infrastructure	INFRA1	The technology infrastructure needed for developing and tailoring products/services to match customers' needs is present and in place today.	0.852	0.87
	INFRA2	The organization's data is effectively protected from losses or any vulnerability through security and risk management services.	0.825	
	INFRA3	Information is shared seamlessly across our organization, regardless of the location.	0.827	
	INFRA4	The technology infrastructure enables us to perform real-time collaborative work.	0.823	
IT Flexibility	ITF1	Our information technology is highly scalable.	0.606	0.758
	ITF2	Our information technology can quickly accommodate changes in business requirements.	0.586	
	ITF3	Functionality can be quickly added to critical applications based on end-user requests.	0.593	
	ITF4	We have a climate that is supportive of trying out new ways of using information technology.	0.908**	
IT Effectiveness	ITE1	Our information technology is effective in reducing costs and improving labour productivity in our business operations.	0.688	0.805
	ITE2	Our information technology improves the efficiency of our day-to-day business operations.	0.679	
	ITE3	Our information technology is effective in supporting our marketing and sales processes.	0.728	
	ITE4	There is integration of business strategic planning and information technology planning.	0.881**	
IT Sensing	ITSens1	The technology infrastructure needed to electronically link our organization with external business partners (i.e. customers, supplier, alliances) is present and in place today.	0.346	0.402*
	ITSens2	Our information technology helps us in determining customer requirements (i.e. products, preferences, pricing and quantity).	0.379	
	ITSens3	Our information technology enables us to develop detailed analyses of our present business situation.	0.312	
	ITSens4	Our information technology is effective in providing information that supports prudent decision-making.	0.301	

Environment Turbulence	ENV1	There is intense competition for market share in this product market.	0.657	0.723
	ENV2	In our business, forecasting demand for products/services is very difficult.	0.705	
	ENV3	In our business, the technology in our products/services is changing rapidly.	0.658	
	ENV4	In our business, customers' preferences change all of the time.	0.624	

* Cronbach's alpha below 0.7; ** Improved if deleted

5.2 Exploratory Factor Analysis (EFA)

According to DeVellis (2003, p. 103), exploratory factor analysis is essential to identify the number of latent variables (factors) that could be extracted from measurement items. This is essential for verifying whether the measurement questions adopted reflect the underlying theoretical model. Moreover, this technique helps to decrease the measurement questions inventory by removing the less significant ones for increased accuracy (Field, 2009; Hair et al., 2010; Netemeyer et al., 2003).

When considering exploratory factor analysis (EFA), there are two kinds of methods: principle component analysis (PCA) and common factor analysis (Hair et al., 2010, p. 106). Common factor analysis helps to highlight the factors that measurement items represent (Hair et al., 2010), whilst principal component analysis is more appropriate for reducing the number of factors to a smaller number with a more meaningful structure (Hair et al., 2010, p. 107). This achieves the minimum number of questions to represent the correct measurement model. Therefore, the researcher adopted the principle component analysis method in this research.

By applying EFA rotation techniques, it is possible to have a much clearer picture of component analysis results (Hair et al., 2010). Rotation amplifies the differences between factors and their loaded (associated) questions, providing a better interpretation of the results (Bryman & Cramer, 2011). Rotation facilitates the identification of questions that are highly loaded on their factors or cross loaded. Moreover, it clarifies underlying factors or dimensions that are commonly represented in the measured questions (Field, 2009; Hair et al., 2010; Tabachnick & Fidell, 2007).

Two techniques available for rotation are the oblique and orthogonal (Hair et al., 2010). The main difference is that the oblique rotation allows the extracted factors to correlate, while the orthogonal rotation assumes no correlation between extracted factors (Field, 2009; Hair et al., 2010). In this research, the underlying factors were not assumed to correlate, and hence orthogonal rotation was adopted. In the SPSS software, the varimax orthogonal rotation was selected under the principle component analysis to perform the EFA.

Hair, et al. (2010), stated two rules of thumb before performing the EFA. The first rule is that the minimum number of samples is 50. The sample size in this research (n=203) is well above this and fulfils this requirement. The second rule, suggested by Hair, et al.

(2010), is to have a minimum of five observations per question. The number of factor questions without excluding any item (even if suggested by Cronbach alpha analysis) is 48. The 48 questions related to hypothesised factors and do not include other questions like firms' profile. Hence, the minimum sample required is 48 multiplied by 5, resulting in a minimum of 240 observations. In this case, Hair, et al. (2010) suggest considering the grouping rule. When the sample is not sufficient, they suggest dividing the measurement into different groups and applying the EFA for each. Accordingly, it is possible to divide the 203 measurements by 5, resulting in 40 groups. However, in our case two groups were sufficient to satisfy the five-observations-per-item rule (Hair et al., 2010).

The theories adopted that dominate this study are the dynamic capabilities and the information technology capabilities. Hence, two groups can represent the measurement models. One group contains items related to market intelligence generation, breadth of knowledge sources, internationalization orientation, absorptive capacity, and ambidexterity as theorised to represent the dynamic capability dimension. The other group contains items related to IT flexibility, IT effectiveness, IT infrastructure, and IT sensing capabilities as theorised to represent the information technology capabilities. The measures of innovation performance and the breadth of knowledge sources have been excluded from EFA for two reasons. The items that compose the dummy variables BREADTH and T_INNO are not expected to be internally consistent. For the BREADTH variable, for example, a firm might have a strong relationship with its suppliers but with no strong relationship with its competitors or research institutes; these two represent different kinds of knowledge sources.

With T_INNO, it is not necessary for a firm with good new-to-firm innovation performance to have good new-to-the world products, as these two measures reflect different kinds of innovation. Moreover, innovation performance measures do not represent a latent variable but rather an observable variable; a similar consideration was approached by the work of Laursen and Foss (2003).

5.2.1 EFA for the Measurements of Innovation Dynamic Capabilities

The following are the results of the EFA, as produced from the SPSS software. One item (INT3) was excluded from the analysis as suggested by the Cronbach alpha analysis. At first, the eigenvalues table suggests seven factors greater that one in their eigenvalue score. This indicates that the software was able to recognise seven factors from the pool of questions analysed. The KMO and Bartlett's test shows satisfactory scores of 0.884 (above

0.5), and (p <0.001), and is successfully below the threshold (p =0.05), suggesting that the correlation matrix was far from the identity matrix (Field, 2009; Hair et al., 2010).

Table 5.3: Number of factors that the SPSS were able to identify and their eigenvalues and model fit test of innovation dynamic capabilities

Total Variance Explained			
Factors	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
RACAP	9.915	31.984	31.984
PACAP	3.019	9.738	41.722
EXL	2.182	7.037	48.76
EXR	1.98	6.388	55.148
INTEL	1.433	4.622	59.77
ENV	1.366	4.407	64.177
INT	1.155	3.725	67.902

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.884
Bartlett's Test of Sphericity	Chi-Square	3538.275
Degree of Freedom		465
Significance		0.000

The extraction method used for the EFA analysis was based on principle component analysis with varimax rotation. All questions loaded successfully (loading > 0.45) (Cua et al., 2001) on the related factors with a maximum cross loading of 0.379. This indicates that the SPSS software has grouped the questions in an order that reflects the theoretical factors.

Table 5.4: Items loading as A result of the EFA analysis

Measures	Factors						
	RACAP	PACAP	EXL	EXR	INTEL	ENV	INT
RACAP3	**0.847**						
RACAP4	**0.832**						
RACAP2	**0.805**						
RACAP5	**0.794**						
RACAP1	**0.776**	0.326					
RACAP6	**0.667**						
PACAP4		**0.726**					
PACAP2		**0.716**					
PACAP1		**0.661**					
PACAP6	0.379	**0.645**					
PACAP3		**0.638**					
PACAP5	0.333	**0.635**					
EXL2			**0.787**				
EXL3			**0.785**				
EXL1		0.314	**0.771**				
EXL4			**0.754**				
EXR1				**0.788**			
EXR2				**0.787**			
EXR3				**0.777**			
EXR4			0.339	**0.646**			
INTEL2					**0.841**		
INTEL3					**0.782**		
INTEL4					**0.657**		
INTEL1					**0.609**		
ENV1						**0.754**	
ENV4						**0.72**	
ENV2						**0.716**	
ENV3						**0.679**	
INT2							**0.834**
INT1							**0.755**
INT4		0.333					**0.673**

5.2.2 EFA for the Measurements of IT Capabilities

The EFA was applied on the group of IT capabilities. All questions were included in this group, including the questions related to IT SENS. Although the Cronbach alpha suggested that the questions of IT SENS did not show internal consistency, it may load on different constructs. As stated earlier, previous literature found difficulties in measuring IT capabilities. Hence, including all the IT factors measures may improve the measurement and provide a better contribution to theory by understanding how the measures will load on each IT factors. At the first round, the EFA test recognised five factors from the pool of questions as shown in Tables 5.5 and 5.6. IT SENS, as suggested by the Cronbach alpha test, was not consistent as one of its questions (ITsens1) was highly loaded on the IT infrastructure factor. Moreover, ITE3 and ITF4 did not load successfully on their related factors. Hence, the EFA test was repeated, keeping ITSens1 and deleting ITSens2, ITSens3, ITSens4, ITE3 and ITF4

Table 5.7 show the results of the repeated EFA after removing the suggested items. At first, the KMO and Bartlett's Test revealed positive results with a KMO score of 0.875 and a significant Bartlett's Test of Sphericity ($p < 0.001$). Moreover, there were three factors with eigenvalues greater than one, indicating that the software recognised three factors from the pool of questions entered in the analysis.

Table 5.5: Number of factors that the SPSS were able to identify and their eigenvalues and model fit test of IT capabilities

Total Variance Explained			
Factors	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
INFRA	5.441	49.462	49.462
ITF	1.687	15.332	64.794
ITE	1.355	12.317	77.111
IT SENS	0.509	4.626	81.737

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.875
Bartlett's Test of Sphericity	Chi-Square	1413.943
Degree of freedom		55
Significance		0.000

Table 5.6: Initial EFA test for the IT capabilities measures

Measures	Factors				
	INFRA	ITF	ITE	IT SENS	Other
INFRA3	**0.827**				
INFRA4	**0.812**				
INFRA2	**0.793**				
INFRA1	**0.781**				
ITSENS1	**0.745**				
ITF2		**0.873**			
ITF3		**0.854**			
ITF1		**0.853**			
ITE1			**0.86**		
ITE2			**0.86**		
ITE3			**0.856**		
ITSENS3				**0.666**	0.317
ITSENS4				**0.585**	
ITSENS2				**0.539**	
ITE4				**-0.505**	
ITF4					**0.919**

The extraction method used for the EFA analysis was based on principle component analysis with varimax rotation. All questions loaded successfully (loading > 0.45) (Cua et al., 2001) on the related factors with no cross loading greater 0.3. This indicates that the SPSS software grouped the questions in an order that reflected the theoretical constructs (latent variables). As expected, the item ITSens1 was highly loaded on the construct INFRA indicating that it represented a good measure for IT infrastructure.

Table 5.7: Repeated EFA test for the IT capabilities measures

Measures	Factors		
	INFRA	ITF	ITE
INFRA3	**0.81**		
INFRA4	**0.807**		
INFRA1	**0.807**		
INFRA2	**0.786**		
ITSENS1	**0.763**		
ITF2		**0.877**	
ITF1		**0.86**	
ITF3		**0.86**	
ITE1			**0.869**
ITE2			**0.868**
ITE3			**0.856**

The results of the EFA analysis for the IT capabilities measures suggest that IT Sens1 represents a good measure for IT infrastructure. As stated earlier, previous studies report challenges in measuring IT capabilities. Some IT capabilities may share similar characteristics with other IT capabilities. In the case of this research, IT Sens1 represents the presence of a firm's technology infrastructure needed to electronically link with external business partners (i.e. customers, supplier, alliances). This particular characteristic of IT may act as an IT sensing capability that helps firms to generate and analyse market intelligence. It may also represent an IT infrastructure characteristic that stimulates the flow of external knowledge that increases the firm's learning ability. Since the EFA analysis suggested that IT Sens1 is more appropriate as a measure for IT infrastructure, the measure is included in a repeated Cronbach Alpha test to make sure it is consisted with the other IT infrastructure measures.

A repeated Cronbach Alpha test was applied to the questions INFRA1, INFRA2, INFRA3, INFRA4, and ITSens1 to check the internal consistency of the factor INFRA after including ITSens1. The results showed higher internal consistency when including ITSens1 as a measure of INFRA, as shown in Table 5.8. The internal consistency was improved, by adding ITSens1 to the other questions on IT infrastructure, from 0.87 to 0.890.

Table 5.8: Cronbach Alpha test for the revised measured of IT capabilities

Measures	Alpha if Item Deleted	Cronbach Alpha
INFRA1	0.872	.890
INFRA2	0.867	
INFRA3	0.868	
INFRA4	0.856	
ITSENS1	0.87	
Alpha level for the previous measures		0.87

5.2.3 EFA for the Measurements of the Entire Research Model

As discussed previously, the minimum sample required for the EFA analysis must satisfy the five-observations-per-item rule (Hair, et al., 2010). At this stage, the items INT3, ITF4, ITE4, INT3, ITSens2, ITSens3, and ITSens4 were permanently excluded from this study. The total number of factors questions is reduced from 48 to 41, hence the minimum required sample analysed using the principle component analysis is 41

multiplied by 5, which results in a 205 sample size, not far away from this research sample size (N=203).

Therefore, the EFA is repeated for the whole set without grouping to confirm the measurement model after removing the above stated measures. The results of the EFA procedure are shown in Tables 5.9 and 5.10. The KMO and Bartlett's test revealed positive results with a KMO score of 0.887 and a significant Bartlett's Test of Sphericity ($p<0.001$). The number of factors with eigenvalues greater than one is 10, reflecting the same number of constructs in this research. The extraction method used for the EFA analysis is based on principle component analysis with varimax rotation.

Table 5.9: Eigenvalues and model fit test for entire research model

Total Variance Explained			
Factors	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
RACAP	12.904	30.724	30.724
INFRA	3.312	7.885	38.609
PACAP	2.846	6.777	45.386
EXL	2.134	5.08	50.466
EXR	2.051	4.882	55.348
INTEL	1.621	3.859	59.208
ITE	1.394	3.319	62.526
ENV	1.336	3.18	65.706
ITF	1.15	2.737	68.443
INT	1.076	2.561	71.004

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.887
Bartlett's Test of Sphericity	Chi-Square	5371.405
Degree of freedom		861
Significance		0.000

All questions loaded successfully (loading > 0.45) (Cua et al., 2001) on the related factors with no cross loading greater 0.42. This indicated that the SPSS software grouped the questions in an order that reflected the theoretical factors (latent variables).

Table 5.10: EFA test for the model fit test for entire research model

Measures	Factors									
	RACAP	INFRA	PACAP	EXL	EXR	INTEL	ITE	ENV	ITF	INT
RACAP3	**0.82**									
RACAP4	**0.82**									
RACAP5	**0.79**									
RACAP2	**0.78**									
RACAP1	**0.76**		0.31							
RACAP6	**0.66**									
INFRA3		**0.80**								
INFRA4		**0.79**								
INFRA2		**0.78**								
INFRA1		**0.78**								
ITSENS1		**0.75**								
PACAP2			**0.71**							
PACAP4			**0.69**							
PACAP3			**0.67**							
PACAP1			**0.65**							
PACAP6	0.35		**0.61**							
PACAP5			**0.59**						0.34	
EXL3				**0.79**						
EXL2				**0.78**						
EXL1			0.31	**0.74**						
EXL4				**0.73**						
EXR1					**0.78**					
EXR3					**0.77**					
EXR2					**0.74**					
EXR4				0.32	**0.58**					
INTEL2						**0.82**				
INTEL3						**0.75**				
INTEL4						**0.69**				
INTEL1						**0.66**				
ITE2							**0.86**			
ITE3							**0.83**			
ITE1							**0.81**			
ENV1								**0.76**		
ENV2								**0.72**		
ENV4								**0.72**		
ENV3								**0.66**		
ITF2									**0.71**	
ITF3									**0.71**	
ITF1									**0.70**	
INT2										**0.83**
INT1			0.33							**0.63**
INT3					0.42					**0.53**

Therefore, the measurement model resulting from both reliability and exploratory factor analysis is achieved. The next step is to calculate the score for each factor variable by taking the mean of its measure. This step is important in order to be able perform the regression analysis. Moreover, by taking the mean of the measures, a clearer picture of the factors, and their relation, is achieved. The next step is to check the three regression assumption (normality, homoscedasticity and multicolinearity). Later, the following chapters will show and discuss the results of quantitative research, including both descriptive and regression findings.

5.3 Regression Assumptions

5.3.1 Normality

Normality is one of three assumptions for multivariate analysis. Regression assumes normality between the variables under analysis (Hair et al., 2010). Previous innovation studies demonstrated highly skewed data and departure from normality in innovation performance measures (Laursen & Salter, 2006; Kirner et al., 2009). Normality can be defined as *"the shape of the data distribution for an individual metric variable and its correspondence to the normal distribution, the benchmark for statistical methods"* (Hair et al., 2010, p. 71).

Besides the visual examination of the histogram distribution, skewness and kurtosis measures of the distributions should be calculated (Hair et al., 2010; Tabachnick & Fidell, 2007). Where skewness describes how symmetrical the distribution is around the centre, kurtosis describes how flat or peaked the distribution is (Field, 2009; Tabachnick & Fidell, 2007). A variable with perfect normal distribution has zero skewness and kurtosis (Hair et al., 2010). In order to assess how far the value of skewness and kurtosis depart from normality, a rule of thumb suggests that the value for skewness and kurtosis should be between ±1 (Aluja et al., 2005). Table 5.11 lists all variables with corresponding skewness and kurtosis values. The table also includes the dummy variables BREADTH, AMB, T_INNO, and RAD. Clearly, most of the variables did not violate (or are at least close enough to) the assumption of normality based on the rule of ±1 statistics threshold (Aluja et al., 2005). A few variables, however, exceeded the threshold significantly: namely, POSITION and T_INNO.

Table 5.11: Skewness and Kurtosis scores

Variable	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
AGE	0.393	0.171	-0.852	0.34
SIZE	0.713	0.171	-0.789	0.34
INDUSTRY	0.18	0.171	-1.194	0.34
POSITION	**1.411**	0.171	**2.175**	0.34
ENV	-0.4	0.171	-0.419	0.34
R&D	0.992	0.171	0.083	0.34
BREADTH	0.123	0.171	-0.819	0.34
INT	-0.068	0.171	-0.973	0.34
INTEL	-0.101	0.171	-0.515	0.34
PACAP	-0.301	0.171	-0.357	0.34
RACAP	-0.218	0.171	-0.743	0.34
EXR	-0.53	0.171	-0.669	0.34
EXL	-0.669	0.171	-0.207	0.34
AMB	-0.582	0.171	-0.241	0.34
ITE	-0.352	0.171	-0.874	0.34
ITF	-0.248	0.171	-0.972	0.34
INFRA	-0.058	0.171	-0.934	0.34
RAD	-0.256	0.171	-1.219	0.34
T_INNO	**1.506**	0.171	**2.409**	0.34

However, when researching enterprises and technological innovation, departure from normality is common (Laursen & Salter, 2006; Kirner et al., 2009) and any condition of normality is hard to satisfy in a rigorous sense (Bagozzi & Yi, 1988). Moreover, according to Hair et al. (2010, p. 72), *"in a small sample of 50 or fewer observations, and especially if the sample size is less than 30 or so, significant departure from normality can have substantial impact on the result. For sample sizes of 200 or more, however, the same effect may be negligible"* (p. 72).

Notwithstanding, and following previous studies (Laursen & Salter, 2006; Kirner et al., 2009), transformations of some of the variables that exhibited a large departure from linearity were applied. According to Hair et al. (2010), a number of transformation remedies are available to the researcher, such as taking the square root, logarithm, or the inverse. Hair et al. (2010) add that *"in many instances, the researcher may apply all of the possible transformations and then select the most appropriate transformed variable"* (p.78). It seems that the variables T_INNO and POSITION have the highest departure from the normality threshold. In the Laursen and Salter (2006) study, logarithmic transformation was applied using $T_{Transformed}$= Ln (1+$V_{Original}$). Adding '1' in the equation

was to overcome the cases that have a zero value. In the Kirner et al. (2009) study, the square root was applied to the innovation performance measures and using $T_{Transformed} = \sqrt{V_{Original}}$. Table 5.12 compares the improvement of using the logarithmic and square root transformation.

Table 5.12: A comparison of transformation techniques

Variable Code	Skewness			Kurtosis		
	Original	SQRT	LOG	Original	SQRT	LOG
POSITION	1.411	-0.09	0.232	2.175	-0.939	-0.55
T_INNO	1.571	0.301	-0.303	2.959	-0.178	-0.619

The two variables in the table, POSITION and T_INNO, were examined. The square root transformation seemed to be the best option to maintain kurtosis within the acceptable range. Therefore, this study adopted the square root transformation. This is also in alignment with the work of Kirner et al. (2009) that transformed the innovation performance measure using the square root transformation. Therefore, at this stage T_INNO and POSITION were transformed using the square root transformation technique. The remaining variables were kept in their original state.

5.3.2 Homoscedasticity

Homoscedasticity assumes *"that the depended variable(s) exhibit an equal level of variance across the range of predictor variable(s)"* (Hair et al., 2010, p. 74). Homoscedasticity is one of the assumptions required for multivariate analysis (Hair et al., 2010). Although the violation of homoscedasticity might reduce the accuracy of the analysis, the effect on ungrouped data is not fatal (Tabachnick & Fidell, 2007, p. 85).

Using visual inspection, the assumption of homoscedasticity was examined. Scatter plots portrayed the standardised predicted dependent variable(s) and standardized residuals. (Hair et al., 2010; Tabachnick & Fidell, 2007). The following plots in Figure 5.1 show the homoscedasticity data for the dependent variables SQRT_T_INNO, RAD, AMB, and RACAP.

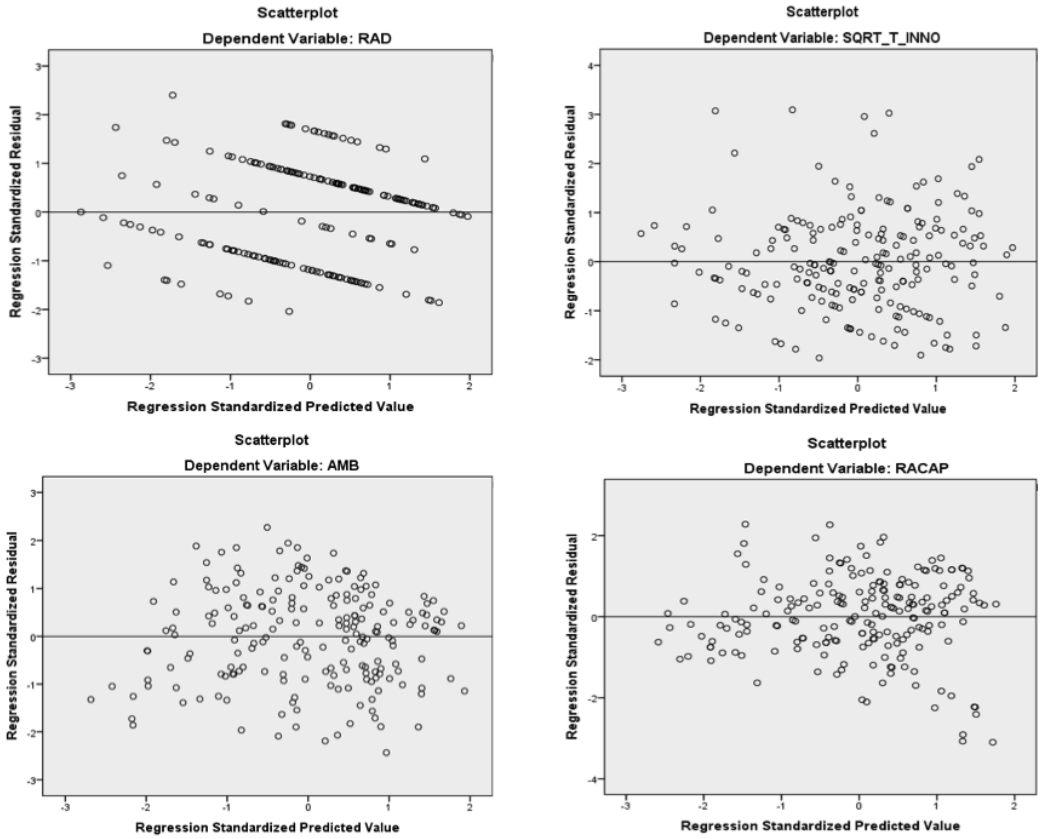


Figure 5.1: Scatterplot showing distribution of residuals for each dependent variable

From the plot we may see that the error in prediction seemed to indicate homoscedasticity because the variance error of prediction in the plot was not centred in a specific range of the predicted variable. Furthermore, the centre line was almost perfectly horizontal, indicating that no liner relationship existed and the error occurred in a random fashion (Hair et al., 2010, p. 75).

5.3.3 Multicollinearity

Multicollinearity is concerned with high correlation between predictors (independent variables) that are supposed to predict a certain dependent variable(s) (Hair et al., 2010). Ideally there should be a high correlation between the dependent variable(s) and the independent variables, while the independent variables exhibit low correlation with each other (Hair et al., 2010). Multicollinearity may lead to significant impact on the regression and statistical results because it can be very difficult to distinguish the contribution of a variable that exhibits multicollinearity in predicting the regression relationship (Field, 2009; Hair et al., 2010). As appears in the Pearson's correlation Table 5.13, there was no sign of multicollinearity. The highest correlation coefficient between variables was 0.634, which does not exceed the threshold of 0.9 as suggested by Hair et al. (2010, p. 200).

Table 5.13: Pearson's Correlation Matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. AGE	1																
2. SIZE	.19**	1															
3. INDUSTRY	-0.01	.18*	1														
4. ENV	0.03	0.05	-0.043	1													
5. SQRT_POSITION	0.03	-.26**	-0.046	-0.03	1												
6. R & D	0.03	.36**	.148*	0.02	0.009	1											
7. INTEL	0.03	0.02	-0.018	.27**	0.024	.222**	1										
8. INT	0.02	.14*	0.053	0.104	-0.13	.172*	.398**	1									
9. BREADTH	0.01	0.03	0.06	.27**	.13*	0.086	.359**	.204**	1								
10. AMB	0.03	0.066	-0.014	.27**	-0.04	.19**	.463**	.360**	.423**	1							
11. PACAP	-0.04	0.053	-0.064	0.1	0.084	.18**	.388**	.483**	.364**	.564**	1						
12. RACAP	-0.02	0.052	0.024	.155*	0.002	.25**	.275**	.299**	.195**	.453**	.634**	1					
13. INFRA	-0.03	0.101	.157*	0.124	-.16*	0.111	.170*	.317**	.141*	.327**	.418**	.446**	1				
14. ITE	0.01	0.066	0.03	.152*	-0.03	0.09	.232**	.303**	.191**	.409**	.274**	.225**	.403**	1			
15. ITF	-0.12	0.078	-0.02	.19**	-0.04	.21**	.354**	.396**	.265**	.576**	.585**	.531**	.517**	.427**	1		
16. SQR_T_INNO	-0.03	0.118	0.07	0.07	0.135	.38**	0.099	.215**	0.108	.311**	.267**	.431**	.180**	.152*	.273**	1	
17. RAD	.16*	.47**	0.068	0.01	-0.11	.38**	.236**	.252**	.162*	.317**	.293**	.338**	.163*	0.104	.273**	.367**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

5.4 Saudi Firms' Innovation Characteristics

The previous chapter showed the steps utilised to filter data and validate measures. After the validation of the measures, the variables for the factors that are hypothesised in this research were computed by calculating the mean of their measures. The next step is to explore the findings of this research. One of the ways to examine the importance of the factors argued and hypothesised in the literature is to explore the differences in the behaviour of firms with different sizes and different innovation performance toward these factors.

Table 5.14 contains the demographic characteristics of the 203 firms from which this analysis will be derived. The maximum and minimum percentages of any single sector in this final data are construction (with 7.9%) and mining (with 2%). The sectors that may be considered hi-tech are information technology (at 6.9%), oil and petrochemicals (at 3%), manufacturing (at 7.4%), and telecom (at 4.4%). Moreover, most of the responses of this survey are from chief operation officers (COOs) (at 49.8%), and chief executive officers (CEOs) (at 32.5%). Therefore, the final data are probably diverse enough and represent key information of Saudi firms.

Table 5.14: Demographic characteristics of the research sample.

Industry	***Frequency***	***Valid Per cent***
Advertising and marketing	13	6.4
Agriculture	12	5.9
Banking	7	3.4
Construction	16	7.9
Education	12	5.9
Food and Beverage	8	3.9
Furniture and Decoration	10	4.9
Medical Sector	10	4.9
Hotel and Holidays	5	2.5
Information Technology (IT)	14	6.9
Insurance	10	4.9
Logistics	5	2.5
Mining	4	2.0
Manufacturing	15	7.4
Media and Publishing	10	4.9

Oil and Petrochemicals	6	3.0
Real Estate	7	3.4
Retail	8	3.9
Telecom	9	4.4
Transportation	7	3.4
Utilities	7	3.4
Other	8	3.9
Total	203	100.0
Respondent Position	*Frequency*	*Valid Per cent*
GM/CEO	66	32.5
Chief Operations Officer	101	49.8
Chief Financial Officer	20	9.9
Chief Information Officer/IT Director	7	3.4
Other	9	4.4
Total	203	100.0
Firm Size (number of employees)	*Frequency*	*Valid Per cent*
Less than 10	33	16.3
10–50	78	38.4
51–250	27	13.3
251–500	22	10.8
501–1000	11	5.4
More than 1,000	32	15.8
Total	203	100.0
Firm Age	*Frequency*	*Valid Per cent*
1–3 years.	71	35.0
3–5 years.	65	32.0
5–10 years.	39	19.2
More than 10 years.	28	13.8
Total	203	100.0
Market Coverage	*Frequency*	*Valid Per cent*
Regional	86	42.4
National	94	46.3
International	23	11.3
Total	203	100.0

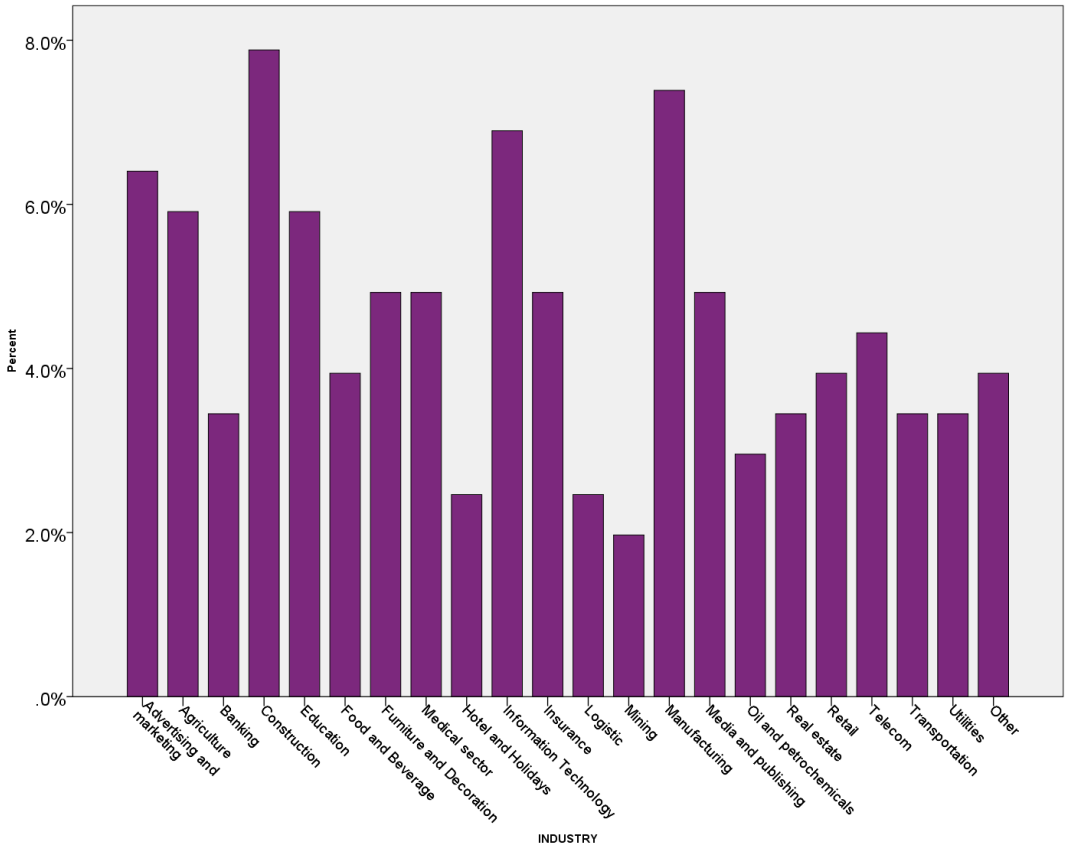


Figure 5.2: Distribution of the sample based on industry.

According to Teece's (2007) view of dynamic capabilities, the factors under study can be grouped into three main dimensions. At first, recognition of external knowledge and opportunities constitutes the sensing capability in Teece's (2007) model. We propose three factors that stimulate firms' ability to recognise opportunities and external knowledge: market intelligence generation (INTEL), breadth of knowledge sources (BREADTH), and internationalization orientation (INT). Each factor comprises a number of practices that are used as measures in the survey. For instance, in the survey, market intelligence generation (INTEL) was captured through four practices that the literature highlights as important. The second capability articulated by Teece (2007) is seizing capability.

Under this dimension, we hypothesised the two factors of absorptive capacity (i.e. potential absorptive capacity (PACAP) and realised absorptive capacity (RACAP)) to be essential for stimulating a firm's ability to acquire external knowledge and apply it to the creation of new products and services. The last capability in Teece's (2007) model is reconfiguring capability. This dimension highlights the importance of continuous

reconfiguring of resources to enable sustainable competitive advantage. In the innovation context, maintaining competitive advantage requires the ability to compete in the short- and long-term. Exploitative innovation strategy aims to maximise the economic advantage from current products and services by improving quality and production while reducing costs. On the other hand, explorative innovation strategy aims to secure a firm's competitive advantage in the long-term. Explorative innovation strategy triggers shifts in the original way of doing things through attempts to introduce a new generation of products and services, to extend the products and their range, to open up new markets, or to enter new technologies. Ambidextrous capacity refers to the ability of firms to maintain a balance of both strategies, as this balance increases firms' prosperity in current markets and reduces the risk from future market forces. These factors, along with the impact of information technology, are explored in the following sections.

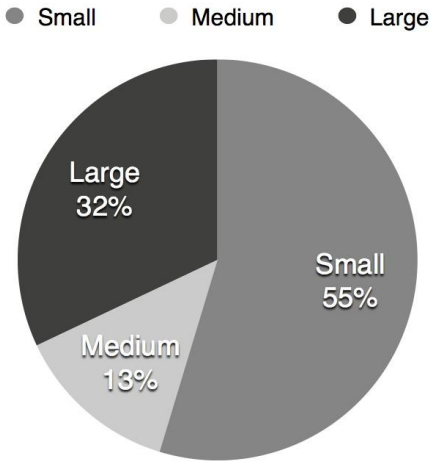
5.4.1 The Effect of Firms' Size on Innovation Dynamic Capabilities

According to the Saudi Industrial Development Fund (2012), *"SMEs are the most important constituents of economic development in many of the developed, and developing, countries of the world. This can be attributed to their effective role in creating numerous job opportunities; elevating living conditions and promoting balanced development in rural areas. Economic studies show that SMEs represent more than 90% of active enterprises worldwide. They employ 50% - 60% of available manpower. Furthermore, their contribution to GDP is around 50%".*

One of the obstacles to the analysis of small and medium enterprises (SMEs) is that they have no universal definition. Currently, this may be based on the number of employees, amount of capital, annual sales volume or other criteria. The World Bank, for example, suggests that enterprises with 50 employees are considered small. However, in the USA small and medium enterprises have 500 employees in the manufacturing and mining industries, or achieve maximum sales of $ 35.5 million annually (Saudi Industrial Development Fund, 2012). On the other hand, the commission of the European communities (2003) categorizes small-sized enterprises as those who have fewer than 50 employees and an annual turnover that does not exceed EUR 10 million, whilst medium-sized enterprises have fewer than 250 employees and a maximum annual turnover of EUR 50 million. In Saudi Arabia, and according to the KAFALA Program that is managed by the Saudi Industrial Development

Fund, *"any small or medium profit-seeking activity having maximum annual sales amounting to SR 30 million is classified as a small and medium enterprise".*

Based on the above multiple views on SMEs classification and due to the unavailability of total annual turnover of the firms surveyed, the researcher decided to depend on the number of employees as a basis for definition. First, the data have been grouped based on firms' size, with small and medium-sized enterprises (SMEs) being those who have 250 employees or less. This definition complies with the entrepreneurial literature (Wolff & Pett, 2000). Therefore, in this analysis, small enterprises are firms that have 50 or fewer employees, medium enterprises have a range of 51 to 250 employees, and large enterprises have 500 or more employees. Figure 5.3 shows the distribution of the 203 firms examined in this study, based on their size. As expected, SMEs represent most of the sample, at around 75%, because smaller firms constitute a large number of firms in many countries. For instance, in China, 99% of all firms are SMEs (Zeng et al., 2010). In parallel with the testing of the conceptual model, this in-depth analysis of firm characteristics will show how firm size relates to innovation performance. In the survey, the researcher attempted to capture in-depth details of the characteristics of firms' innovation. Such detail was needed because innovation can be interpreted from different perspectives, such as a firm's innovation impact on sales and degree of radicalness. In this survey, a matrix developed for this purpose helps to capture those two dimensions. More clearly, the researcher attempted to capture data related to the sales performance of each degree of radicalness of innovation.

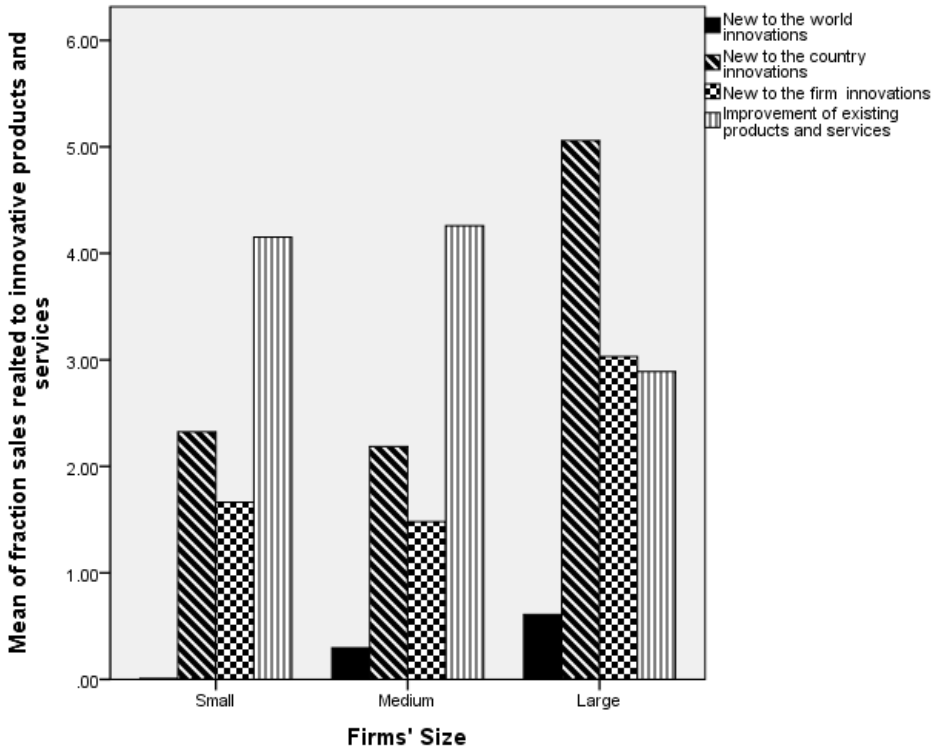


Firm's Size	Small	Medium	Large
Count	111	27	65

Figure 5.3: Distribution of data based on firms' size.

The four degrees of radicalness include innovation that is new-to-the-world, new-to-the-country, new-to-the-firm, and an improvement of existing products or services. Figure 5.4 demonstrates how the firms differ, based on their size, in achieving different kinds of innovation. For instance, large firms are able to achieve a higher degree of innovation performance in products that are new-to-the-world, whilst small and medium-sized firms have similar performance across the different kinds of innovations. However, it seems that medium-sized firms are able to achieve a better performance in new-to-the-world innovations. These findings pose the question of how different-sized firms manage their sources of knowledge and technology.

Figure 5.4: Mean of innovation performance based on firm size.



5.4.1.1 The Effect of Saudi Firms' Size on Recognition Capacity

This study questioned whether the size of a firm influences its ability to recognise opportunities and valuable external knowledge. Figure 5.5 shows the number of highly-used external sources for innovation activities (a source is considered highly-used if the respondent scores 5 or higher on a scale of 1 to 7). On average, larger firms have three highly-used external sources. On the other hand, medium and small firms usually rely on an average of two highly-used external sources. This indicates that larger firms are better able to achieve a

strategic relationship with external parties and are more able to acquire and achieve a better mixture of sources of external knowledge.

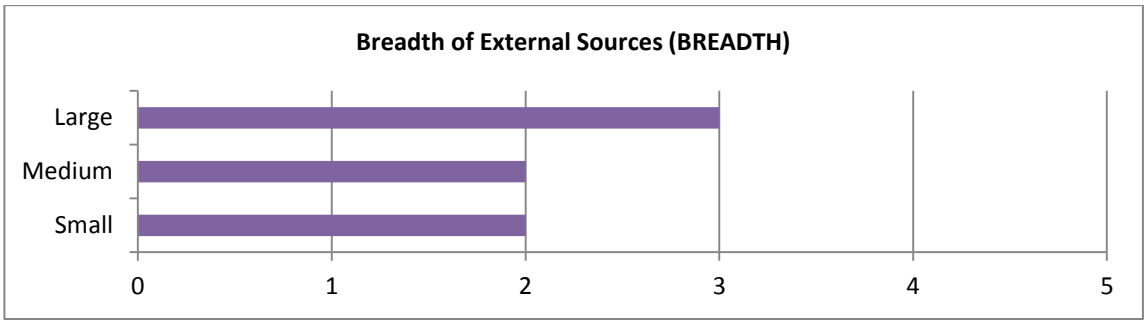


Figure 5.5: The average number of highly-used external sources (breadth of sources).

Figure 5.6 reflects how the different-sized firms use their sources for innovating activities. Small-sized firms use customers more intensively compared to medium and large firms. For all firms sizes suppliers are the second most important source used for innovation activities.

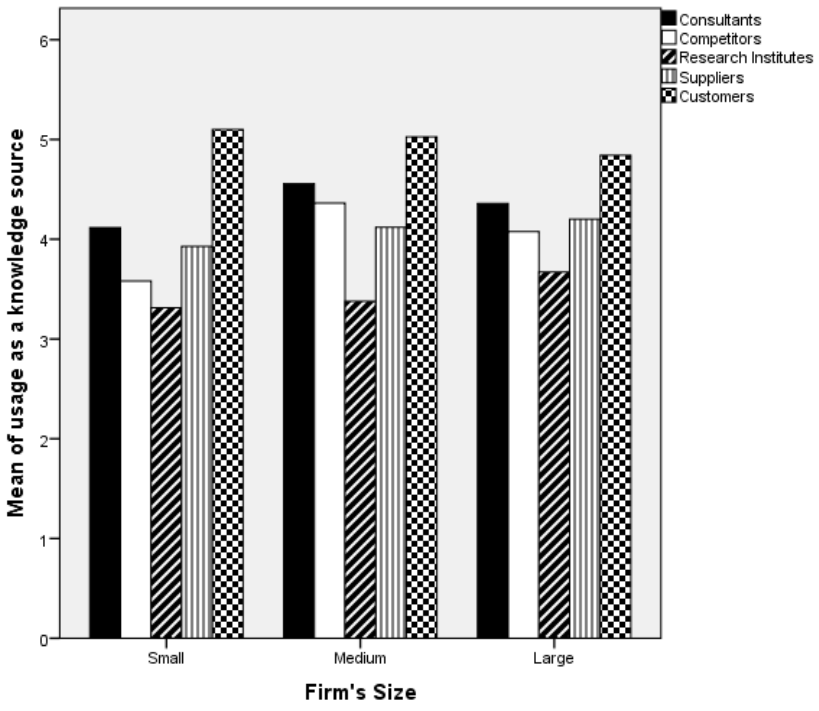


Figure 5.6: Mean of usage of source for innovation activities based on innovation size.

Research centres are used more by large firms than by small and medium-sized firms. Medium firms show highest usage of consultant. Small firms are highest in using customers. What is interesting is that small and medium-sized enterprises (SMEs) have the same pattern

of usage. They use customers more intensively, while suppliers are their second-most used source, and consultants and research centres represent their least-used sources. Large firms seem to have more balanced usage of all sources.

With regard to market intelligence generation, four practices were surveyed on a scale of 1 to 7. These practices included in-house research, attention to shifts in the industry (such as competition, technology, and regulations), changes in customers' preferences, and the effects of changes in business on customers. Figure 5.7 shows the average score of these practices on different sizes of firms. Surprisingly, smaller firms exhibited a higher propensity for market intelligence generation, compared to medium and large firms. Large firms had the lowest scores for market intelligence. One reason for this finding may be that most of the small firms were relatively younger than the medium-sized and large firms and that market research was the main driver for those small business ventures. The other possibility is that the Saudi market is less mature than the international market, and that larger firms are more engaged in the global innovation chain, hence paying more attention to intelligence from the international market and depending more on external research houses, including consultants. As shown in Figure 5.6, medium and large firms use consultants at higher rates as a source for innovation activities.

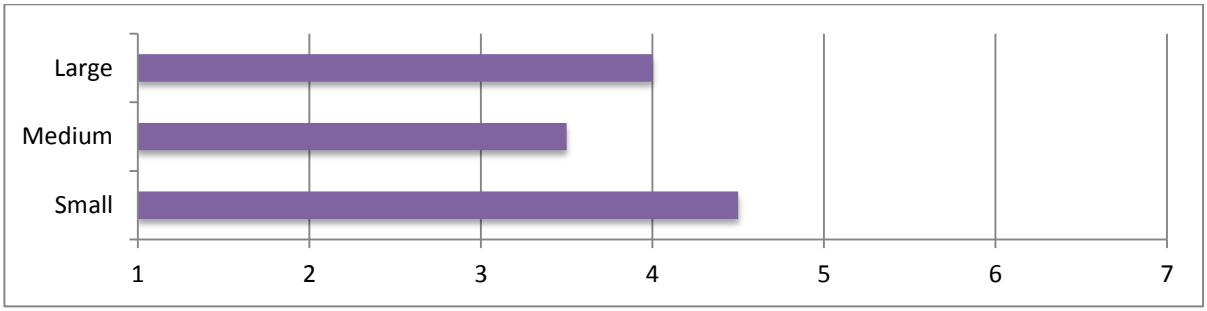


Figure 5.7: The average scores on practices of market intelligence generation.

One of the responds in the survey commented: *"Our future success is determined by our ability to interpret the current market condition and getting closer to customers. Currently, customers can freely access products from around the world, putting more pressure on us to stand in the face of globalised competition".*

Internationalization orientation is concerned with the firm's practices associated with searching for external knowledge, alliances, and expertise at the international level. Again, these practices were rated on a scale of 1 to 7. Figure 5.8 shows the average scores of these practices for firms of different sizes. Both medium-sized and large firms exhibited higher internationalization orientation compared to small firms, which probably stems from the limited resources available for small firms and the greater complexity of value provision in the case of medium-sized and large firms. This aligns with the interpretation of Figure 5.7, which indicates that the larger the firm, the greater its departure from dependency on the local market towards the international market for intelligence and knowledge.

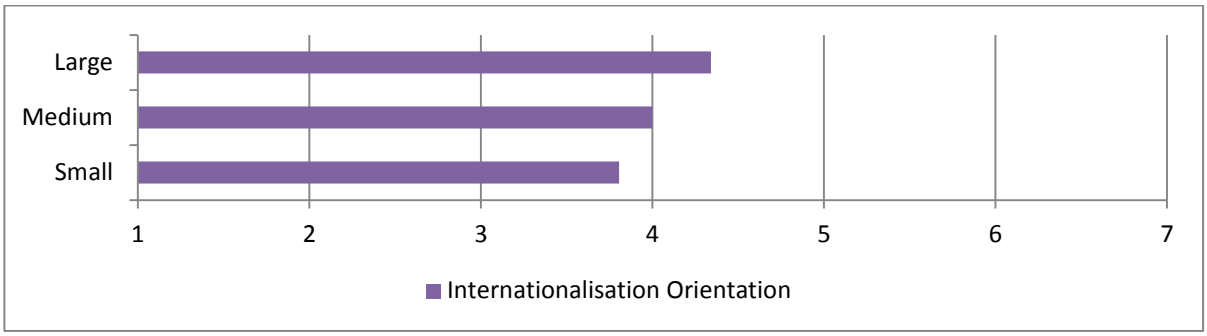


Figure 5.8: The average of scores on practices of internationalization orientation (INT)

5.4.1.2 The Effect of Saudi Firms' Size on Absorptive Capacity

Absorptive capacity comprises the important practices of knowledge acquisition and development within firms. As discussed in the literature review, two main factors constitute absorptive capacity. The first is potential absorptive capacity (PACAP), which represents firms' practices related to knowledge acquisition and assimilation (measured in this research through six practices). The other component is realised absorptive capacity (RACAP), which comprises six firms' practices related to knowledge transformation and exploitation (also measured in this research through six practices). These practices were surveyed using a scale from 1 to 7. Figure 5.9 suggest that larger firms have higher potential absorptive capacity compared to small firms. This indicated that larger firms exhibit a higher ability of knowledge acquisition and assimilation. Knowledge acquisition is mainly dependent on external sources, hence this is an indication that larger firms show better ability in knowledge scanning and knowledge sources utilisation. Linking this interpretation with Figure 5.8 (internationalization

orientation), it seems that dependence on international markets for knowledge scanning results in a higher chance of external knowledge accumulation.

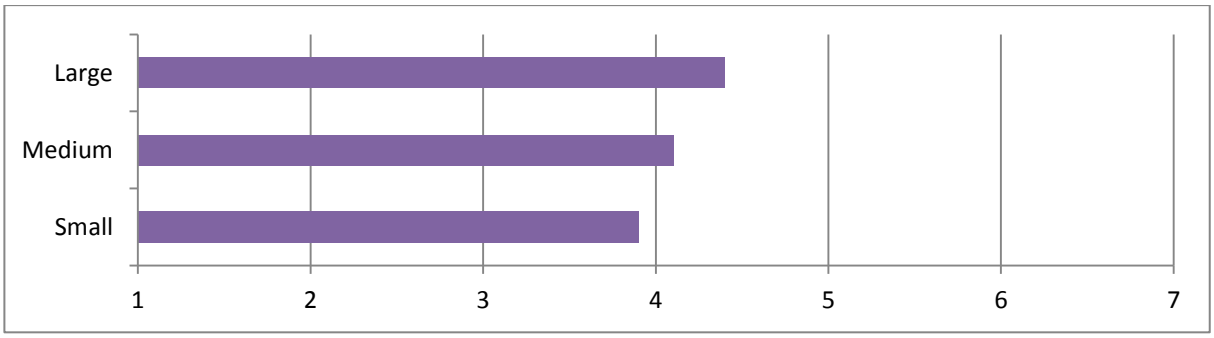


Figure 5.9: The average of scores on practices of potential absorptive capacity (PACAP).

Similarly, larger firms exhibited higher realised absorptive capacity, and hence higher knowledge transformation and exploitation, as shown in Figure 5.10. This probably stems from the availability of resources and the culture that supports innovation activity, which encourage firms to take risks. Moreover, realised absorptive capacity depends on potential absorptive capacity (as discussed in theoretical terms earlier). Smaller firms exhibit lower levels of knowledge acquisition and assimilation (potential absorptive capacity) and, therefore, they are expected to have a lower level of knowledge transformation and exploitation (realised absorptive capacity).

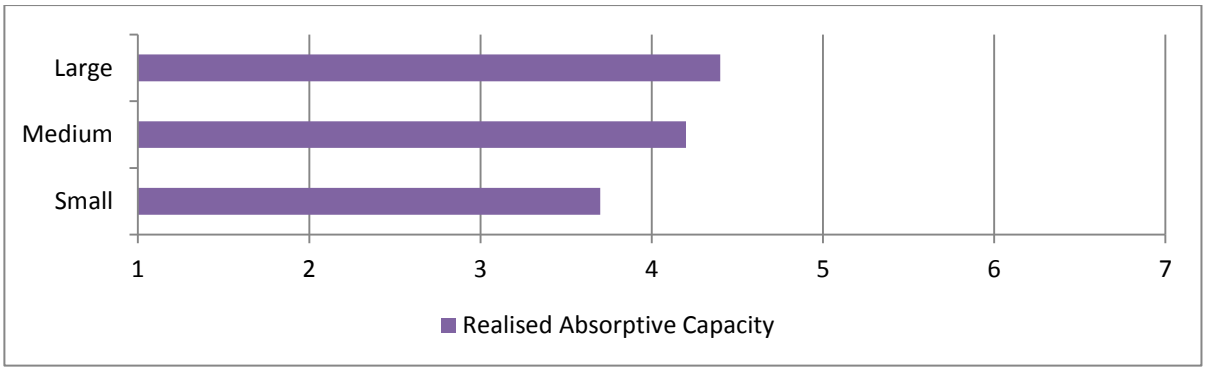


Figure 5.10: The average of scores on practices of realised absorptive capacity (RACAP).

One of the respondents in the survey commented, *"one of the challenges we face is the fast changes in technology. We keep trying to improve our staff's skills in today's way of conducting business, which we know for sure will be soon obsolete".*

5.4.1.3 The Effect of Saudi Firms' Size on Ambidextrous Capacity

As explained earlier, ambidextrous capacity represents firms' ability to balance two important paradoxical innovations strategies: exploitative innovation strategy (which focuses on short-term competitive advantage) and explorative innovation strategy (which focuses on long-term competitive advantage). Figures 5.10 and 5.11 show the firms' objectives for innovation projects over the last three years, as reported by respondents. Figure 5.10 represents the firms' objective for projects associated with exploitative innovation strategy, while Figure 5.11 represents the firms' objective associated with explorative innovation strategy. Again, these projects were surveyed on a scale of 1 to 7.

As shown in Figure 5.10, improving the quality of existing products has higher scores for small firms. For large firms, improving yield and reducing material consumption is the primary concern. For medium-size firms, improving yield and improving production flexibility seems to be the most important objectives. Interestingly, it seems that large and medium firms have more balanced innovation objectives compared to small firms. With regard to explorative innovation projects, large firms consider entering new technology fields as their highest objective for innovation projects, sharing approximately equal weight to other objectives. Medium-sized firms consider extending their project range as the most important objective, with entering new technology fields having the highest importance. Small firms consider opening up new markets as the most important objective. However, it also seems that large and medium firms pay balanced attention to the four surveyed innovation objectives, as the scores for the four objectives are relatively close to each other.

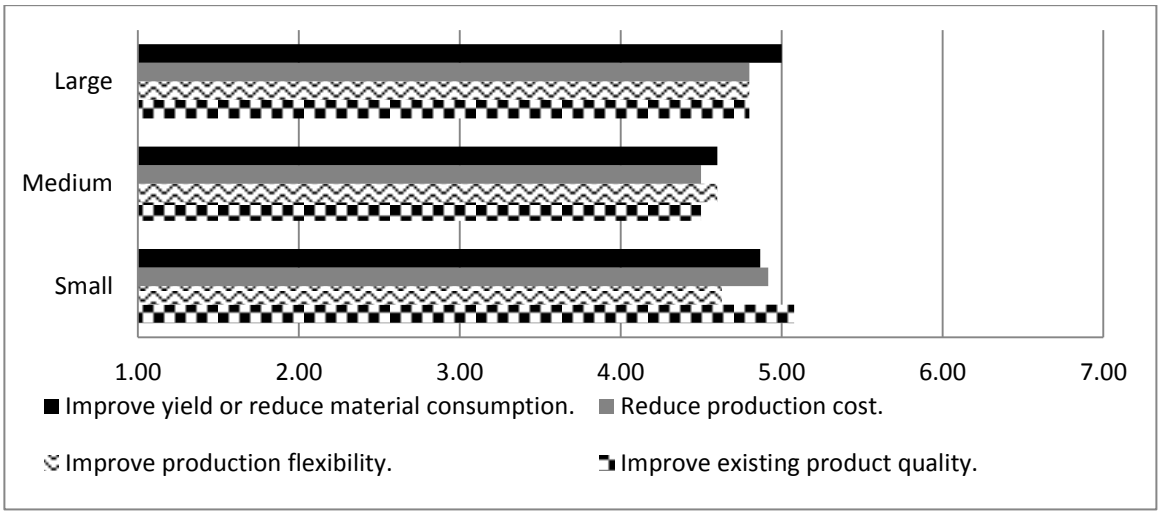


Figure 5.10: Weights of objectives of implementing innovative projects in the last three years (exploitative innovation strategy).

One of the respondents in the survey commented: *"One of the challenges we face is the fast changes in technology. We keep trying to improve our staff's skills in today's way of conducting business, which we know for sure will be soon obsolete."*

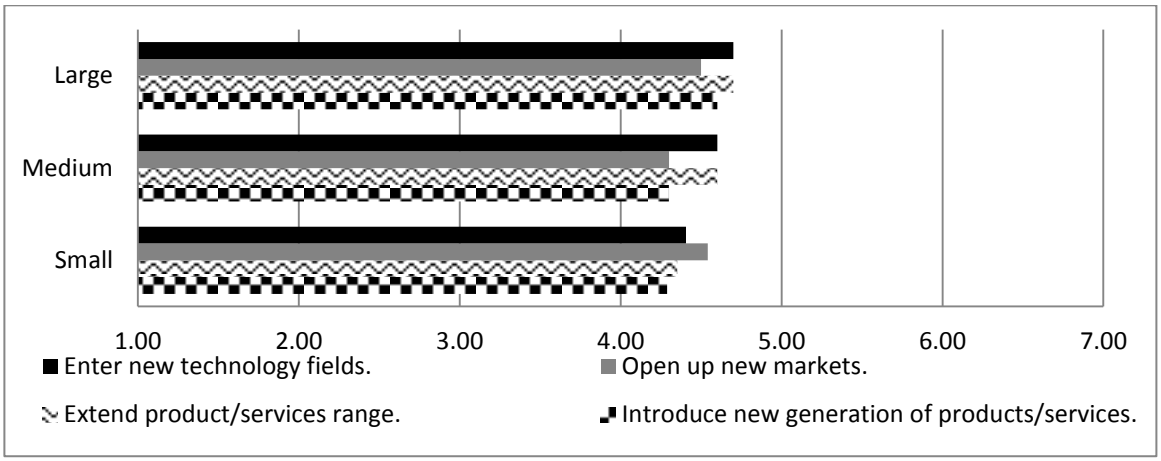


Figure 5.11: Weights of objectives of implementing innovative projects in the last three years (explorative innovation strategy).

By taking the mean of the score, the objective for innovation projects may have portrayed an overall picture of the explorative and exploitative innovation strategies of the Saudi firms. Figures 5.12 and 5.13 show the average scores for exploitative and explorative innovation strategies, respectively. In Figure 5.12, larger firms reported relatively higher exploitative activities compared to smaller firms. For explorative innovation strategy, as shown in Figure 5.13, smaller firms have a lower focus on explorative innovation strategy compared to medium and large firms. This may stem from the fact that larger firms tend to have dedicated R&D departments and more access to both financial and human capital, leading them to continuously search for new ways to improve their competence within new markets or by entering new technology fields.

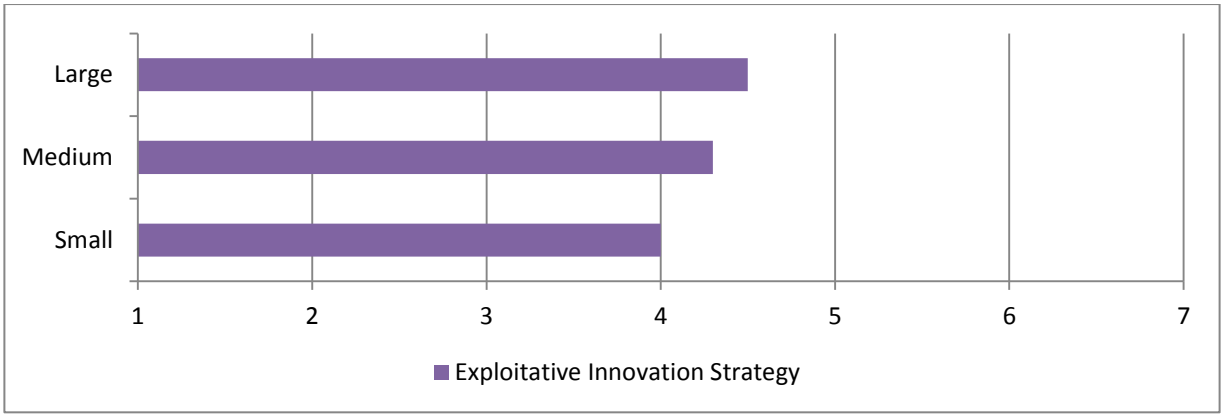


Figure 5.12: The average of scores for exploitative innovation strategy (EXP).

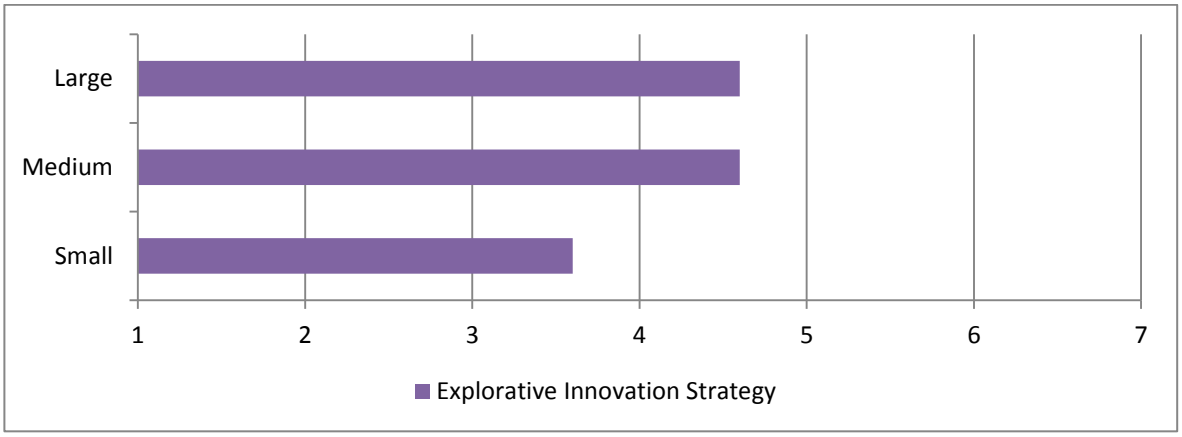


Figure 5.13: The average of scores for explorative innovation strategy (EXR).

More important is the ability to balance between explorative innovation and exploitative innovation strategies. Ambidextrous capacity is measured through simple addition of the factors of exploitative innovation strategies and explorative innovation strategies. Hence, a higher score in the ambidextrous level is achieved when a firm exhibits a high level of activities in both exploitative and explorative innovation. Figure 5.14 portrays the level of ambidextrous capacity for different sizes of firms, with larger firms exhibiting more ambidextrous capacity than smaller firms. Furthermore, although smaller firms are expected to be more flexible and agile, it seems that more established firms are better able to manage the ability to maximise their economic advantage and, at the same time, search for new ways to secure their position in the future. This probability stems from their difference in experience, access to skills and resources, and higher propensity for exploring new markets. As shown

previously, larger firms show higher internationalization orientation and absorptive capacity, which may play an important role in the firms' innovation activities.

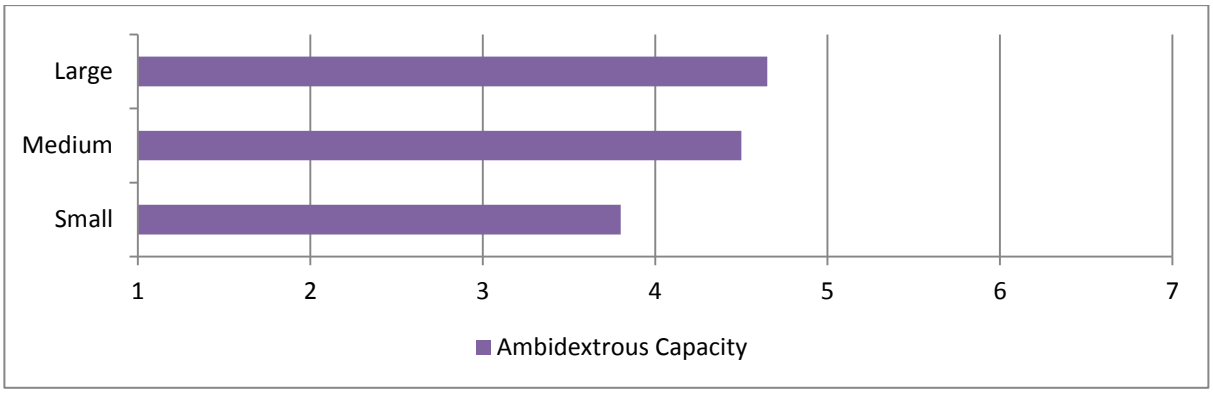


Figure 5.14: The average of scores for ambidextrous capacity.

5.4.1.4 The Effect of Saudi Firms' Size on IT Capabilities

Information technology plays an important role inside the organizations. From the literature review, three main capabilities were identified and hypothesised to be essential to stimulate the innovation process inside the firms: IT infrastructure (INFRA), IT flexibility (ITF), and IT effectiveness (ITE). However, IT is known to be costly and requires skill in order to produce a high return on investment. Hence, it is expected that differences in IT capabilities will occur based on firm size.

The IT infrastructure capability is associated with knowledge management capabilities, as well as firms' linkages with external parties. Figure 5.15 shows that medium and large firms have better IT infrastructure capability compared to small firms. IT effectiveness is associated with the success of the IT infrastructure to reduce cost and support the overall productivity of the firm. In this regard, large size firms have the highest scores for IT effectiveness. IT flexibility is related to the adaptability of IT infrastructure and its scalability, and the ability to meet changing user requirements. Medium and small firms seem to have relatively lower IT flexibility compared to large firms. The significance of the differences is tested in the next chapter.

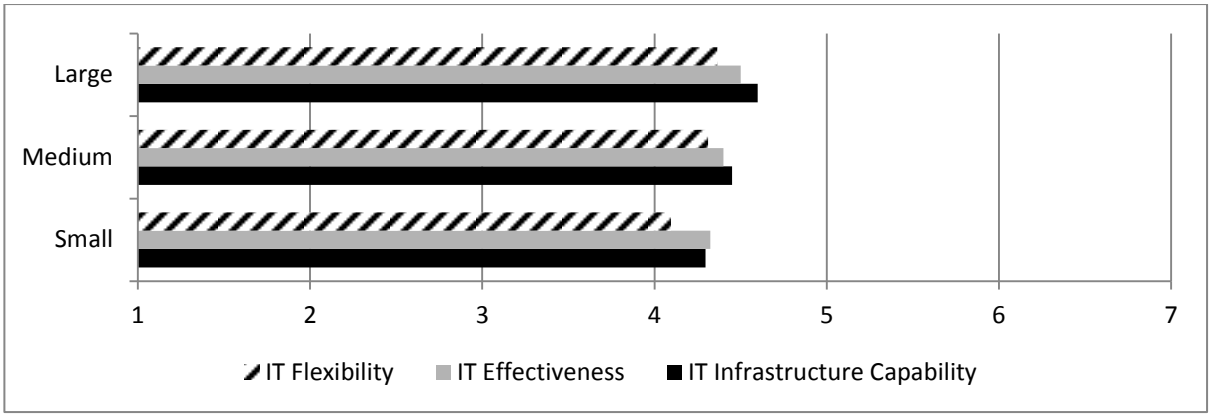


Figure 5.15: Differences in IT capabilities based on firms' size.

One of the respondents in the survey from a large firm commented: *"The amount of money injected in the IT department is always huge. The IT projects never stop. There is always upgrading, customisation, and new standards."*

On the other hand, a respondent in the survey from a small firm commented: *"We have few staff members, and our systems requirements are not complex. We simply outsource with an IT service company to save time and money."*

5.4.1.5 The Effect of Saudi Firms' Size on Research and Development

The research and development (R&D) expenditure is examined to determine whether any difference, based on firm size, exists regarding the percentage of sales dedicated to research and development. The figure below shows a clear difference based on firms' size. Large firms dedicate about 5% their sales to R&D activities, while medium-sized firms, on average, dedicate over 2.5%, and small firms dedicate over 2.2% to these activities.

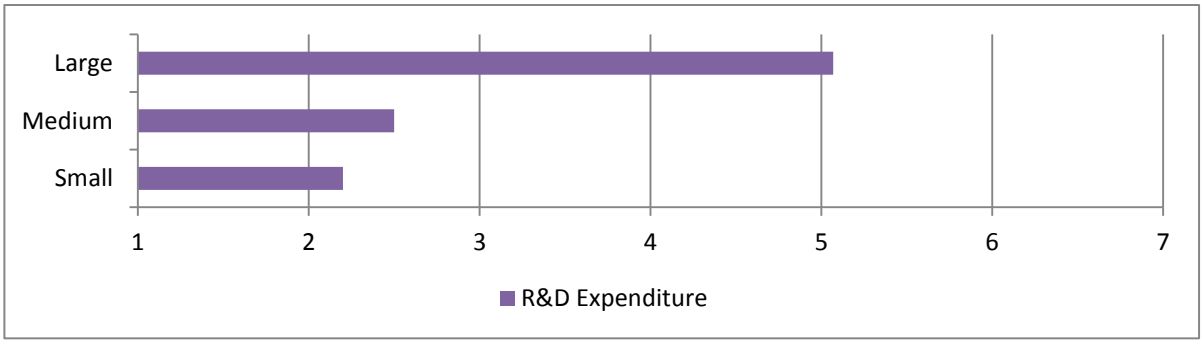


Figure 5.16: Differences in R&D expenditure based on firms' size.

Another interesting characteristic is the differences of R&D expenditure based on firms' industry. Figure 5.17 shows industry-based distributions of the mean of R&D expenditure as a percentage of sales. The top-four industries in terms of R&D expenditure are utilities, real estate, logistics, and oil and petrochemicals. This probably reflects the state of the country, which injects a vast amount of its budget into infrastructure and is engaged in a radical shift toward modernisation.

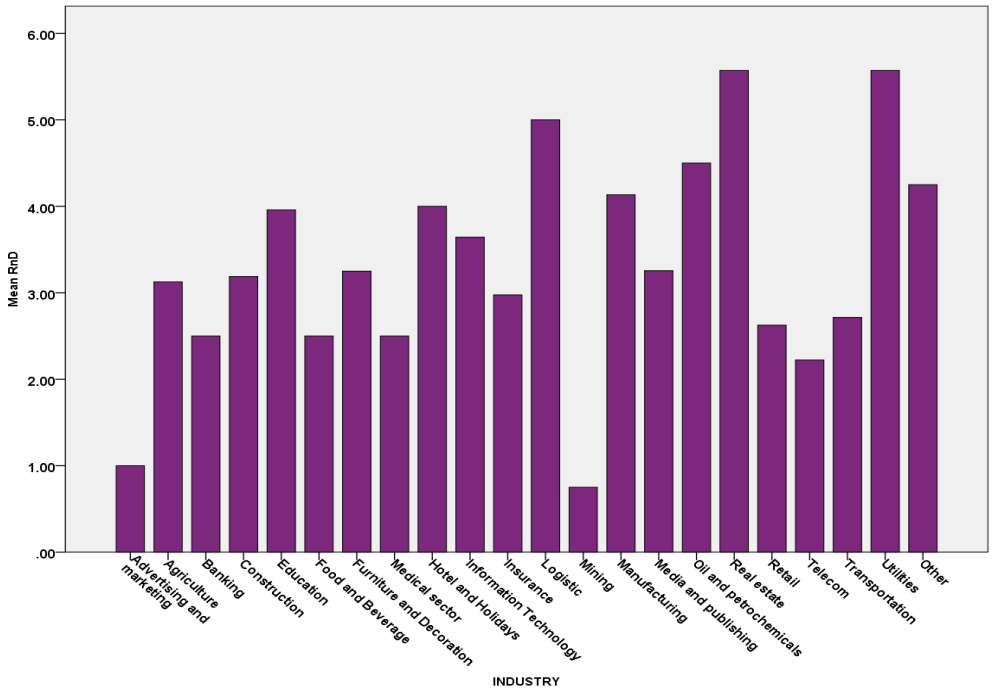


Figure 5.17: Mean of R&D expenditure based on industry sector.

From another perspective, it is important to gain an overall picture of how different-size firms behave in regard to the factors discussed earlier. The spider chart in Figure 5.18 portrays the factors of this research and how different size firms behave towards them. In general, the larger the firm, the higher the scores it achieves in factors that are hypothesised to stimulate innovation performance. One exception is for market intelligence generation, which is more valued by medium and small-sized firms. Overall, large and medium-sized Saudi firms demonstrate higher dynamic innovation capabilities than smaller firms. A clear difference pertains to factors that directly relate to the innovation process, such as absorptive capacity, R&D expenditure, breadth of knowledge sources and ambidextrous capacity.

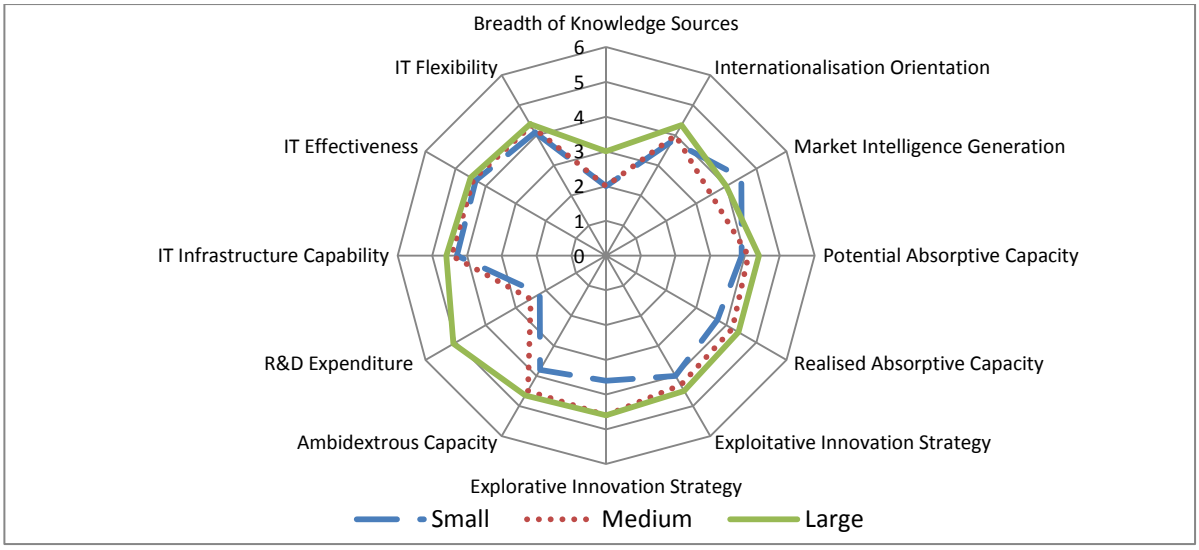


Figure 5.18: Spider charts showing the different behaviours of different-size firms toward dynamic innovation capabilities.

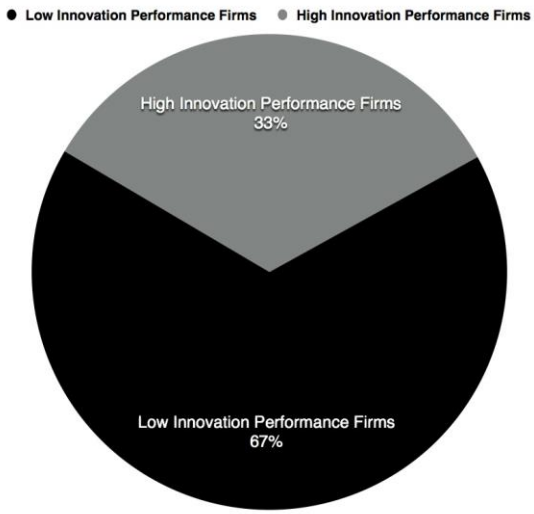
To summarise, the innovation process of the Saudi firms' seems to be influenced by R&D, breadth of knowledge sources (BREADTH), internationalization orientation (INT), absorptive capacity practices (PACAP and RACAP), and ambidextrous innovation strategy (AMB). Yet, smaller firms appear to exhibit lower ability in the innovation dynamic capabilities identified. Small firms represent a large portion of Saudi enterprises, as in the case of many other countries. Hence, the Saudi government interventions should pay special attention to the obstacles that face small firms in improving their innovation dynamic capabilities.

The findings of this study highlight factors that smaller firms seem to have difficulty attaining. The following section will re-examine how these factors are attained by firms with high- and low-innovation performance.

5.4.2 Characteristics of High- and Low-Innovation Performance Saudi Firms

In order to examine how low-innovation-performance Saudi firms and high-innovation-performance Saudi firms differ in term of their dynamic capabilities, the data of this research were divided based on innovation performance, as shown in Figure 5.19. The innovation performance was captured through four measures: new-to-the-world, new-to-the-country, and new-to-the-firm innovations, as well as improvements to existing products and services. The firms that reported having innovations that are new-to-the-country or new-to-the-world were assigned to a group labelled 'high innovation performance', while firms that

reported having innovations that were new-to-the-firm or improvements of existing products and services were assigned to a group labelled ‘low innovation performance’.



	Low Innovation Performance Firms	High Innovation Performance Firms
Count	135	68

Figure 5.19: Distribution of data based on high- and low-innovation performance.

5.4.2.1 Differences in Saudi Firms’ Recognition Capacity

The three factors that are theoretically suggested to influence firms’ ability to recognise opportunity and external valuable knowledge are market intelligence generation (INTEL), internationalization orientation (INT), and breadth of knowledge sources (BREADTH). Figure 5.20 shows that firms with high-innovation performance have a higher breadth of knowledge sources. On average, higher-innovation performance has two external sources that are commonly used for innovation activities, compared with single sources that are used for innovation activities in lower-innovation-performance firms. Mutually, firms with higher-innovation performance exhibit higher internationalization orientation, signalling a propensity for upgrading the search practices for opportunities and bringing new knowledge to the international level. However, there appear to be no significant differences in the level of market intelligence generation between high-innovation-performance and low-innovation-performance firms.

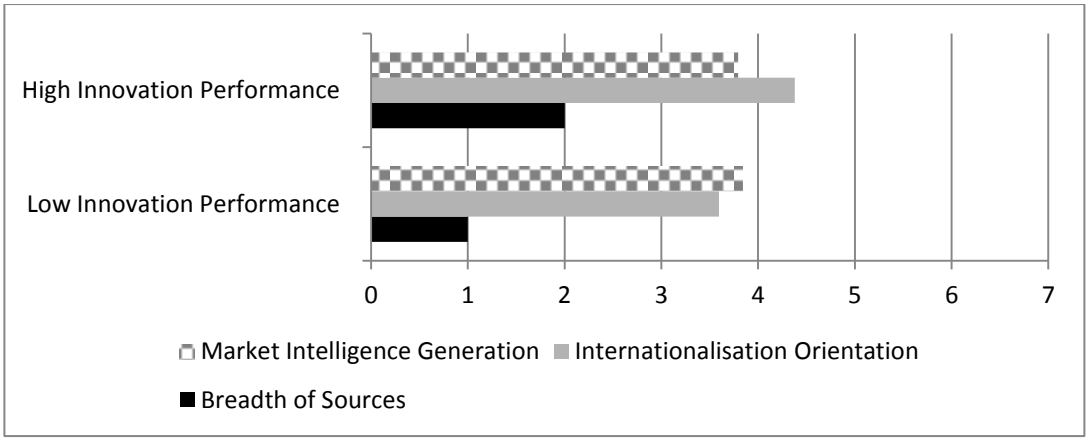


Figure 5.20: The differences in ability to recognise external knowledge and opportunity based on innovation performance level.

5.4.2.2 Differences of Saudi Firms' Absorptive Capacity

Absorptive capacity relates to practices associated with knowledge acquisition and development inside firms. It has two dimensions: potential absorptive capacity, which comprises practices associated with knowledge acquisition; and assimilation and realised absorptive capacity, which comprises practices related to knowledge transformation and exploitation. As shown in Figure 5.21, higher-innovation-performance firms exhibit higher potential and realised absorptive capacity compared to low-innovation-performance firms. This indicates that higher-innovation performance requires a tendency for new knowledge acquisition and more active knowledge processes.

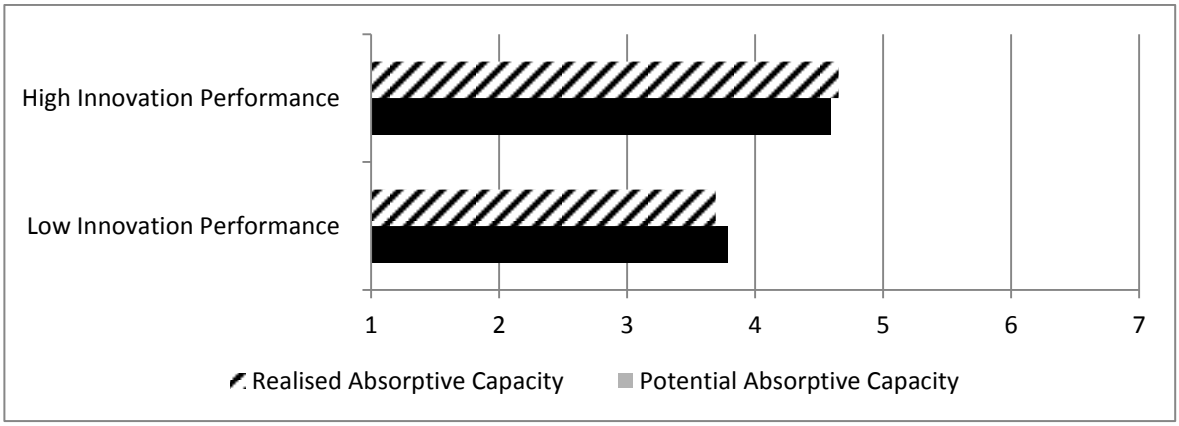


Figure 5.21: The differences in absorptive capacity based on innovation performance level.

5.4.2.3 Differences of Saudi Firms' Ambidextrous Capacity

The innovation strategy highlights firms' strategic mind-set in pursuing competitive advantage. Exploitative innovation strategy is incrementally-oriented and seeks to maximise its current economic advantage through improvement of existing products and services, reduction of cost, and enhancement of quality. Explorative innovation strategy, on the other hand, is radically oriented toward exploring new ways of securing competitive advantage by introducing new products, utilising new technologies, and entering new markets. Both explorative and exploitative innovations are essential for innovation performance and sustainable competitive advantage. The ability to balance the two strategies is labelled 'ambidexterity'. Figure 5.22 shows the differences between low- and high-innovation-performance firms in pursuing both strategies. Higher-innovation-performance firms exhibit a higher level of ambidexterity compared to lower-innovation-performance firms. This indicates that innovation performance benefits from seeking both explorative and exploitative innovation strategies.

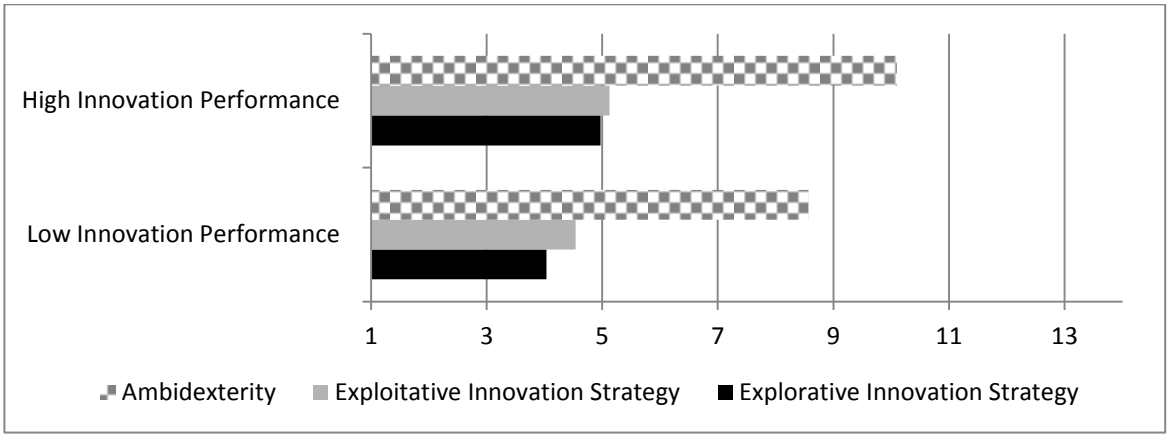


Figure 5.22: The differences in innovation strategy based on innovation performance level

5.4.2.4 Differences in IT Capabilities of Saudi Firms

It seems that differences exist between high- and low-innovation-performance firms in terms of IT capabilities as shown in the figure below. IT flexibility has the highest differences, probably indicating the importance of having flexible infrastructure to meet the changing

demands inside the firms. A difference also exists between IT infrastructure capability and IT effectiveness, although it is not clear if such a difference is significant. In general, the three capabilities of IT that are hypothesized to be important to firms' innovation process are relatively higher in firms' with higher innovation performance, as shown in the figure below.

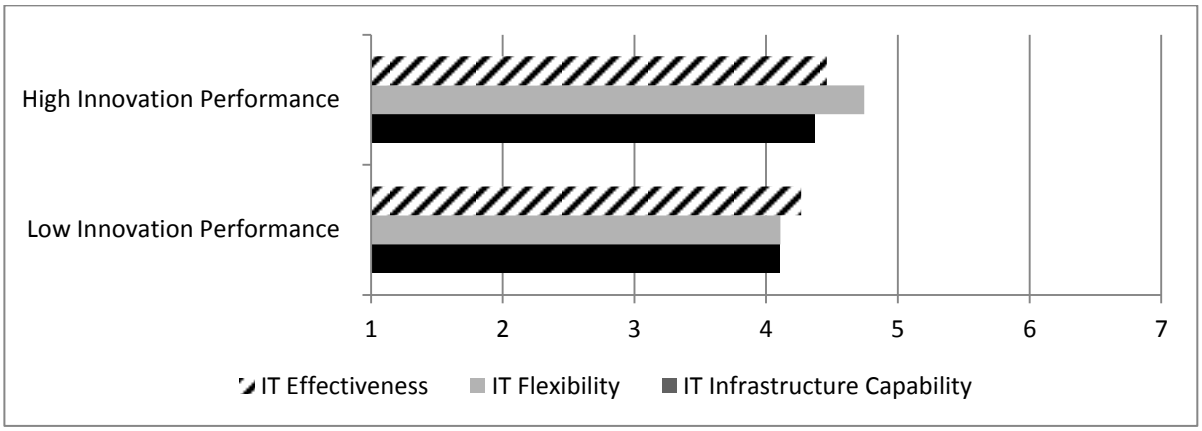


Figure 5.23: The differences in IT capabilities based on innovation performance level.

5.4.2.5 Visualising Differences in Saudi Firms' Innovation Performance

To gain a clearer picture of the difference in capabilities between high- and low-innovation-performance firms, a spider chart was constructed, as shown in Figure 5.23. Overall, there are clear differences in most of the factors suggested in the literature. A clear difference is exhibited through R&D expenditure. High-innovation-performance firms dedicated, on average, more than 4% of their sales to research and development activities, compared to only 2% for low-innovation-performance firms. Other important differences can be detected in the knowledge-related factors, such breadth of knowledge sources (BREADTH), internationalization orientation (INT), potential absorptive capacity (PACAP), and realised absorptive capacity (RACAP). On the other hand, there is no clear difference detected in market intelligence generation (INTEL) between low- and high-innovation-performance firms.

Similarly, it seems that IT effectiveness (ITE) has no clear impact on the innovation process in comparison to IT flexibility (ITF) and IT flexibility (ITF). High-innovation-performance firms have a better balance in regard to innovation strategy (EXL and EXR). On

the other hand, low-innovation-performance firms seem more oriented for exploitative innovation strategy. This indicates a stronger focus on maximising benefits from existing products, with less attention on new ways of offering value. In summary, Figure 5.24 suggests that the practices identified in the literature have an influence on Saudi firms' innovation performance, and that executives might benefit from implementing such practices in order to achieve better innovation prosperity and sustainable competitive advantage.

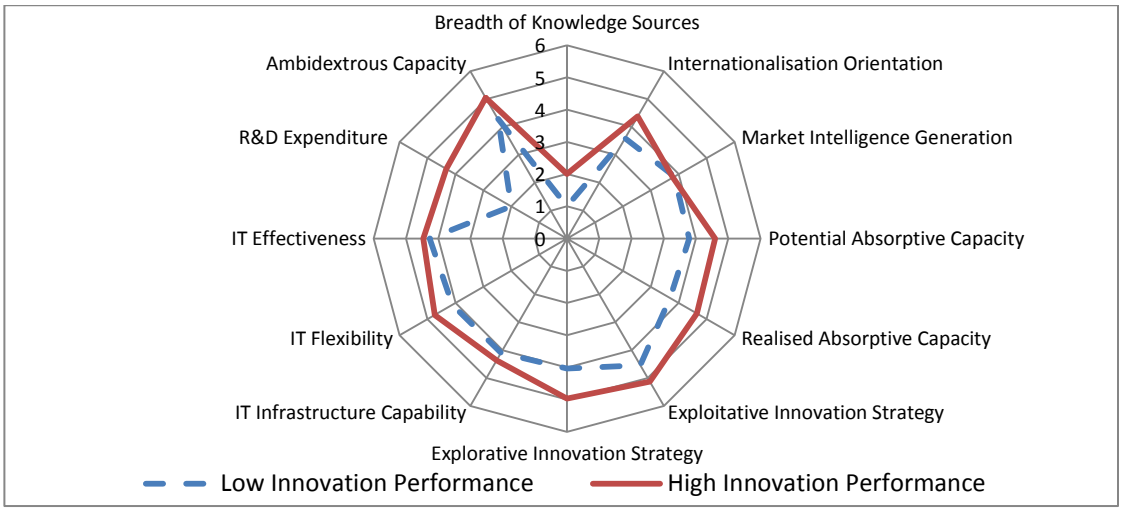


Figure 5.24: The differences of dynamic innovation capabilities of Saudi firms based on innovation performance level (Ambidextrous capacity score is divided by two to fit the chart scale).

5.4.3 Comments by Respondents

Besides the quantitative data filled in by respondents, the survey also allows for comments that respondents think are relevant. The respondents' comments fall into three main areas. First, comments highlight the effect of lack of public transportation on product availability and product price. Currently, Saudi Arabia lacks a rail and bus network, which could increase the firms' flexibility in terms of cost. Employees also face the cost of driving, which reflects operating costs, hence the increased product and service price offering.

Furthermore, respondents also comment on the role of government in providing market data. It seems that firms find it difficult to obtain statistics from the government on different sectors' performances. This is reflected as an obstacle in the feasibility study and increases the risks of ventures. Moreover, the services provided by consultants seem to be compromised due to the lack of updated market data. Hence, the innovation activities are less encouraged because firms do not have a clear picture of what the Saudi markets actually need.

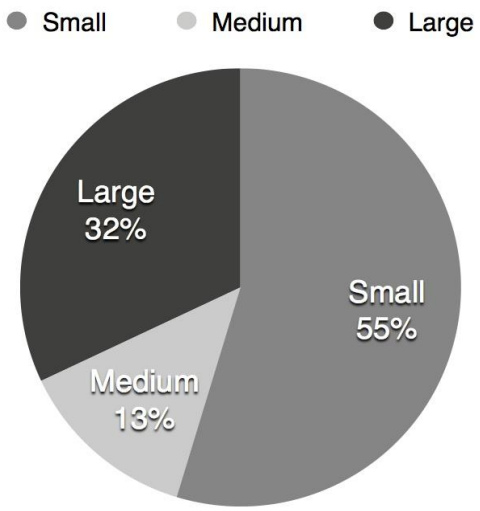
Respondents also commented on the use of employees as sources of knowledge inside the firms. The employees' skills and abilities are highlighted as vital to the firms' innovation activities. Saudi firms seem to have difficulty accessing skills and expertise from the Saudi market. Even if they decided to search for such talent outside Saudi Arabia, the labour regulations of the Saudi government make this difficult as a result of the government initiative to nationalise jobs in the Saudi markets.

5.5 T-test and Analysis of Variance (ANOVA)

The survey findings were presented in the previous section. The data were split based on each firm's size and innovation performance. Then, the factor hypotheses in this study were portrayed to determine if differences exist in these factors, based on each firm's size and innovation performance. Differences existed in the firms' practices to recognise external knowledge (breadth of knowledge sources, internationalization orientation), absorptive capacity practices and innovation strategies. Moreover, these factors had an effect on differentiating between high and low innovation performance.

However, it is important to examine whether these differences are statistically significant, since statistical evidence is required in order to accept or reject our hypothesis. Such differences have been argued in previous research. For instance, Dean et al. (1998) highlighted the differences between large organizations and SMEs, in terms of their approach towards countering internal and external pressure. Hence, they may have differences in their innovation capabilities. Larger organizations may have less agility compared to SMEs, as they become trapped by their own rules, procedures, and systems over time (Morris et al., 2008). On the other hand, large firms have better access to both human and financial resources (Cooper et al., 1994; Forbes and Milliken, 1999). Carroll and Hannan (2004) and He and Wong (2004) reported the possible effect of a firm's size on growth. Fosfuri and Tribó (2008) reported a correlation between a firm's size and potential absorptive capacity. Moreover, Chang et al., (2011) showed that firm's age is positively correlated with the ability of the firm to balance innovation ambidexterity, while firm's size has no significant correlation. In the following section, t-Test and ANOVA (analysis of variance) are used to see if certain factors have significant differences, based on firm size and international orientation. The researcher decided to statistically examine the influence of firm size and its international orientation on

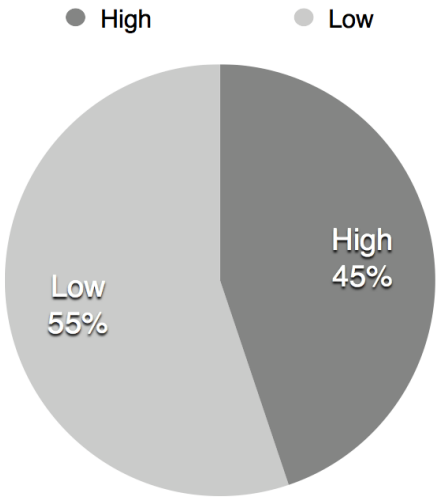
the firms' research and development (R&D) and IT capabilities. In a later section, regression analysis is used to test the hypotheses of this study and determine if the factors hypothesised play a significant role in firms' innovation performance.



Firm's Size	Small	Medium	Large
Count	111	27	65

Figure 5.25: Sample distribution based on firm size

The data were also split into two groups, based on internationalization orientation level. Low internationalization orientation represents the firms that score 4 or less on the Likert scale (ranging from 1 to 7), while firms with a high internationalization orientation are those that score 5 or higher. The frequency analysis of the two groups is as follows.



Internationalisation Oirentation Level	High	Low
Count	91	112

Figure 5.26: Sample distribution based on firm size

5.5.1 Influence of Firms' Size on R&D Expenditures

R&D expenditure is measured as the percentage of sales devoted to R&D. Since the goal was to test differences in R&D expenditure, an independent t-test was performed on firm's size and R&D expenditure using the SPSS software package. The independent t-test examines if there is a significant difference in the means of two groups (Pallant, 2011). The test showed no significant differences ($p > 0.05$) between small and medium firms.

Table 5.15: Independent t-test between the mean R&D spending of small and medium firms

R&D	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	t	df	**Sig. (2-tailed)**	Mean difference	Std. error difference
Equal variances assumed	1.79047984	0.1831007	-0.490	136	0.62481572	-0.3	0.66208875
Equal variances not assumed			-0.5891	52.105	0.55827441	-0.3	0.55079012

The same test was repeated for small and large firms. This time, a significant difference ($p < 0.01$) was detected, indicating that there is a significant difference, in terms of R&D expenditure, between small and large firms.

Table: 5.16: Independent t-test between the mean R&D expenditure of small and large firms

R&D	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	t	df	**Sig. (2-tailed)**	Mean Difference	Std. Error Difference
Equal variances assumed	0.001	0.9	-5.363	174	0.000	-2.8	0.480
Equal variances not assumed			-5.572	150.105	0.000	-2.8	0.4623

An independent t-test was also performed on medium and large firms. This test showed a significant difference in R&D expenditure between medium and large firms ($p < 0.01$).

Table: 5.17: Independent t-test between the mean R&D expenditure of medium and large firms

R&D	Levene's test for equality of variances		t-test for equality of means				
	F	Sig.	t	df	**Sig. (2-tailed)**	Mean Difference	Std. Error Difference
Equal variances assumed	3.28	0.07	-4.73	90	0.000	-2.57	0.612
Equal variances not assumed			-5.05	56.708	0.000	-2.57	0.573

Based on the previous independent t-tests, large firms differ significantly in their R&D expenditure. Thus, the analysis of variance (ANOVA) should show a significant difference between the firms' R&D expenditure. An ANOVA test will be used to directly compare the means of the three groups (small, medium, and large firms) and report the significance of their differences (Pallant, 2011). Table 5.18 indicates that the mean R&D expenditure level for large firms is 5%, compared to 2.5% and 2.2% for medium and small firms, respectively. Table 5.19 confirms that there is a significant difference between firms' R&D expenditure based on their size.

Table 5.18: Descriptive data of firms R&D expenditure

Organization size	N	Mean	Std. deviation	Std. error
Small	111	2.2	3.23	0.306
Medium	27	2.5	2.377	0.457
Large	65	5.07	2.789	0.346
Total	203	3.28	3.2266	0.22

Table 5.19: ANOVA test comparing the mean R&D expenditures of small, medium, and large firms

	Sum of squares	df	Mean square	F	Sig.
Between groups	310.246	2	155.123	17.305	.000
Within groups	1792.845	200	8.964		
Total	2103.091	202			

Table 5.20 portrays the correlation between the firms' R&D expenditure and their usage of external sources for innovation activities. This helps to illustrate the link between firms' collaboration with external parties and their R&D activities. The table suggests that the higher the R&D expenditure, the more dependent firms are on research institutes. This may also indicate that firms do not have strong ties with their supply chains, as R&D expenditures are not correlated with innovation activities involving a supplier or customers.

Table 5.20: Pearson's correlation between R&D expenditure and the use of different sources for innovation activities

Factor	R&D expenditure	Suppliers	Customers	Research institutes	Consultants	Competitors
R&D expenditure	1	0.024	0.057	**0.233****	0.088	0.109
Suppliers		1	0.317**	0.154*	0.251**	0.213**
Customers			1	0.173*	0.277**	0.232**
Research institutes				1	0.253**	0.365**
Consultants					1	0.167*
Competitors						1

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

5.5.2 Influence of Firms' Size and Internationalization Orientation on IT Capabilities

The ANOVA test was repeated to examine the influence of the firms' size on their IT capabilities. Tables 5.21 and 5.22 show the results of the ANOVA test, with no significant difference in the means ($p > 0.05$). Therefore, the test failed to detect any relationship between the firms' size and IT capabilities (IT flexibility, IT effectiveness, and IT infrastructure).

Table 5.21: Descriptive analysis of IT capabilities based on firm size

Factor	Organization size	N	Mean	Std. deviation
IT Infrastructure	Small	111	4.297	1.607
	Medium	27	4.453	1.471
	Large	65	4.497	1.565
	Total	203	4.601	1.573
IT Effectiveness	Small	111	4.324	1.665
	Medium	27	4.419	1.591
	Large	65	4.505	1.524
	Total	203	4.376	1.605
IT Flexibility	Small	111	4.095	1.330
	Medium	27	4.311	1.438
	Large	65	4.366	1.305
	Total	203	4.211	1.336

Table 5.22: ANOVA test of the effect of firm size on IT capabilities

Factor		Sum of squares	df	Mean square	F	**Sig.**
IT Infrastructure	Between groups	2.789	2	1.395	.561	.571
	Within groups	497.068	200	2.485		
	Total	499.858	202			
IT Effectiveness	Between groups	.900	2	.450	.173	.841
	Within groups	519.174	200	2.596		
	Total	520.074	202			
IT Flexibility	Between groups	3.316	2	1.658	.928	.397
	Within groups	357.260	200	1.786		
	Total	360.576	202			

An independent t-test was also performed to detect any existing relationship between the firms' internationalization and their IT capabilities (IT flexibility, IT effectiveness, and IT infrastructure). In all cases, there was a significant difference between firms with low and high internationalization orientations, in terms of IT capability ($p < 0.01$), as shown in Tables 5.23 and 5.24. The higher the international orientation, the better IT the capabilities are likely to be.

This signals the positive influence of a firm's internationalization orientation level on its IT capabilities.

Table 5.23: Descriptive analysis of IT capabilities based on internationalization orientation level

Factor	Organization size	N	Mean	Std. deviation
IT Flexibility	LOW	112	3.9911	1.53404
	HIGH	91	4.9048	1.47848
IT Effectiveness	LOW	112	3.9583	1.62385
	HIGH	91	4.8901	1.42902
IT Infrastructure	LOW	112	3.9179	1.29658
	HIGH	91	4.6176	1.28397

Table 5.24: ANOVA test for the effect of a firm's internationalization orientation level on IT capabilities

Factor		Levene's test for equality of variances		t-test for equality of means			
		F	Sig.	t	df	**Sig. (2-tailed)**	Mean Difference
IT Flexibility	Equal variances assumed	0.28	0.597	-4.289	201	**0.000**	-0.91369
	Equal variances not assumed			-4.306	195.208	**0.000**	-0.91369
IT Effectiveness	Equal variances assumed	3.139	0.078	-4.288	201	**0.000**	-0.93178
	Equal variances not assumed			-4.345	199.692	**0.000**	-0.93178
IT Infrastructure	Equal variances assumed	0.112	0.738	-3.841	201	**0.000**	-0.69973
	Equal variances not assumed			-3.845	193.318	**0.000**	-0.69973

In summary, a number of t-tests and ANOVA tests were performed and presented in this section. Table 5.25 summarises the results of these tests.

Table 5.25: Summary of all tests in this section and their results

Test	Grouping criteria	Dependent variable(s)	Level of significance (*p*)	Interpretation
ANOVA	**Firms' size:** *Small* *Medium* *Large*	**R&D expenditures**	**Significant** ($p < 0.001$)	A difference was detected between firms' size and R&D expenditure.
Independent t-test	**Firms' size:** *Small* *Medium*	**R&D expenditures**	Not significant ($p > 0.05$)	No difference was detected between small and medium firms, in terms of R&D expenditure.
Independent t-test	**Firms' size** *Small* *Large*	**R&D expenditures**	**Significant** ($p < 0.001$)	A difference was detected between small and large firms, in terms of R&D expenditure.
Independent t-test	**Firms' size:** *Medium* *Large*	**R&D expenditures**	**Significant** ($p < 0.001$)	A difference was detected between medium and large firms, in terms of R&D expenditure.
ANOVA	**Firms' size:** *Small* *Medium* *Large*	**IT capabilities:** *IT infrastructure* *IT flexibility* *IT effectiveness*	Not significant ($p > 0.05$)	No difference was detected between firms' size, in terms of IT capabilities.
Independent t-test	**Firms' internationalization orientation**	**IT capabilities:** *IT infrastructure* *IT flexibility* *IT effectiveness*	**Significant** ($p < 0.001$)	A difference was detected between firms' internationalization orientation and their IT capabilities (IT infrastructure, IT flexibility, IT effectiveness).

The following section will cover the model testing using the regression analysis. Furthermore, it will state the accepted and rejected hypotheses, in order to report the factors that appear to be significant for firms' innovation performance.

5.6 Research Model Regression and Hypotheses Testing

In order to assess the conceptualised theoretical model and test the hypothesis stated in Chapter 3, the researcher adopted multiple linear regression. The research model, after eliminating the hypotheses regarding IT sensing capabilities, is shown in Figure 5.27. The IT sensing capability hypothesis was eliminated due to the inconsistency of the measures used, based on the Cronbach alpha test. The regression analysis of the theoretical model shown in Figure 5.27 can be divided into five steps. Each handles a specific part of the model in which the relationship between independent and dependent variables may exist. Although structural equation modelling (SEM) can be used to perform the analysis for the whole model at once, it requires much larger datasets, in order to obtain accurate results. Hence, the researcher decided to adopt the multiple linear regression technique, which better fits the data size for this research.

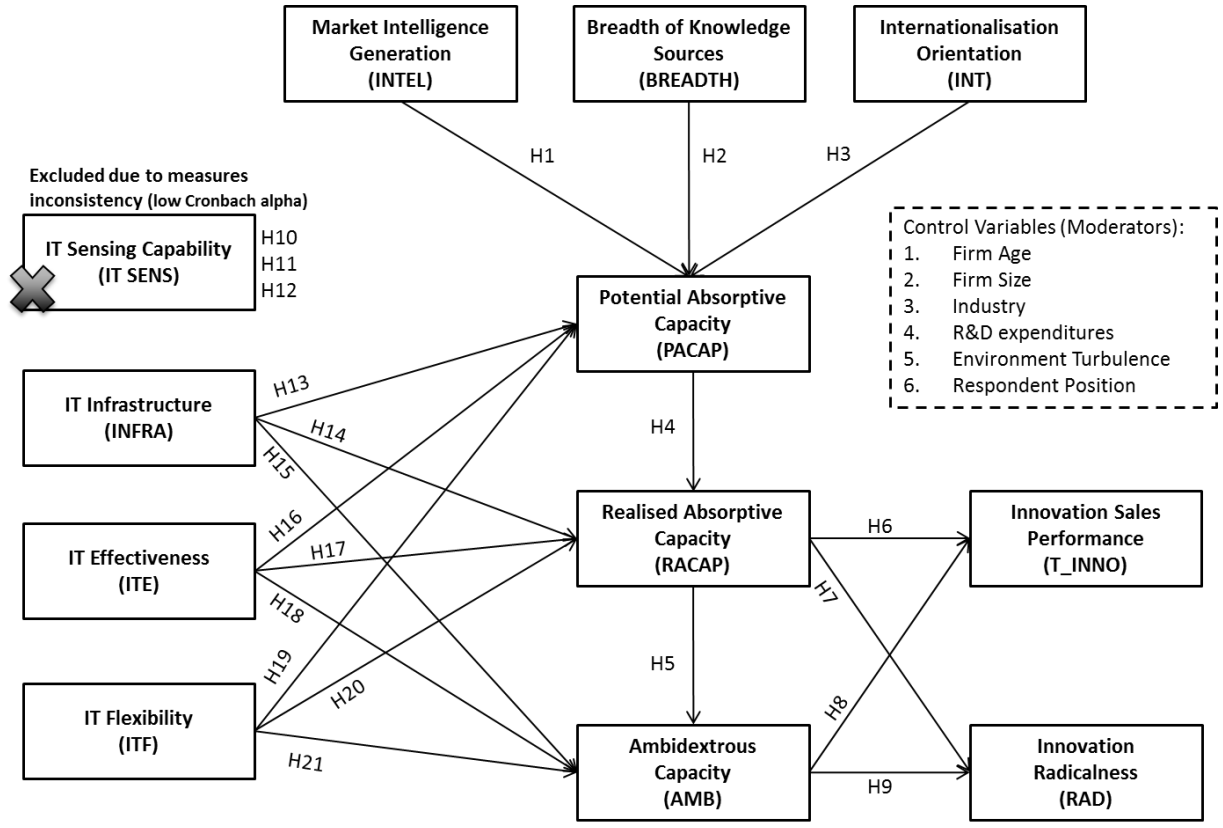


Figure 5.27: Conceptual model of the research

Regression analysis is a statistical tool used to identify linear relationships between independent and dependent variables, if they exist (Pallant, 2011). There are two main kinds

of regression analysis: simple and multiple regressions (Pallant, 2011). The former is adopted if a single independent variable is used to predict the dependent variable, while the latter is chosen when there is a group of independent variables that are used to predict the dependent variable (Pallant, 2011).

This study's hypothesis includes a number of variables (factors) to predict the dependent variable (e.g. innovation sales performance and innovation radicalness), as explained in the following sections. For instance, it is hypothesised that market intelligence generation (INTEL), breadth of knowledge sources (BREADTH), and internationalization orientation (INT) positively affect a firm's absorptive capacity (PACAP). In such cases, multiple linear regression is used to analyse whether relationships exist the between variables. Generally, linear regression is suitable for ordinal and scale variables (Pallant, 2011; Allison, 1999).

In the case of this research, it is important to make sure that the independent variables (market intelligence generation, breadth of knowledge sources, and internationalization orientation) are significant, regardless of the firm's size or age (control variables). In such cases, the regression analysis will regress the control variables on the dependent variables and then regress the independent variables and control variables on the dependent variable. The results will help to understand if adding the independent variables to the analysis will provide a significant improvement in predicting the dependent variable.

5.6.1 Regression of Firms' Recognition Capacity of External Knowledge

The first step of the analysis focuses on the impact of the firm's ability to recognise opportunities and external knowledge (market intelligence generation (INTE), breadth of knowledge sources (BREADTH), and internationalization orientation (INT)) on its potential absorptive capacity (PACAP). As explained previously, this study views absorptive capacity as a dynamic capability that has two main dimensions: potential and realised absorptive capacity. Therefore, in this step of the regression analysis it is interesting to test whether market intelligence generation (INTE), breadth of knowledge sources (BREADTH), and internationalization orientation (INT) help to increase the firm's potential absorptive capacity (PACAP). Moreover, the analysis also examines how different IT capabilities influence the firm's potential absorptive capacity (PACAP).

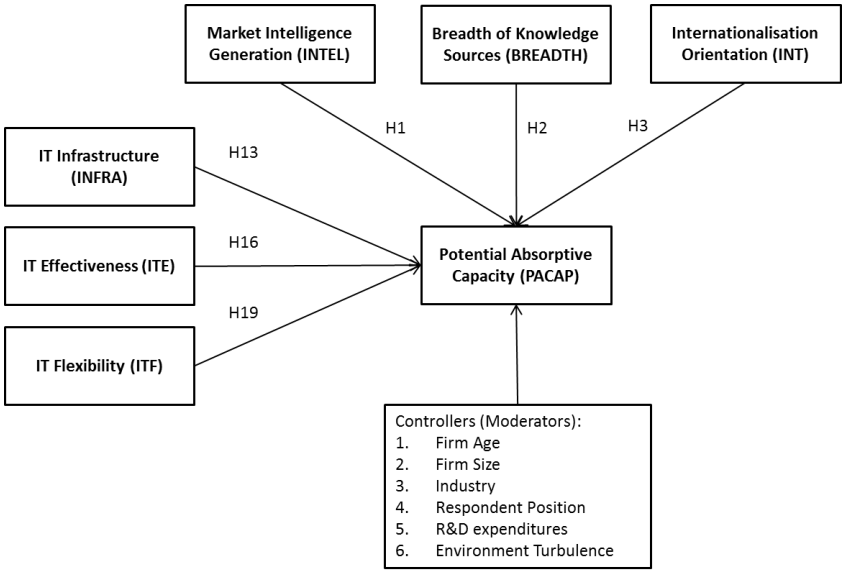


Figure 5.28: The regression analysis for potential absorptive capacity (the influence of market intelligence generation, breadth of knowledge sources, internationalization orientation, IT infrastructure, IT effectiveness, and IT flexibility on the firm's potential absorptive capacity)

In order to control for firm age, firm size, R&D expenditure, industry, respondent position, and environment turbulence (i.e. taking into consideration the effects of the control variables on the regression results), multiple linear regression is performed. Basically, SPSS will perform the regression for the control variables only as a separate model and calculate the model's significance. It will then calculate the significance of another model where both control variables and independent variables are combined. In this way, the software will calculate if there is a significant change between the control variables model and the combined model (Pallant, 2011). Using the linear regression procedure of the SPSS software, the potential absorptive capacity (PACAP) is put in the dependent variable box and the control variables (firm age, firm size, R&D expenditure, industry, respondent position, and environment turbulence) are put in the independent variables box labelled 'Block 1'. Market intelligence generation (INTE), breadth of knowledge sources (BREADTH), internationalization orientation (INT), IT flexibility (ITF), IT effectiveness (ITE) and IT infrastructure (INFRA) are put in the independent variables box labelled 'Block 2'. The results are summarised in Table 5.17. The table shows the results of the two models. Model 1 is the result of the regression analysis for the effect of control variables on the potential absorptive capacity (PACAP). Model 2 shows the results of the regression analysis when combining the

control variables with the independent variables (market intelligence generation (INTE), breadth of knowledge sources (BREADTH), internationalization orientation (INT), IT flexibility (ITF), IT effectiveness (ITE) and IT infrastructure (INFRA)).

Table 5.27: Summary of the results of the regression analysis of market intelligence generation, breadth of knowledge sources, internationalization orientation, IT infrastructure, IT effectiveness, and IT flexibility on the firm's potential absorptive capacity.

Dep. Variable: Potential Absorptive Capacity (PACAP)		Model 1 (Control variables only)				Model 2 (Hypothesis testing)			
		n= 203				*n = 203*			
		β	β Standardised	t	Sig	β	β Standardised	t	Sig
	(Constant)	3.355		7.882	0.000	1.276		3.349	**0.001*** **
Control variables	INDUSTRY	-0.017	-0.085	-1.208	0.229	-0.024	-0.116	-2.166	**0.032***
	R & D	0.074	0.182	2.408	**0.017***	0.012	0.030	0.510	0.610
	SQR_POSITION	0.119	0.089	1.246	0.214	0.152	0.114	2.098	**0.037***
	AGE	0.125	0.100	1.282	0.201	0.058	0.046	0.784	0.434
	ENV	0.093	0.097	1.399	0.163	-0.078	-0.081	-1.475	0.142
	SIZE	-0.023	-0.030	-0.352	0.726	-0.011	-0.015	-0.231	0.818
Ind. variables	**BREADTH**					0.199	0.187	3.250	**0.001*** **
	INT					0.187	0.249	4.147	**0.000*** **
	INTEL					0.088	0.091	1.463	0.145
	ITF					0.291	0.349	5.206	**0.000*** **
	ITE					-0.062	-0.076	-1.284	0.201
	INFRA					0.180	0.184	2.890	**0.004****
Model summary	F	2.379				16.106			
	Model sig.	**.031***				**0.000*** **			
	R^2	0.068				.504			
	Adjusted R^2	0.039				.473			
	ΔR^2					.436			
	ΔF sig.					**0.000*** **			
	VIF maximum	1.498				1.727			

*Significant at the 0.05 level, **significant at the 0.01 level, and ***significant at the 0.001 level; I.V.: Independent variable.

The results of the regression analysis show that the model is significant ($p < 0.001$). The R^2 suggests that the independent variables (breadth of knowledge sources (BREADTH), international orientation (INT), IT flexibility (ITF), and IT infrastructure (INFRA)) are responsible for about than 50% of the variance in the firms' potential absorptive capacity (PACAP). According to the VIF values, there is no sign of multicollinearity (VIF < 10) (Hair

et al., 2010, p200). It is also reported that market intelligence generation (INTEL) and IT effectiveness (ITE) are not significant compared to the other factors.

The coefficients of the standardised beta put IT flexibility (ITF) and internationalization orientation (INT) as the most influential factors on the firms' potential absorptive capacity, while breadth of knowledge sources (BREADTH) and IT infrastructure (INFRA) show similar impacts on the firms' potential absorptive capacity (PACAP). The control variables results suggest that the firms' industry plays a role in their level of potential absorptive capacity (PACAP). Surprisingly, R&D expenditure did not show a significant linear relationship with potential absorptive capacity in Model 2. Therefore, the results reject hypotheses H1 and H16, and support the remaining hypotheses, H2, H3, H13, and H19.

5.6.2 Regression of Firms' Absorptive Capacity

The analysis here focuses on the factors that affect each firm's capability to acquire external valuable knowledge. This part focuses on the factors that affect firms' ability to use and multiply the acquired knowledge towards developing or improving existing products/services. More specifically, the factors that positively affect firms' realised absorptive capacity (RACAP) are shown in the figure below.

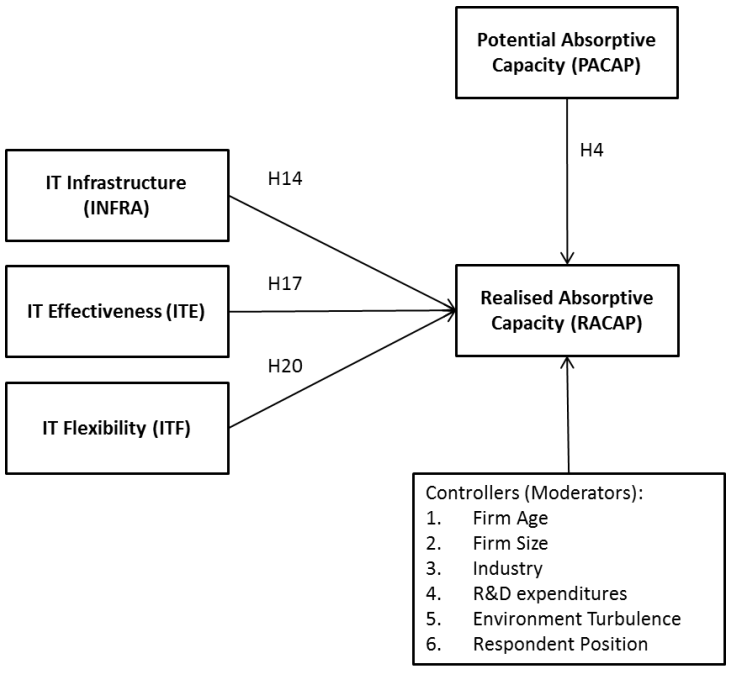


Figure 5.29: The regression analysis for realised absorptive capacity (the influence of potential absorptive capacity, IT flexibility, IT effectiveness, and IT infrastructure on firms' realised absorptive capacity).

A hierarchical regression analysis is applied in the same way as in the previous part. Model 1 represents the effect of the control variables on the dependent variable (realised absorptive capacity (RACAP)). Model 2 represents the effects of the independent variables (potential absorptive capacity (PACAP), IT flexibility (ITF), IT effectiveness (ITE), and IT infrastructure (INFRA)).

Table 5.22: Summary of the results of the regression analysis of potential absorptive capacity, IT flexibility, IT effectiveness, and IT infrastructure on firms' realised absorptive capacity

Dep. variable: Realised Absorptive Capacity (RACAP)		Model 1 (Control variables only)				Model 2 (Hypothesis testing)			
		n = 203				*n = 203*			
		β	β Standardised	t	Sig	β	β Standardised	t	Sig
	(Constant)	2.940		6.702	**.000*****	0.490		1.209	0.228
Control variables	INDUSTRY	0.001	0.006	0.090	0.928	0.005	0.025	0.464	0.643
	R&D	0.109	0.257	3.458	**0.001*****	0.055	0.129	2.222	**0.027***
	SQR_POSITION	0.014	0.010	0.142	0.887	-0.006	-0.004	-0.076	0.939
	AGE	0.135	0.102	1.338	0.182	0.070	0.053	0.904	0.367
	ENV	0.154	0.153	2.242	0.026*	0.066	0.066	1.240	0.217
	SIZE	-0.078	-0.095	-1.143	0.255	-0.064	-0.078	-1.234	0.219
Ind. variables	**PACAP**					0.469	0.448	6.727	**0.000****
	ITF					0.146	0.167	2.309	**0.022***
	ITE					-0.054	-0.063	-1.053	0.294
	INFRA					0.181	0.176	2.684	**0.008****
Model summary	F	3.468				17.927			
	Model sig.	**0.003***				**0.000*****			
	R^2	0.096				0.483			
	Adjusted R^2	0.068				0.456			
	ΔR^2					0.387			
	ΔF sig.					**0.000*****			
	VIF maximum	1.498				1.948			

*Significant at the 0.05 level, **significant at the 0.01 level, and ***significant at the 0.001 level

I.V.: Independent variable.

The results of this part of the regression analysis show that the model was significant ($p < 0.001$). The R^2 suggests that the independent variables (potential absorptive capacity (PACAP), IT flexibility (ITF), IT effectiveness (ITE), and IT infrastructure (INFRA)) are

responsible for about 48% of the variance in the firms' realised absorptive capacity. According to the VIF values, there is no sign of multicollinearity (VIF < 10) (Hair et al., 2010, p. 200). However, the IT effectiveness (ITE) is again not significant, when compared to the other factors.

The coefficients of the standardised beta place potential absorptive capacity (PACAP) as the most influential factor on firms' realised absorptive capacity (RACAP), while IT flexibility (ITF) and IT infrastructure (INFRA) show relatively similar impacts on firms' realised absorptive capacity (RACAP). R&D expenditure has a significant impact on realised absorptive capacity. Therefore, the results reject hypothesis H17 but support the remaining hypotheses, H4, H14, and H20.

5.6.3 Regression of Firms' Ambidextrous Capacity

The hierarchical regression analysis continues by examining the factors that affect each firm's ability to balance explorative and exploitative innovation strategies (ambidextrous capacity). As in previous parts, Model 1 examines the effect of the control variables on the dependent variable (ambidextrous capacity), while Model 2 examines the effects of both the control variables and independent variables (realised absorptive capacity (RACAP), IT flexibility (ITF), IT effectiveness (ITE), and IT infrastructure (INFRA)).

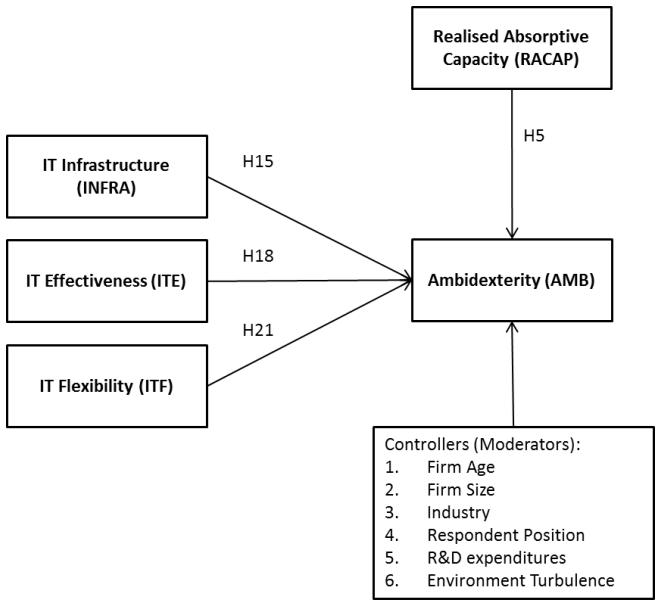


Figure 5.30: The regression analysis for ambidextrous capacity (the influence of realised absorptive capacity, IT flexibility, IT effectiveness, and IT infrastructure on the firm's ambidextrous capacity)

Table 5.23: Summary of the results of the regression analysis of realised absorptive capacity, IT flexibility, IT effectiveness, and IT infrastructure on firms' ambidextrous capacity

Dep. variable: Ambidextrous capacity (AMB)		Model 1 (Control variables only)				Model 2 (Hypothesis testing)			
		n = 203				*n = 203*			
		β	β Standardised	t	Sig	β	β Standardised	t	Sig
	(Constant)	5.876	-0.018	7.200	**0.000*****	2.334		2.944	**0.004****
Control variables	INDUSTRY	-0.007	0.199	-0.267	0.790	-0.001	-0.002	-0.028	0.978
	R & D	0.162	-0.052	2.753	**0.006****	0.051	0.063	1.020	0.309
	SQR_POSITION	-0.140	0.186	-0.766	0.444	-0.167	-0.063	-1.104	0.271
	AGE	0.469	0.270	2.500	0.013	0.357	0.142	2.310	**0.022***
	ENV	0.519	-0.111	4.077	**0.000*****	0.285	0.148	2.668	**0.008****
	SIZE	-0.175	-0.018	-1.378	0.170	-0.136	-0.087	-1.306	0.193
Ind. variables	**RACAP**					0.358	0.187	2.768	**0.006****
	ITF					0.625	0.375	5.171	**0.000*****
	ITE					0.327	0.200	3.215	**0.002****
	INFRA					-0.119	-0.061	-0.878	0.381
Model summary	F	5.586				15.126			
	Model sig.	**0.000*****				**0.000*****			
	R^2	0.146				0.441			
	Adjusted R^2	0.120				0.412			
	ΔR^2					0.295			
	ΔF sig.					**0.000*****			
	VIF maximum	1.498				1.803			

*Significant at the 0.05 level, **significant at the 0.01 level, and ***significant at the 0.001 level

I.V.: Independent variable.

The results of the regression analysis show that the model is significant ($p < 0.001$). The R^2 suggests that independent variables (realised absorptive capacity (RACAP), IT flexibility (ITF), IT effectiveness (ITE), and IT infrastructure (INFRA)) are responsible for more than 44% of the variance in the firms' ambidextrous capacity (MB). According to the VIF values, there was no sign of multicollinearity (VIF < 10) (Hair et al., 2010, p.200). However, IT infrastructure (INFRA) was not significant, compared to the other factors.

The standardised beta coefficients show that IT flexibility and IT effectiveness were the most influential factors on the firms' ambidextrous capacity. Realised absorptive capacity is significant, as hypothesised. Moreover, the firm's age and the environment's turbulence have a significant impact on the firms' level of ambidexterity. Therefore, the results reject hypothesis H15 but support the remaining hypotheses, H5, H18, and H21.

5.6.4 Regression of Firms' Innovation Performance

5.6.4.1 Innovation Sales Performance

The same procedure, as used before, is repeated for this part of the research model's regression analysis. The analysis focuses on the factors that influence firms' innovation performance. As explained earlier, innovation performance is captured through two dimensions: innovation sales performance (T_INNO) and innovation radicalness (RAD). It is hypothesised that realised absorptive capacity (RACAP) and ambidextrous capacity (AMB) have positive impacts on a firm's innovation sales performance. The measure of innovation sales performance is transformed using the square root transformation to increase the variable level of normality. The transformed measure is labelled (SQR_T_INNO). The analysis started with Model 1, which examines the effect of control variables on the dependent variable (innovation sales performance (SQR_T_INNO)), while Model 2 combines the control variables and the independent variables. The table below shows the results of the regression for Models 1 and 2.

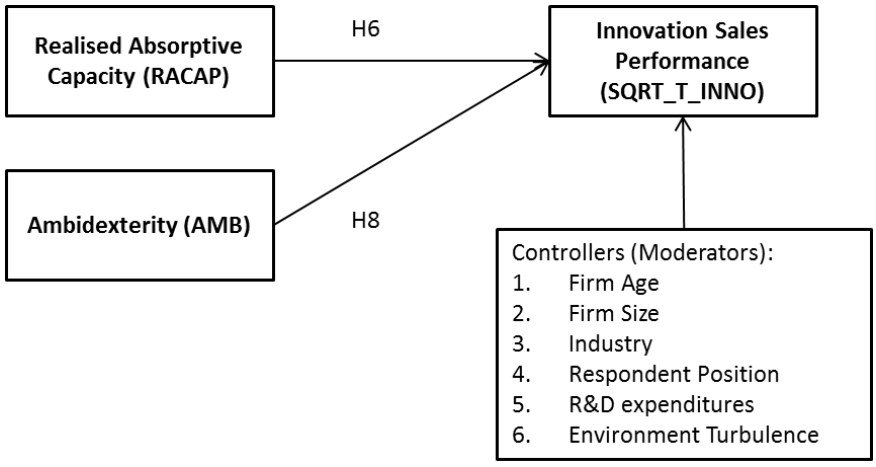


Figure 5.31: The regression analysis for innovation sales performance (influence of firms' realised absorptive capacity and ambidextrous capacity on innovation sales performance).

Table 5.24: Summary of the results of the regression analysis of firms' realised absorptive capacity and ambidextrous capacity on innovation sales performance

Dep. Variable: Square root of innovation sales performance		Model 1 (Control variables only) *n = 203*				Model 2 (Hypothesis testing) *n = 203*			
		β	β Standardised	t	Sig	β	β Standardised	t	Sig
	(Constant)	1.694		3.834	0	-0.057		-0.122	0.903
Control variables	INDUSTRY	0.005	0.022	0.328	0.743	0.006	0.027	0.455	0.649
	R&D	0.153	0.353	4.929	0	0.097	0.224	3.378	**0.001****
	SQR_POSITION	0.157	0.11	1.618	0.107	0.167	0.117	1.926	0.056
	AGE	-0.085	-0.061	-0.906	0.366	-0.082	-0.058	-0.975	0.331
	ENV	0.101	0.099	1.506	0.134	-0.004	-0.004	-0.064	0.949
	SIZE	0.007	0.008	0.106	0.916	0.025	0.03	0.45	0.653
I.V	**RACAP**					0.342	0.336	5.025	**0.000*****
	AMB					0.101	0.19	2.789	**0.006****
Model summary	F	6.122				12.414			
	Model sig.	**0.000*****				0.**000*****			
	R^2	0.158				0.339			
	Adjusted R^2	0.132				0.311			
	ΔR^2					0.181			
	ΔF sig.					0.000***			
	VIF maximum	1.317				1.357			

*Significant at the 0.05 level, **significant at the 0.01 level, and ***significant at the 0.001 level

I.V.: Independent variable.

The results of in this part of the regression analysis show that the model is significant ($p < 0.001$). The R^2 suggests that the independent variables (realised absorptive capacity (RACAP) and ambidextrous capacity (AMB)) are responsible for more than 33% of the variance in the firms' innovation sales performance. According to the VIF values, there is no sign of multicollinearity (VIF < 10) (Hair et al., 2010, p. 200).

The standardised beta coefficients place realised absorptive capacity (RACAP) as the most influential factor on the firms' innovation performance. Moreover, R&D expenditure has a significant impact on the firms' level of innovation sales performance. Therefore, the results support hypotheses H6 and H8.

5.6.4.2 Innovation Radicalness

For the last part in the regression analysis, the same procedure is repeated. This time, firms' innovation radicalness (RAD) is the dependent variable. Realised absorptive capacity (RACAP) and ambidextrous capacity (AMB) are hypothesised to have positive impacts on the firms' innovation radicalness (RAD). The analysis started with Model 1, which examines the effect of the control variables on the dependent variable (RAD), while Model 2 combines both the control variables and the independent variables. The table below shows the results of the regression for Models 1 and 2.

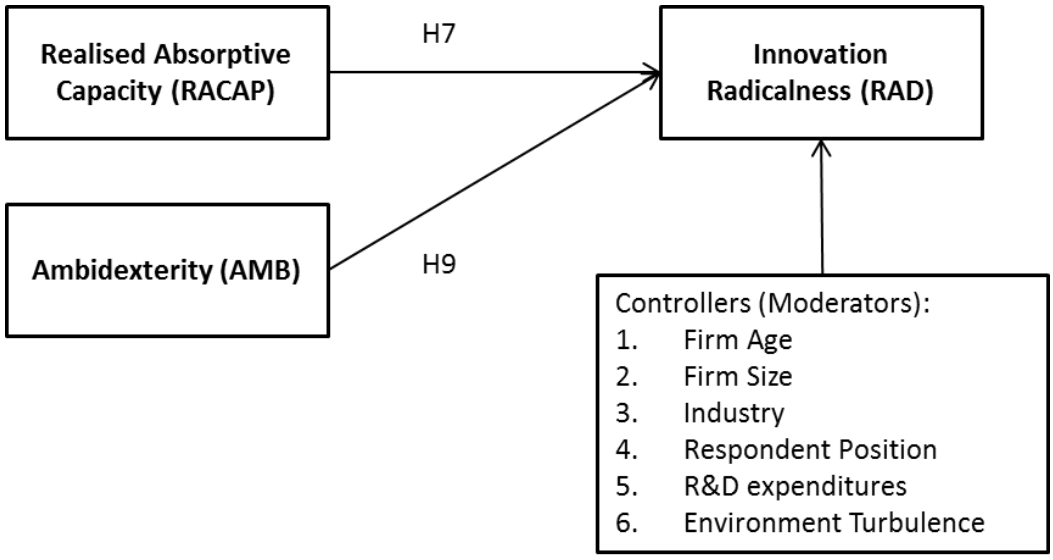


Figure 5.32: The regression analysis for innovation radicalness (the influence of firms' realised absorptive capacity and ambidextrous capacity on the firm's innovation radicalness).

The results of this part of the regression analysis show that the model is significant ($p < 0.001$). The R^2 value suggests that the independent variables (realised absorptive capacity (RACAP) and ambidextrous capacity (AMB)) are responsible for more than 38% of the variance in the firms' innovation radicalness. According to the VIF values, there is no sign of multicollinearity (VIF < 10) (Hair et al., 2010, p. 200). The standardised beta coefficients show that realised absorptive capacity (RACAP) is the most influential factor on the firms' innovation radicalness. Moreover, R&D expenditure has a significant impact on the firms' level of innovation radicalness. Therefore, the results support hypotheses H7 and H9.

Table 5.25: Summary of the results of the regression analysis of firms' realised absorptive capacity and ambidextrous capacity on the firm's innovation radicalness.

Dep. Variable: innovation radicalness		Model 1 (Control variables only)				Model (Hypothesis testing)			
		n = 203				*n = 203*			
		β	β Standardised	t	Sig	β	β Standardised	t	Sig
	(Constant)	1.4		4.267	0	0.323		0.893	0.373
Control variables	INDUSTRY	-0.006	-0.034	-0.557	0.578	-0.005	-0.029	-0.509	0.612
	R & D	0.09	0.259	3.926	0	0.057	0.163	2.555	**0.011***
	SQR_POSITION	-0.039	-0.034	-0.542	0.588	-0.03	-0.026	-0.441	0.66
	AGE	0.101	0.089	1.442	0.151	0.101	0.089	1.548	0.123
	ENV	-0.014	-0.017	-0.277	0.782	-0.082	-0.1	-1.7	0.091
	SIZE	0.242	0.36	5.188	0	0.253	0.376	5.815	0
I.V	**RACAP**					0.173	0.211	3.273	**0.001*** **
	AMB					0.08	0.188	2.864	**0.005** **
Model summary	F	13.002				15.201			
	Model sig.	**0.000*** **				**0.000*** **			
	R^2	0.285				0.385			
	Adjusted R^2	0.263				0.360			
	ΔR^2					0.10			
	ΔF sig.					0.000***			
	VIF maximum	1.317				1.357			

*Significant at the 0.05 level, **significant at the 0.01 level, and ***significant at the 0.001 level

I.V.: Independent variable.

By completing this part of the regression analysis, the research hypotheses and all parts of the research model have been examined. Table 5.26 summarises the results of the multiple linear regression, showing the supported and rejected hypotheses. The accepted hypotheses suggest that firms may better recognise opportunities and external knowledge by increasing their breadth of knowledge and internationalizing their search for new knowledge and skills. This, consequently, will increase the firms' ability to transform and exploit new knowledge through realised absorptive capacity.

Table 5.26: Summary of accepted and rejected hypotheses as a result of regression analyses

Hypothesis	Independent variable	Dependent variable	Result of hypothesis testing
H1	Market intelligence generation (INTEL)	Potential absorptive capacity (PACAP)	**Rejected (*p* = 0.145*)**
H2	Breadth of knowledge sources (BREADTH)	Potential absorptive capacity (PACAP)	Accepted (*p* = 0.001)
H3	Internationalization orientation (INT)	Potential absorptive capacity (PACAP)	Accepted (*p* = 0.000)
H4	Potential absorptive capacity (PACAP)	Realised absorptive capacity (RACAP)	Accepted (*p* = 0.000)
H5	Realised absorptive capacity (RACAP)	Ambidextrous capacity (AMB)	Accepted (*p* = 0.006)
H6	Realised absorptive capacity (RACAP)	Innovation sales performance (SQRT_T_INNO)	Accepted (*p* = 0.000)
H7	Realised absorptive capacity (RACAP)	Innovation radicalness (RAD)	Accepted (*p* = 0.001)
H8	Ambidextrous capacity (AMB)	Innovation sales performance (SQRT_T_INNO)	Accepted (*p* = 0.006)
H9	Ambidextrous capacity (AMB)	Innovation radicalness (RAD)	Accepted (*p* = 0.005)
H10	IT sensing capability (IT SENS)	Potential absorptive capacity (PACAP)	**Excluded (Low Cronbach Alpha)**
H11	IT sensing capability (IT SENS)	Realised absorptive capacity (RACAP)	**Excluded (Low Cronbach Alpha)**
H12	IT sensing capability (IT SENS)	Ambidextrous capacity (AMB)	**Excluded (Low Cronbach Alpha)**
H13	IT infrastructure (INFRA)	Potential absorptive capacity (PACAP)	Accepted (*p* = 0.004)
H14	IT infrastructure (INFRA)	Realised absorptive capacity (RACAP)	Accepted (*p* = 0.008)
H15	IT infrastructure (INFRA)	Ambidextrous capacity (AMB)	**Rejected (*p* = 0.381)**
H16	IT effectiveness (ITE)	Potential absorptive capacity (PACAP)	**Rejected (*p* = 0.200)**
H17	IT effectiveness (ITE)	Realised absorptive capacity (RACAP)	**Rejected (*p* = 0.294)**
H18	IT effectiveness (ITE)	Ambidextrous capacity (AMB)	Accepted (*p* = 0.002)
H19	IT flexibility (ITF)	Potential absorptive capacity (PACAP)	Accepted (*p* = 0.000)
H20	IT flexibility (ITF)	Realised absorptive capacity (RACAP)	Accepted (*p* = 0.022)
H21	IT flexibility (ITF)	Ambidextrous capacity (AMB)	Accepted (*p* = 0.000)
Total of number of hypotheses			21
Total of number of accepted hypotheses			14
Total of number of rejected hypotheses			7

Realised absorptive capacity and ambidextrous innovation strategy have a significant impact on a firm's ability to increase its sales from innovative products and services, and stimulate its ability to introduce more radical products. Therefore, the data of this research suggest that breadth of knowledge sources, internationalization orientation, potential absorptive capacity, realised absorptive capacity, and ambidextrous capacity are imperative dynamic innovation capabilities that have a significant impact on a firm's innovation performance. Moreover, the three IT capacities - IT infrastructure, IT effectiveness, and IT flexibility - have a significant impact on a firm's ability to acquire, assimilate, transform, and exploit knowledge into innovative products and services.

The next section will discuss the revised research model that emerged from the regression analysis. Furthermore, the section will attempt to verify the revised research model through qualitative research using interviews before proceeding to the discussion.

5.6.5 Revised Research Model

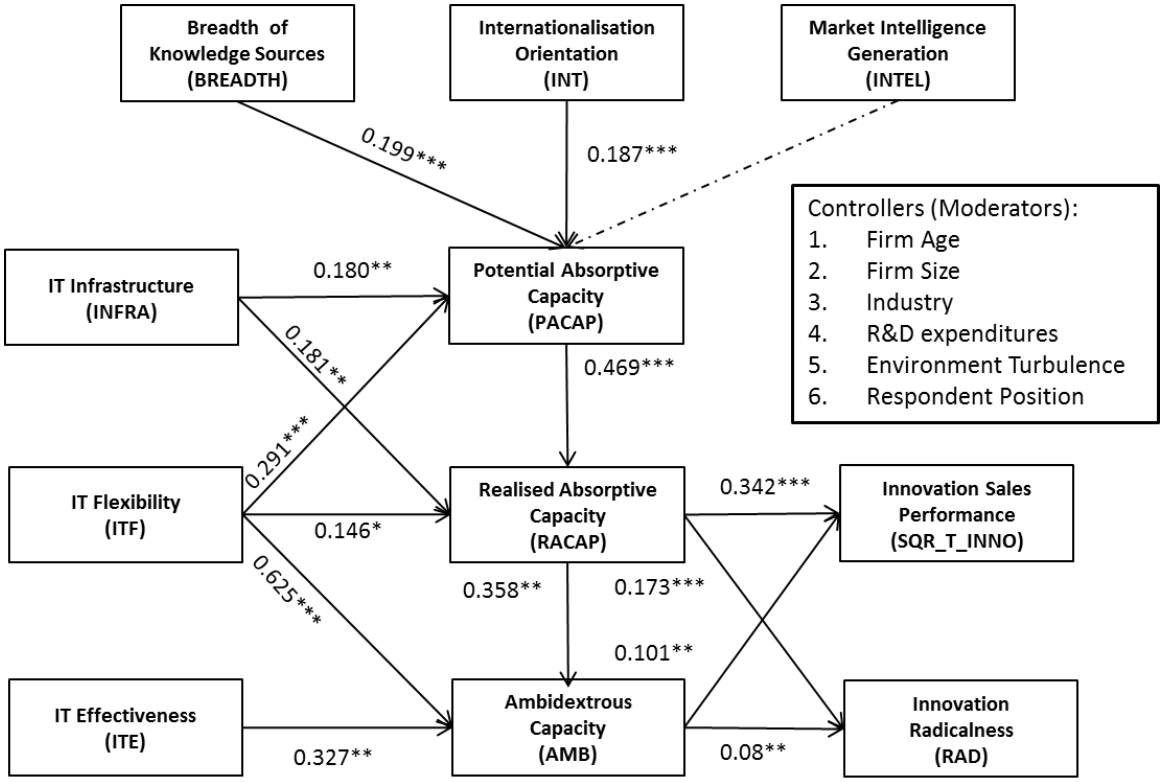
The revised research model, shown in Figure 6.9, exhibits the refined research model based on the supported hypotheses, according to the results of the multiple linear regression analyses. The original conceptual model of this research aimed to study the different capabilities that stimulate knowledge flow into firms, as well as multiplying it and exploiting it into successful products/services. The research focused on the strategic firms' level analysis, rather than the employees' level analysis. Hence, the target is to identify the firms' practices that can be adopted to achieve higher innovation performance.

At first, both breadth of knowledge sources and internationalization orientation (INT) have positive impacts on the firms' level of potential absorptive capacity. Having a variety of knowledge sources increases the firms' recognition of valuable external knowledge. If this is combined with internationalization orientation (i.e. seeking resources, experience, and alliances at a global level), firms will be better able to acquire valuable external knowledge and technology. In addition, the firm's IT infrastructure capabilities are essential to ensure a better flow of knowledge into the firm, better protection, usability and accessibility at each stage of the knowledge process. Furthermore, the firm's IT infrastructure needs to be flexible and responsive to users' changing requirements. The rigidity of the firm's IT infrastructure will inhibit the firm's flexibility in the face of frequent market changes and conditions.

When potential knowledge is absorbed, it must be transformed and exploited to capture an economic advantage, by means of innovative products/services. This stage of knowledge flow is reflected in this research as 'realised absorptive capacity'. According to the research results, realised absorptive capacity can be positively stimulated by the availability of IT infrastructure that is capable of managing the firm's knowledge stock. Moreover, flexible IT infrastructure is important to match the changing demands of every process of knowledge transformation and exploitation.

Nevertheless, lacking a proper innovation strategy for the transformed and exploited knowledge may reduce a firm's chances of innovation's prosperity. Innovation failure might result from missed alignment between invention and a proper development strategy. Therefore, firms must have both the capability to perform an explorative innovation strategy (i.e. more radical-oriented innovations) and an exploitative innovation strategy (i.e. more incrementally-oriented innovations). Gaining the capability to balance both innovation strategies (ambidexterity) helps to match the absorbed knowledge with the existing market opportunities to maximise the economic advantage of the innovation and diverge from innovation failure.

However, ambidextrous capacity involves managing highly contradictory strategies (i.e. explorative and exploitative innovation strategies). Thus, the firm's information technology characteristics are vital for the firm to overcome this challenge. IT flexibility and IT effectiveness are fundamental characteristics of the firm's IT infrastructure and enhance the firm's capability to achieve ambidexterity. Ambidextrous capacity and realised absorptive capacity are imperative for transforming knowledge into innovations. Hence, the firm's innovation performance is enhanced by stretching the firm's innovation portfolio and maximising the innovation economic advantage. Figure 5.33 portrays the revised theoretical model with the significance level and the unstandardised beta coefficient for each factor.



*Significant at the 0.05 level, **significant at the 0.01 level, and ***significant at the 0.001 level

Beta coefficients are unstandardized; dash lines indicate non-significant effect; IT sensing capability is not included in the analysis due to the low Cronbach's alpha level.

Figure 5.33: Revised regression and theoretical model.

5.7 Validation of the Revised Research Model

A qualitative approach was adopted to validate the research results. Five interviews were conducted with key individuals in government and industry. The first two interviews presented here are concerned with satellite technology transfer and gaming technology transfer cases.

From industry, interviews were conducted with the general managers of two high-tech companies: a system integration manager in a science park and an IT manager of a retail company. From government, the interview was with the general manager of the Saudi Industrial Prosperity Authority, who is 'responsible for the development of industrial cities with integrated infrastructure and services' (Modon, 2011). The meetings range from about 45 minutes to two hours. The interviews were semi-structured in nature and used to discuss key

factors of the revised model, in order to confirm the research findings. The questions raised in the interviews are attached in Appendix C.

5.7.1 The Case of Satellite Technology Transfer

The following information has been extracted from the interview with a systems integration manager at a Saudi science park. The interview lasted about two hours and attempted to understand the knowledge flow and progress inside the science park regarding low earth satellite technology.

The goal is to increase the firm's ability to master satellite technology. At the beginning, the firm focused on component technology, such as electronic-component development, mechanical structure design, or solar technology. According to the system integration manager, this strategy was not effective. He argued that *"in 2003, the strategy was changed to import systems integration knowledge. We engaged with international parties sending our engineers aboard for training. We also have collaborated with international parties in designing and integrating the different components of the low earth satellite".* They discovered that training their engineers to integrate different system components unlocks their ability to design and implement other systems. The period from 2003 to 2007 was one of R&D without any commercial application. The system integration manager stressed that *"one of the challenges in systems integration is to keep track of every design version as the different components of a system require coherence with each other. Therefore, sharing progress among team members is of high importance".* The system integration manager highlighted that there are software applications that help to handle knowledge and documentation related to systems design, such as product life cycle management (PLM) from Siemens. On top of documentation and structuring of knowledge, they are strict in applying what they learn to increase the skills of the team. *"We push our team hard towards prototyping, experimentations, and using all possible sources, such as engaging with parts suppliers and international partners, especially with the availability of real-time communication tools, such as video conferencing."* In 2007, the firm launched its first satellite, and its engineers were already mastering designing tools such as DXB, Solid Edge, FEKO, and MATLAB. *"The investment into satellite technology resulted in the ability to design and implement other complex systems. In 2011, we started profit from our investment is satellite technology. We*

were able to commercialise different kinds of systems, such as transponders, RF modulators, firmware/software design, and PCB boards".

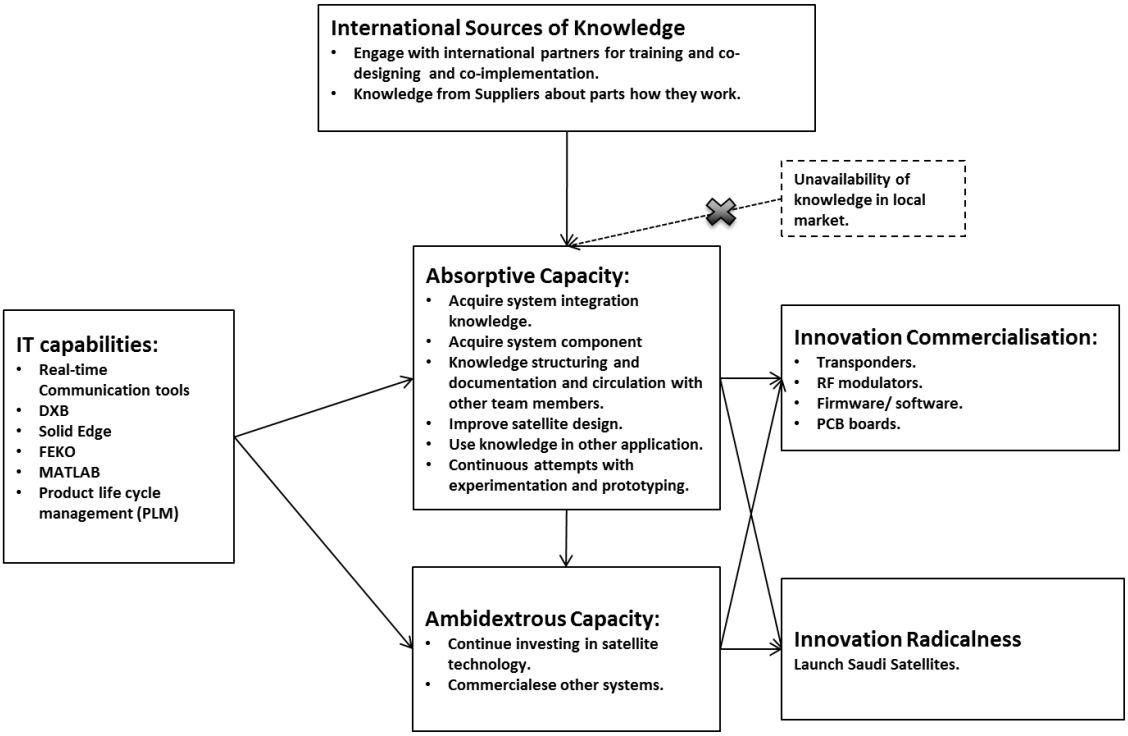


Figure 5.34: A diagram for the dynamic capabilities in transferring satellite technology.

5.7.2 The Case of Gaming Technology Transfer

The following information has been extracted from the interview with a general manager (GM) of an IT company in Saudi Arabia. The company is six years old and has more than 30 employees. The interview lasted about one and a half hours and attempted to understand the knowledge flow and progress inside the firm regarding gaming knowledge transfer.

The GM said that *"in 2007, we were studying the potential of mobile telecommunication market. The mobile industry has witnessed dramatic changes in terms of mobile devices capabilities, operating systems and application markets".* The firm used international publications and sources, such as techcrunch.com and springwise.com, to keep up with the latest advancement in technology and changes in consumer behaviour, especially as the local market sources had limited information available. Social networks, such as

Twitter, are also important sources of information. The firm follows key people on social media and tracks their comments on new technology and its potential.

The firm was interested in the gaming market on mobile phones, yet it lacked experience. Therefore, it sought international consultants to find the right partners and hire the right employees with the rights skills. The GM added *"the international consultants direct us to other firms in developing countries. We discovered that even key international gaming firms outsource part of their design process to firms in developing countries in the Far East".*

The GM added that another important source of knowledge is the libraries provided by operating system developers. For example, Apple provides developers with a software development kit (SDK) for iOS, a mobile operating system, with detailed documentation about usability and functionality, and Google does the same with Android. However, parts of the graphic design require outsourcing. The GM stressed that *"we try hard to keep records, improve documentation skills, and learn knowledge. We use software like ASANA to improve employee communication and collaboration. We have regular meetings to share latest updates, brainstorm, and review projects. One of the challenges in software industry is maintaining confidentiality. That is why I try to maintain loose coupling among departments".*
In terms of graphic and animation design, the firm provides employees with the MAYA software platform. However, some of the design process requires outsourcing. For instance, image rendering is an intensive process that requires supercomputers. The GM argued *"in this process, we outsource the image-rendering process to other firms abroad specialised in such services".*

In 2010, the company gained a capability that enabled it to engage in commercial applications beyond gaming, such as location-based applications, social network integration applications, plug-ins, and graphical user interface (GUI). The GM said *"in fact, we commercialise applications in the area of location-based applications, social network integration applications, and plug-ins more than gaming applications".*
He adds "*I see this business as connecting the dots of information*". Within three years, the company was able to generate a profit, as well as having valuable ideas and contributions from employees. The GM closed with *"clients' behaviour is central to our strategy, and they represent an important source of ideas due to their feedback when using our applications".*

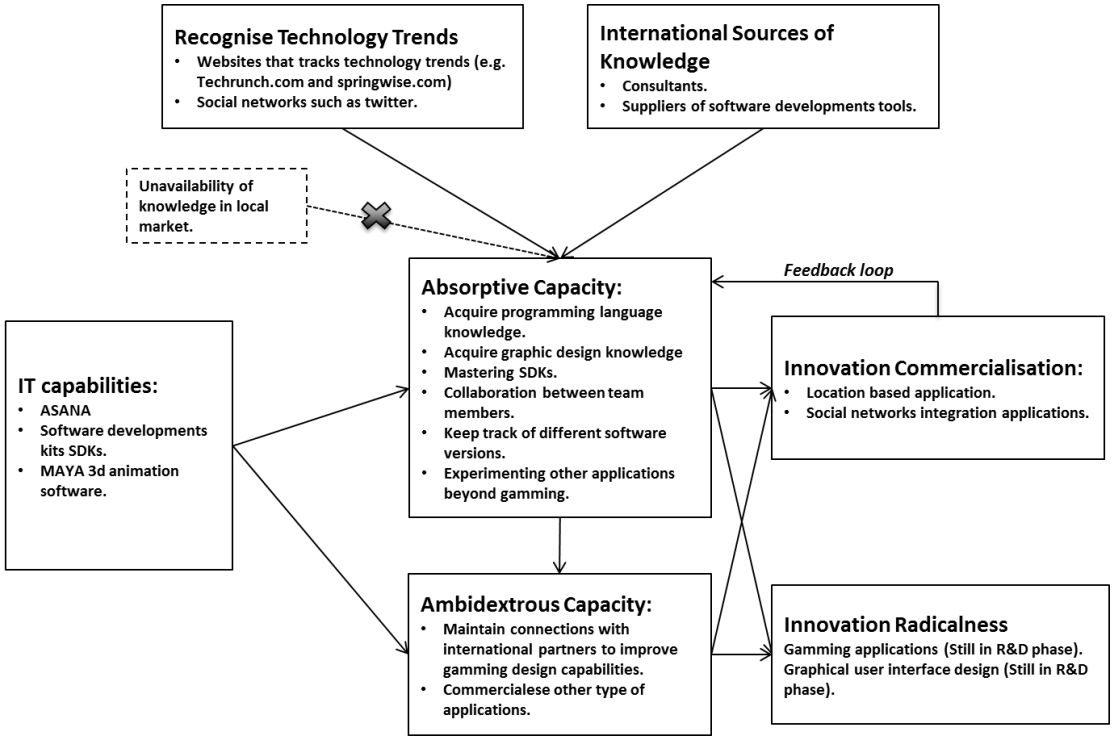


Figure 5.35: A diagram for the dynamic capabilities in transferring gaming technology.

5.7.3 Other Interviews

5.7.2.1 A Governmental Perspective

An interview was conducted with the general manager of the Saudi Industrial Property Authority. The following information was extracted from the dialogue of the interview:

"Innovation is core in our planning to boost the economy and move away from the domination of oil. Currently, we craft our policy to stimulate innovation activities through financial and logistic support, especially for SMEs."

"One of the problems that we face is the weak ties between the three major players: government, universities, and industry. Unfortunately, I do not see strong communication channels. Yet, a large amount of financial resources and policies have recently been dedicated to encourage cooperation between universities and industry."

"For instance, the King Abdullah scholarship program sends thousands of students annually to developed countries as a mean to import state-of-the-art knowledge, which can then be injected back into our knowledge infrastructure. Beside knowledge, students have a chance to network and, in many cases, get attached to leading companies."

Technology infrastructure is another dimension of the government's plan to stimulate the knowledge economy. Currently, the government, through its business partners, is constructing new economic cities from scratch. These cities will provide state-of-the-art technology infrastructure and an atmosphere that will probably attract foreign companies. The GM stressed that:

"We are confident that these cities will contribute greatly to the Saudi economy and to our enterprises' ability to innovate and succeed, even globally"

5.7.2.2 An IT Firm GM Perspective

Another interview was conducted with the GM of a high-tech company. The following information was extracted from the dialogue of the interview:

"The heavy competition put tremendous pressure on us to innovate. With the abundance of product offerings, it is difficult to catch the customer's eyes and attention to even evaluate our products. This forces us to spend a lot of effort to be up-to-date with the market's offerings and technology status, in order to be able to see and approach chances."

As high-tech firms, they cooperate closely with universities. For instance, they have a mutual agreement with King Saud University to support their research and development activities. The GM highlights:

"This agreement releases the pressure a bit on our R&D funding, which would be greatly restricted if we act independently. In terms of technology, we usually expand our scanning to an international level. Most of the time, we innovate by integrating different, existing components to provide innovative functions. Hence, we network with global providers to exchange knowledge about their components and how they work. Some software solutions require outsourcing with an international partner most of the time. Therefore, acting globally is not a choice anymore."

Their products usually require knowledge integration and, therefore, input from different employees. The GM argued:

"Teamwork that promotes sharing and circulation of information is our culture of work and fuels us with ideas and experimentation. The dilemma of innovation is that it is a must and it is costly. If we went into research mode without a good return, we will simply face a difficult financial situation. Therefore, we try hard to maximise our returns from existing products until we see a good market opportunity. I see ourselves fluctuating between a mood

of profitability and a mood of innovation; although it is hard to manage, it seems to be healthy for us."

5.7.2.3 An IT Executive Perspective

The third interview was conducted with the IT Executive of a retail company. The following information was extracted from the dialog of the interview:

"Information technology plays a major role in firms' productivity and ability to handle information. Nevertheless, it still seems underestimated. This is probably due to the fact that it's costly, and most of the time, companies struggle to have good returns on their investment. When choosing and implementing an IT solution or a product, highly skilled resources are vital to have a clear understanding of what the company needs, both now and tomorrow".

"One of the main considerations of executives when investing in IT is productivity. Executives mainly view IT as a tool to improve productivity, reduce errors, and enhance communication. However, IT executives should consider other serious aspects. One of the important aspects of IT is its ability to continuously meet the organization's needs. Currently, enterprises try to be responsive changing demands and changing market conditions. In such situations, we, as IT executives, try hard to not make the IT infrastructure an obstacle when the firm requires changes."

Based on the above interviews, the researcher was satisfied with the revised research model, which was shown at the end of each meeting and discussed with the interviewees. No major concern was highlighted in the interviews regarding the model. The market intelligence generation was repeatedly highlighted by interviewees as important but difficult to access in the Saudi market. This might explain why this factor is reported non-significant in the regression analysis of the 203 responses from Saudi firms. Therefore, this stage of the research (i.e. qualitative research) positively supports the revised research model.

5.8 Conclusion

This chapter started with the validation of the measures used in the survey of this research. The reliability tests suggested, through use of the Cronbach alpha value, removing one factor (IT sensing) and a few questions from other factors. The validity test was performed

using the EFA procedure, and it regrouped and loaded most of the measures in their correct position (correct questions loading). As a result, the factors were computed using their loaded measures by computing their mean. The regression assumption was checked using the computed mean of the measures in preparation for regression analysis and hypothesis testing.

This chapter also portrayed how Saudi firms responded to the research survey. The charts in this chapter show that there are differences in the innovation factors of high- and low-innovation firms. It also seems that firm size plays a role in firms' behavior toward the innovation factors identified in this research. Furthermore, the chapter covered the analysis of data using t-test, ANOVA test, and regression analysis in order to examine whether the factors identified in this study have a statistically significant impact on firms' innovation performance.

Chapter 6: Discussion

6.1 Saudi Firms R&D Performance

Cohen and Levinthal (1990) highlighted R&D as an indication of absorptive capacity. Although absorptive capacity is currently captured through multidimensional items, R&D expenditure is still recognised as central to innovation activities and the ability of organizations to learn (De Jong & Freel, 2010). The research results show that Saudi R&D expenditure has a positive relationship with the organization's size, as shown in Tables 5.18 and 5.19. This means that larger firms dedicate a larger percentage of sales to R&D activities.

Frenz and Ietto-Gillies (2009), in a study using responses from 679 UK firms, found a significant positive correlation between in-house R&D expenditure and the firms' size. Yet, no significant correlation was found between bought-in R&D (expenditure dedicated to acquire external knowledge) and firms' size. Chen et al. (2011) reported a negative correlation between R&D expenditure and firms' size in a study of 209 firms in Zhejiang in China. The work of Lin et al. (2012) also reported a significant negative correlation between firms' size and R&D expenditure in a study of 126 U.S. firms. Similarly, Lee et al. (2010) found that the R&D expenditure of Korean manufacturing firms is negatively correlated with the firms' size. In the same way, Mihalache et al. (2012) did not find any significant correlation between Dutch organizations' size and R&D expenditure, using 276 responses. Similarly, Lichtenthaler's (2009) work highlighted that no significant correlation was observed among 175 large and medium-sized enterprises in a study in Germany. Comparing the results from Saudi firms and previously published works, it is suggested that small and medium Saudi firms should push their R&D activities further as they fall behind firms in other countries in term of resources devoted to R&D activities.

Since the research data indicate that larger Saudi firms exhibit higher R&D expenditure than SMEs, it is interesting to examine the effect of R&D expenditure on the use of different knowledge sources for innovation activities. Table 5.20 shows that R&D expenditure is only positively correlated with the use of research institutes as a source of innovation activities. In contrast, Tsai (2009) reported that the R&D intensity of Taiwanese firms is positively correlated with cooperation with suppliers and customers. This is probably important, since it indicates how different countries differ in their use of R&D resources.

Taiwanese firms share their R&D resources with suppliers and customers and show stronger ties in their supply chain, both of which are important for innovation success (Fischer & Varga, 2002).

The R&D activities of Saudi firms rely more heavily on research institutes, which is important for more radical innovations (Gemünden et al., 1996). However, this does not mean that Saudi firms are able to provide more radical innovations than firms in other countries. Rather, it indicates the temptation to acquire relatively new knowledge and technology that other sources in the Saudi market cannot provide. This point empirically supports the proposition of Alshumaimri et al. (2010), who suggest that universities are designed to act as technology transfer channels that are strategically supported by the Saudi government to stimulate the country's transformation from an oil economy to a knowledge economy.

6.2 Firms' Practices for Recognising External Knowledge

In this research, three dynamic capabilities were proposed to have a significant role in enhancing the firm's ability to recognise valuable external knowledge: market intelligence generation, breadth of knowledge sources and internationalization orientation. Market intelligence generation is one dimension of market orientation, with the other dimensions of market orientation being intelligence dissemination and responsiveness. Only market intelligence generation was included in this study, because the other dimensions of market orientation share a degree of similarity with absorptive capacity. The regression analysis shows that market intelligence generation is not a significant factor for a firm's potential absorptive capacity. This might be linked, as founded in the qualitative research, to the limited availability of Saudi market intelligence. Other scholars suggest that market orientation, in general, may result in firms overemphasising their current products rather than searching for new ideas for innovative products and services (Baker & Sinkula, 2007). However, a study by Wren et al., (2000), using data from various countries including United States, New Zealand, Korea, Belgium, Norway, and Sweden, has found that market intelligence is significant for the development of new products. One possible explanation is provided in the study of Fang et al. (2012), who found, using 2733 Taiwanese manufacturing firms, that the effect of market orientation was augmented when the firms processed a large amount of inter-organizational knowledge. This aligns with the findings of Kibbeling et al. (2013) that external partners have high potential for influencing a firm's innovativeness. Table 5.13 may support this conclusion:

there is a positive correlation ($r = 0.359$, $p \leq 0.01$) between breadth of knowledge sources and market intelligence generation. This means that Saudi firms that exhibit higher usage of external knowledge sources have higher dependency on market intelligence generation.

Breadth of knowledge sources have been found to have a significant impact on a firm's potential absorptive capacity, as the regression analysis shows. This indicates that Saudi firms that exhibit closer relationships with external partners for innovation activities are better able to acquire and assimilate new knowledge into their firms. This aligns with previous studies that have supported the importance of breadth of knowledge sources on a firm's innovation performance. Laursen and Saleter (2006) have found, using extensive data from the UK, that firms' innovation performance is positively associated with their ability to use external sources for knowledge. Similarly, Leiponen and Helfat (2010), using the data of 339 firms in Finland's industrial sector, have found that successful innovation is associated with wider breadth of knowledge sources. Yet these studies do not explain what capabilities a firm needs in order to achieve higher innovation prosperity. The findings of this research suggest that Saudi firms with low absorptive capacity are less able to take advantage of external knowledge sources to improve their innovation performance. These findings also confirm Fosfuri and Tribó (2008) findings from the data of 2464 Spanish firms that a corporation with external parties is a key antecedent for potential absorptive capacity. This indicates that absorptive capacity mediates the relationship between breadth of knowledge sources and innovation performance. Table 5.13 supports this as direct correlation does not exists between firms' sales innovation performance and their breadth of knowledge sources. This means that firms' potential absorptive capacity (ability to acquire and assimilate knowledge) and realised absorptive capacity (transformed exploited knowledge) are essential for them to handle knowledge from external sources.

Firms must not, however, limit their search for knowledge to the local market. The internationalization of the searching process is essential for acquiring new knowledge that may lead to better innovation performance. The regression results reveal that internationalization orientation is a significant antecedent for potential absorptive capacity. This indicates that Saudi firms, which were able to develop alliances with external partners, used advanced knowledge from foreign countries, and access advanced management skills from foreign

countries, were better able to acquire and assimilate external knowledge into their firms. Sharma and Blomstermo (2003) suggest that internationalized knowledge is a predecessor of foreign market entries. Lagendijk and Lorentzen (2007) highlight that economic performance relies more on global connections that complement other capacities. The regression analysis of the data of Saudi firms suggests that firms that possess higher internationalization orientation have better absorptive capacity. This concurs with Davenport (2005), who says that internationalization is crucial for firms' growth, especially if the localised supply chain is not mature. Saudi firms with higher internationalization show a greater degree of knowledge acquisition than other firms.

6.3 Knowledge Absorption and Innovation Strategy

The research results also highlight the important role of absorptive capacity practices. Volberda et al's (2010) intensive review on the area of absorptive capacity highlights the lack of understanding of the effect of inter-organizational relationships on firms' ability to acquire and translate knowledge into successful innovations. The regression analysis suggests that potential absorptive capacity practices play a significant role in acquiring knowledge from external parties for innovation activities. The regression analysis shows that Saudi firms with higher absorptive capacity were able to achieve better balance in their innovation strategies. Other authors report the role of absorptive capacity in firms' innovativeness. For instance, Kostopoulos et al. (2011), researching 461 Greek firms, found that absorptive capacity directly affects firms' innovation performance. Yet, in their study, absorptive capacity is measured as a reflection of the R&D activities rather than as a set of practices that handle knowledge. The regression analysis of Saudi firms' data indicates that the two components of absorptive capacity (potential and realised) comprise essential practices for knowledge utilisation. Potential absorptive capacity facilitates knowledge acquisition from external sources and assimilates it within the firm's boundaries. This aligns with the finding by Spithoven et al. (2010), who argue, using data from Belgian firms, that absorptive capacity is a precondition for inbound open innovation.

The results of the regression analysis indicate that absorptive capacity stimulates the flow of external knowledge and translation into innovative products and services. Both innovation economic advantage and innovation radicalness were found to be enhanced

through higher absorptive capacity and higher ambidextrous capacity. Moreover, Saudi firms with higher absorptive capacity are better able to use external sources for innovation activities, and hence have better inbound open innovation. This supports the work of Schildt et al. (2012), who suggest, using 110 public US corporations, that potential absorptive capacity represents the learning bottleneck for firms, while realised absorptive capacity represents the exploitation bottleneck.

Saudi firms that exhibit higher realised absorptive capacity are better able to transform absorptive knowledge into innovative products and service. Datta et al. (2012) have also proposed that realised absorptive capacity enhances firms' abilities to pursue both explorative and exploitative innovations (ambidextrous capacity). The regression analysis confirms this proposition. Saudi firms that exhibited a better capacity to handle their knowledge transformation and exploitation practices (realised absorptive capacities) achieved higher ambidextrous capacity.

This also adds to other studies that attempt to link ambidextrous capacity to firms' performance. For instance, Cao et al. (2009) surveyed Chinese high-tech firms and found a positive relationship between ambidexterity and performance. Hughes et al. (2010) studied 260 high-tech firms in Mexico. In their study, they found that innovation in ambidextrous strategy resulted in marketing differentiation, cost leadership advantages, and exported performance. Wang and Rafiq (2012) found, in a study of 150 UK and 242 Chinese high-tech firms, that ambidextrous culture and new product development outcomes are measured as radical product innovation, incremental product innovation, and speed to markets. Similarly, Sarkees et al. (2010), using data from 135 US firms, found that ambidextrous capacity stimulated firms' revenue and profit. In our study, we have established a positive link between firms' ambidextrous capacity and their innovation sales performance and innovation radicalness.

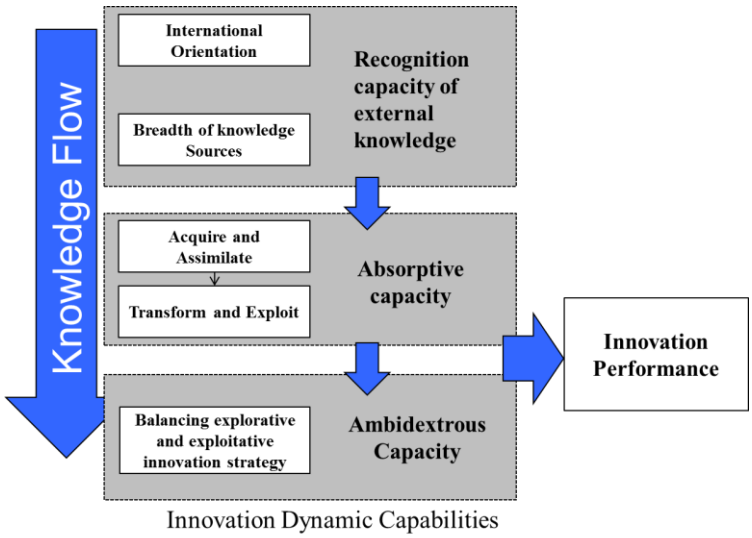


Figure 6.1: The innovation dynamic capabilities proposed and examined in this research for higher firms' innovation performance.

6.4 The Impact of IT Capabilities on Firms Innovation Practices

Since IT capabilities are argued to have a significant impact on many dimensions of organizational performance - such as agility, efficiency, and financial performance (Tallon & Pinsonneault, 2011; Wade & Hulland, 2004; Lu & Ramamurthy, 2011) - it is interesting to see if the firm's size affects its ability to develop IT capabilities. The effect of the size of Saudi firms on their IT capabilities does not seem to be significant, as shown in Table 5.22. Other works reported the possible effect of firm size on IT capability. For instance, Joshi et al. (2010) highlighted a positive correlation between IT knowledge capabilities and an organization's size.

On the other hand, the internationalization orientation level of Saudi firms has a significant, positive effect on IT capabilities, as shown in Table 5.24. Scholars argue that the impacts of aspects, such as skills, people, vendors, and consultants, on IT success is important (Lyytinen et al., 1998; Lyytinen et al., 2009). Therefore, it is imperative to scan for the right partners, skills, and technology, even outside the Saudi local market. Lyytinen et al. (2009) demonstrated how Hadeed, a steel company totally owned by SABIC, one of the largest petrochemical companies in Saudi Arabia and the world, faced immense challenges during its ERP project, especially to maintain human capital with the required skills and knowledge.

Tables 5.22 and 5.24 may reflect that the local Saudi market does not provide sufficient support for Saudi firms, regardless of their size, in order to sustain stronger IT capabilities.

Internationalization orientation measures the firm's propensity to target foreign knowledge, skills, and alliances. Hence, it increases the firm's awareness of proper ways to develop IT capabilities and configurations. This indicates that the local Saudi market is probably not sufficient to fulfil firms' needs to achieve higher IT capabilities. According to AlGhamdi et al. (2011), official government data regarding Saudi firms' IT capabilities are disappointingly poor. This research findings contributes by providing a clearer picture regarding the current state of Saudi firms' IT capabilities. The results highlighted in Tables 5.22 and 5.24 show that Saudi firms may benefit from exposure to the global market's knowledge and skills, regardless of their size, to achieve better IT capabilities. This is also useful for any Saudi government intervention that plans to improve the overall e-commerce strategy of the Saudi market, in order to improve Saudi firms' competitiveness (Aladwani, 2003).

The regression results highlight the impact of information technology on the Saudi firms' innovation dynamic capacities. Benitez-Amado et al. (2010) have called for study on the impact of information technology on firms' innovation performance. Our results indicate three distinct information technology capabilities that enhance firms' innovation performance. IT infrastructure, IT flexibility, and IT effectiveness were hypothesized to enhance the Saudi firms' innovation process. The regression analysis shows that IT infrastructure and IT flexibility did indeed stimulate the Saudi firms' ability to acquire knowledge from external sources. The results indicate that IT infrastructure facilitated the firms' ability to acquire and process external knowledge. This finding aligns with that of Real et al. (2006), who surveyed 149 Spanish companies and found that information technology enabled organizational learning. IT flexibility seems to have a central role in all innovation dynamic capacities.

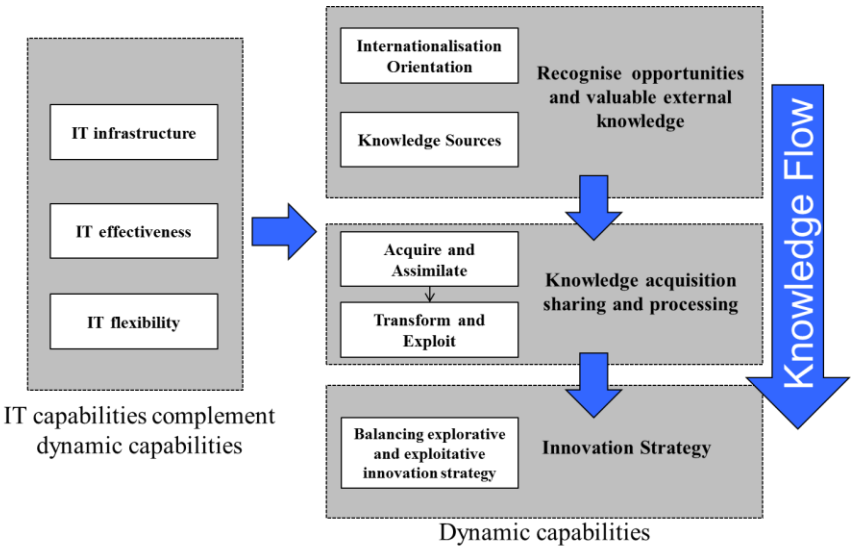


Figure 6.2: The IT capabilities proposed and examined in this research act in complement with other dynamic capabilities (absorptive and ambidextrous innovation strategy). Such synergy enhances the firm's innovation performance.

Tallon and Pinsonneault (2011) have highlighted the significant impact of IT flexibility on firms' agility. The results from Saudi firms add that IT flexibility has a significant impact on the potential absorptive capacity, realised absorptive capacity, and ambidextrous capacity, and thus play a significant role in firms' competitive advantage. These results also support the study by Doherty and Terry (2009), who suggest that a firm's sustained competitive advantage may benefit from the effective application of IT capabilities. On the other hand, the results from Saudi firms indicate that IT effectiveness, which focuses on improving efficiency and productivity, does not show a significant impact on knowledge acquisition, assimilation, transformation, and exploitation. Yet IT effectiveness combined with IT flexibility plays a significant role at the commercialisation stage of the innovation. The balance of exploitation and exploration strategies (ambidextrous capacity) seems to be stimulated by IT effectiveness and IT flexibility. These results support the argument by Nevo and Wade (2011) that suggests that the synergy between IT and other firms' capabilities may result in firm-level benefits.

From a different perspective, Marston et al. (2011) stress that *"one of the significant opportunities of cloud computing lies in its potential to help developing countries reap the benefits of information technology without the significant upfront investments that have stymied past effort"*. This research proposes three IT capabilities that are important for

innovation performance: IT flexibility, IT effectiveness, and IT infrastructure. This contributes to the research agenda suggested by Marston et al. (2011), which aims to understand how cloud computing service providers may tailor their offerings to capture emerging markets, especially with SMEs.

The results suggest that government initiatives should take place to build bridges with IT solution providers and consultants from outside the Saudi local market. At the same time, better support is required to enhance the provision of IT services by local firms. These points complement the work of AlGhamdi et al. (2011), which proposed a model for government initiatives to improve local e-commerce performance. Improving the IT capabilities of Saudi firms will help them to develop a better competitive position, access a wider marketplace, provide effective services to customers, and improve their overall efficiency, in order to better meet the market's needs (Aladwani, 2003)

6.5 Conclusion

This chapter examined the research data using the t-test, ANOVA test, and regression analysis. It was found that breadth of knowledge sources and internationalization orientation have significant positive impacts on Saudi firms' ability to acquire and accumulate new knowledge. Firms' practices related to knowledge transformation and exploitation facilitate their abilities to achieve both incremental and radical innovation. The few Saudi firms that showed higher ability to grasp these innovation capabilities were able to achieve higher innovation performance. Furthermore, IT capability seems to play a significant role in facilitating firms' abilities to process knowledge for the purpose of introducing innovative products and services. The next chapter will conclude this research by highlighting academic and practical implications, limitations, and suggestions for future studies.

Chapter 7: Conclusion

This research attempts to provide an answer to three research questions: What are the practices that might enable firms' dynamic capabilities in the context of innovation? Are dynamic capabilities valuable for stimulating firms' innovation performance? What is the role of information technology in firms' dynamic capabilities?

With regard to the first question, this research highlights the breadth of knowledge sources and internationalization orientation as key to enabling the firms' capacity to identify external knowledge. Moreover, the firms' potential absorptive capacity and realised absorptive capacity comprise practices associated with knowledge acquisition, assimilation, transformation and exploitation. In addition, ambidextrous capacity enables firms to maximise their economic advantage from current product and services, and seek the introduction of more radical innovative products and services. Secondly, these dynamic capacities are tested empirically and shown to have significant impact on the firms' innovation performance. Thirdly, three IT capabilites are identified and examined in this research: IT infrastructure, IT effectiveness and IT flexibility. These three capabilities play a significant role in enhancing the firms' ability to acquire and process knowledge towards introducing innovative products and services.

In the previous chapters, the data analysis and results were discussed in detail, including testing the research model and the related hypotheses. This final chapter will conclude this thesis by highlighting its significance, practical implications, theoretical contributions, the limitations of this research, several recommendations for future research, and a final conclusion.

7.1 Summary of Research Findings

- The majority of the surveyed Saudi firms (67%) reported that innovations activities are limited to new-to-the-firm products and services, or for improving existing products. Few firms (33%) showed the ability to introduce new-to-the-country and new-to-the-world products and services.
- The top three innovation dynamic capabilities of firms that are able to introduce products and services new to the world, or at least new to the country, are

internationalization orientation, potential absorptive capacity, and realised absorptive capacity.

- The lowest three innovation dynamics capabilities of low innovation performance firms are internationalization orientation, realised absorptive capacity, and explorative innovation strategy capacity.
- There is a remarkable and significant difference between high and low innovation performance firms in terms of R&D expenditures. The firms that are able to introduce products and services that are new to the world (or at least new to the country) dedicate about 4.3% of their sales to R&D activities. On the other hand, firms that are only able to introduce products and services new to the firm, or only able to improve existing products and services dedicate only about 2% of their sales to R&D activities.
- The R&D expenditure of Saudi SMEs is lower than larger firms. Studies of other countries, such as the United Kingdom, the United States, China, Korea, Germany, and the Netherlands, report no positive correlation between firm size and R&D expenditure. This indicates that Saudi SMEs pay less attention to R&D activities compared to SMEs in other countries.
- The research findings also show that Saudi firms' R&D expenditure only correlates with the use of a research institute as a source for innovation activities. This indicates that Saudi firms' R&D activities do not heavily depend on other important parties in the supply chain, such as customers and suppliers, which are indicated as significant sources of knowledge in other studies. This also may demonstrate the weak ties of the Saudi supply chain in terms of collaborative innovation activities.
- In regard to IT capabilities, internationalization orientation has a significant impact on IT infrastructure, IT flexibility, and IT effectiveness. This indicates a significant relationship between the quality of firms' IT capability and their abilities to access international knowledge, parties, skills, and markets. It also may indicate the lower value provision of local IT service providers.
- In terms of firms' recognition capacity of external knowledge, the regression analysis of this study reports two dynamic capabilities that have a positive impact: breadth of knowledge sources and internationalization orientation. The regression analysis also suggests that IT infrastructure and IT flexibility play a significant role in enhancing the

firms' abilities to acquire external knowledge. The R^2 for the factors that increase the firms' recognition capacity is about 50%. On the other hand, market intelligence generation seems to not be significant in the case of Saudi firms. The qualitative study suggests that the poor availability and accessibility of market data is the reason behind such a result, which contradicts results from studies in different countries.

- IT infrastructure and flexibility are significant factors for facilitating Saudi firms' ability to acquire external knowledge. On the other hand, IT effectiveness has no significant impact as reported in the results of the regression analysis.
- The ability of firms to transform and exploit knowledge requires higher levels of potential absorptive capacity. The regression analysis of the responses from Saudi firms shows that the firms' potential absorptive capacity, IT infrastructure and IT flexibility have a significant impact on the firms' ability to transform and exploit knowledge with an R^2 of 48%. However, it seems that IT effectiveness has no significant role.
- The firms' realised absorptive capacity, IT effectiveness and IT flexibility play a significant role in increasing Saudi firms' ability to balance explorative and exploitative innovations strategies. This increases the firms' ambidextrous capacity, which has been indicated as being challenging in other studies. The R^2 for these factors is 44%.
- This study measures innovation performance in different dimension, innovation sales performance and innovation radicalness. This study shows that this method of mentoring innovation performance is a useful indicator for reflecting the firms' innovation practices.
- Both the firms' innovation sales performance and innovation radicalness require strong knowledge transformation, exploitation capabilities, and a balanced innovation strategy that allows the firms to benefit from incremental and radical innovative products and services. The regression analysis for the firms' innovation performance shows that realised absorptive capacity and ambidextrous capacity are significant factors for innovation performance with R^2 over 33%.

7.2 Meeting the Research Questions and Objectives

The aim of this research is to examine the organizational and information technology capabilities concerning knowledge development and innovation performance of Saudi firms. In order to meet this aim, a set of research questions and objective were proposed. In regard to the first research question ('What are the practices that might reflect firms' dynamic capabilities in the context of innovation?), two objectives were proposed to help answer this question. The following table shows the objectives related to the research questions and summarises their findings.

Table 7.1: Objectives and findings related to the first research question.

Objectives	*Findings*
Conduct a comprehensive literature review in a thematic approach to identify the factors that reflect firms' dynamic capabilities in the context of innovation.	• Chapter 2 in this thesis represents a comprehensive literature review in the areas of dynamic capabilities, absorptive capacity, inter-organizational networking, ambidextrous capacity and firms' IT capabilities. • The factors identified that reflect the firms' dynamic capabilities in the context of innovation are: market intelligence generation, breadth of knowledge sources, internationalization orientation, potential absorptive capacity, realised absorptive capacity and ambidextrous capacity. • The literature review also revealed four IT capabilities that work in synergy with firms dynamic capabilities: IT sensing capability, IT infrastructure, IT flexibility and IT effectiveness.
Integrate the identified factors into a model that reflects the dynamic capabilities in the context of firms' innovation.	• Chapter 3 states 21 hypotheses that integrate the factors identified in Chapter 2 into a model that reflects the firms' dynamic capabilities in the context of innovation, as shown in Figure 3.10 in Chapter 3. • It was hypothesised that firms with better market intelligence generation, breadth of knowledge sources and internationalisation orientation have better

	absorptive capacity, and consequently better ambidextrous capacity, and as a result the firms will achieve higher innovation performance.

The second research question was related to the role of IT in firms' innovation processes and how it may help firms to improve their knowledge development and transformation through examining its role in improving the firms' dynamic capabilities. Hence, the second research question was, 'What is the role of information technology in firms' dynamic capabilities?'. One research objective was proposed to help answering this question. The following table shows the objective related to the second research question and its finding.

Table 7.2: Objectives and findings related to the second research question.

Objective	*Findings*
Examine the role of information technology on firms' dynamic capabilities.	• In Chapter 3 the four IT capabilities were proposed to have an impact on the firms' dynamic capabilities: IT sensing capability, IT infrastructure, IT flexibility, and IT effectiveness. • The four IT capabilities have been hypothesised to have an impact on the firms' absorptive capacity and ambidextrous capacity. • IT infrastructure and IT sensing capabilities help the firms to import and assimilate knowledge inside the firms. IT infrastructure also assists knowledge transformation and exploitation through tools and systems that aid knowledge process, design and application. • IT flexibility enhances the firms' adaptation and responsiveness to changes in users' demands, as well as shifts in markets' needs. • IT effectiveness aids firms by enhancing the overall effectiveness. IT effectiveness assists in reducing cost and improving productivity. This leads to higher ability to maximise economic advantage from firms' innovative products and services.

The third research question ('Are dynamic capabilities valuable for stimulating firms' innovation performance?') aims to examine if the dynamic capabilities identified in the previous objectives have an actual impact on the firms' innovation performance. Hence, this research question will verify if the research model is significantly able to predict (to some extent) firm's innovation performance. The following table shows the objective related to this research question and its findings.

Table 7.3: Objectives and findings related to the third research question.

Objective	*Findings*
Empirically test the research model by evaluating it in the context of the deployment of innovative products and services using innovation measures that reflect the innovation radicalness and innovation sales performance.	• In Chapter 4, the design of the research was discussed in order to test the model. The data were collected by surveying all 4500 firms registered in Riyadh Chamber of Commerce and Industry. The screening process of the data leads to 203 usable responses from Saudi firms. • In Chapter 5, the data were analysed quantitatively to validate the measures used in the survey and then the research model was tested using regression analysis. • Out of the 21 hypotheses, seven were rejected. Market intelligence generation was an insignificant factor in the firms' dynamic capabilities. Moreover, the hypotheses related to IT sensing capabilities were rejected due to internal measurement inconsistency. • The remaining hypotheses show that breadth of knowledge source, internationalization orientation, absorptive capacity and ambidextrous capacity have a significant impact on the firms' innovation sales performance and innovation radicalness, indicating that the factors identified as dynamic capabilities enhance the firms' innovation performance. • IT infrastructure, IT flexibility and IT effectiveness also show a significant impact on the firms' dynamic capabilities, indicating that IT capabilities complement the

	firms' dynamic capabilities to enhance knowledge flow and development to achieve better innovation performance. • In Chapter 5, the research model was able to explain statistically more than 33% (R^2) of firms' innovation sales performance and 38% (R^2) of firms' innovation radicalness. • In Chapter 6, results on firms' practice related to knowledge recognition and absorption, as well as ambidextrous innovation strategy, were discussed with further results reported by other scholars in the area of firms' innovation.

7.3 Significance of the Research Findings

The transformation towards a knowledge-based economy has linked firms' success to their learning capabilities and innovation (Huggins & Strakova, 2012). However, many firms struggle to refresh their knowledge as a result of learning inertia (Hing et al., 2012). This research provides firms with a firm-level model that stimulates the knowledge flow into firms and increases their ability to process knowledge into innovative products and services.

The research identifies practices associated with external knowledge recognition, knowledge absorption, and innovation strategies that can be applied inside firms as routines that manipulate firms' resources towards achieving better innovation performance. The research also examines the role of IT in facilitating the firms' innovation processes and highlights key IT capabilities, which are different at each stage of the knowledge processes. The IT capabilities highlighted are proposed as a basis for firms when assessing their IT investment. It further represents a foundation for IT service providers and the future of cloud computing services by highlighting the IT capabilities that are imperative for firms' innovation practices. The research also provides the Saudi government with knowledge regarding Saudi firms' innovation performance. It identifies the strengths and weaknesses of such innovation practices, and this may act as guidance for future governmental intervention, which aims at boosting firms' innovativeness and aiding the shift towards knowledge economy.

7.4 Uniqueness and Novelty of This Research

This research's uniqueness and novelty is due to the effort of integrating multidisciplinary theory regarding firms' innovation, such as dynamic capabilities, market orientation, networking theory, absorptive capacity, ambidextrous capacity and IT capabilities. The research begins to break down the main components of the dynamic capabilities theory into more practical practices that can be observed and measured. The research further pays attention to the synergy between IT and firms' innovation practices, and how it may stimulate firms' innovation performance. The novelty of this research is summarised as follows:

- This research represents an original attempt to break down the dynamic capabilities building blocks into more practical and empirically testable practices integrated in a model that explains a firm's innovation performance at the firm level. The proposed model in Chapter 3 explains how firms may develop practices that better utilise resources to sense and seize external knowledge, as well as continuously reconfigure resources to increase responses to market changes.
- The model also represents an original attempt to integrate market orientation, networking theory, absorptive capacity theory, and ambidextrous innovation strategy into one model that shows knowledge flow and processing inside firms and identifies practices that enhance the firms' ability to recognise valuable external knowledge, absorb it, and exploit it as a final product and service.
- The research model is one of the first empirical studies that attempts to explain the synergy between IT and innovation dynamic capabilities and their role in the firm's innovation performance. The model explains which IT capabilities positively impact the firm's innovation dynamic capabilities, and which consequently lead to higher innovation performance.
- This research takes into consideration the effect of local geographical knowledge on firms' performance and includes the internationalization of firms' access to knowledge and skills as a key practice that enhances firms' innovation activities. The research shows the statistical significance of the internationalization of the firms' knowledge on firms' ability to acquire and utilise knowledge for novel products and services. Therefore, the strong government initiative to stimulate the Saudi knowledge economy through new universities, improved infrastructure, and new smart cities should

facilitate firms' access to international sources of knowledge and skills in order for them to achieve higher innovation performance.

- This study is one of the first empirical studies that quantitatively examines Saudi firms' innovation performance, and hence contributes to the large existing gap of research regarding Saudi firms' innovation performance. It also represents, due to the quantitative data and analysis, a valuable reference for researchers who are interested in examining the innovativeness of Saudi firms. It further represents a valuable reference for the Saudi government's policy for knowledge-based transformation to stimulate the Saudi knowledge economy.

7.5 Theoretical Contributions

The research model used in this study portrayed practices that stimulate external knowledge flow into firms. It shows that firms may better recognise external knowledge by increasing their breadth of knowledge sources, both in local and international markets. The larger the number of strong ties with knowledge sources - such as customers, suppliers, consultants, and research institutes - the higher the firm's awareness of the current state of knowledge, technology, and market demands. Consequently, this stimulates the firms' ability to acquire external knowledge.

This contributes directly to the gap highlighted by Volberda et al. (2010), which suggests conducting a study that explains the effect of inter-firm interactions as a macro-antecedent for absorptive capacity. In this regard, this research reports that higher interaction with more knowledge sources positively influences absorptive capacity. Moreover, Volberda et al. (2010) further stress the need to link realised absorptive capacity with outcomes, such as innovation and firm's performance. Thus, researching Saudi firms' shows that realised absorptive capacity practices positively influence firms' innovation performance, both directly and indirectly, through ambidextrous capacity, which is a balance of explorative and exploitative innovation strategy.

As the external knowledge becomes recognised, the firm's internal absorptive capacity practices facilitate the firm's ability to acquire the potential knowledge, share it internally, multiply it with existing knowledge, and exploit it through innovative products or services. However, the transformation of knowledge into a final product or service requires a proper innovation strategy, i.e. firms should have the ability to fit the final products or services with

market needs to maximise the innovation's economic advantage. This confirms Datta's (2012) proposition that ambidexterity helps firms to commercialise innovation.

In general, the model contributes to the call for empirical research in dynamic capabilities. For instance, this research model was developed in a way that can empirically support the proposed model suggested by Wang and Ahmed (2007). In their review of dynamic capabilities studies, they highlight absorptive, adaptive, and innovative capabilities as key components of dynamic capabilities. They further stressed that empirical research into dynamic capabilities was still not mature and that further studies are important.

Furthermore, the results of this research contribute to narrowing the gap highlighted by Easterby-Smith et al. (2009) in their recent review of the dynamic capabilities literature. They stress that previous studies only focused on dynamic industries, and further research is needed in order to include traditional industries and other countries with different conditions. The results of this research show that the type of industry has no significant effect on the importance of dynamic capabilities (networking with multiple knowledge sources both in local and international markets, absorptive capacity, and ambidextrous innovation strategy), as hypothesised in this study.

This research also contributes to Benitez-Amado et al.'s (2010) call for a better explanation of how IT contributes to a firm's performance. The three IT capabilities that have been suggested (IT infrastructure, flexibility, and effectiveness) have a positive impact on a firm's innovation dynamic capabilities. This may also respond to Easterby-Smith et al.'s call (2009), which suggested that a research gap regarding linking IT to dynamic capabilities existed.

In addition, the study also starts to fill in a large gap of knowledge regarding Saudi firms' capabilities and their innovation performance, which represent some of the most important aspects to which Saudi Arabia needs to pay attention (Iqbal, 2011; Shin et al. 2012). This research provides quantitative data regarding Saudi firms' practices and innovation performance, and shows the differences between high and low innovation performance firms in these practices. The research also provides data regarding the current IT capabilities of Saudi firms, which are highlighted as disappointedly poor (AlGhamdi et al., 2011).

7.6 Practical Implications

Regarding the practical implications of this research, it provides key business decision makers with important views on how to improve their firm's innovation performance. At first, the study identified strategic routines that help firms to better utilise their resources. It stimulates the firms to scan for external opportunities through a greater utilisation of external sources, and extends the scan for external knowledge and opportunities at the global level. Internally, a firm may apply routines that facilitate knowledge accumulation and assimilation to increase its overall knowledge stock. Mutual routines that facilitate knowledge transformation and exploitation are essential for the development of knowledge into commercially innovative products and services. Furthermore, this research also stresses that the balance between the two orthogonal innovation strategies (exploration and exploitation) are important in order to maintain both short-term profit and long-term survival.

Some applications may benefit from these research results, such as decision criteria regarding innovation projects or innovation scorecards. The practices identified in this research can be used as assessment criteria for ability of firms to handle innovation projects. In the section of recommendations for future research, some food for thought is provided for how to take this research forward for these applications.

From a different perspective, the research results indicate that SMEs devote fewer resources to R&D activities compared to larger firms. The results suggest that large Saudi firms have better R&D expenditure compared to SMEs. Other studies have suggested that there are no significant differences between large firms and SMEs in terms of R&D expenditure, as discussed earlier. This may partially explain why Saudi firms, in general, have lower innovation performance than firms in other countries such as the United Kingdom, United States, Netherlands, and Korea, and in developing countries such as Taiwan. Therefore, managers in SMEs are encouraged to increase their R&D expenditure in order to cope with current globalisation pressures.

In terms of IT, it is important for business executives to implement IT capital that assists in sustaining a competitive advantage. Hence, IT that supports a firm's innovation performance is important to increase the returns from an expensive investment in IT. This research highlights three essential IT capabilities that executives should consider when investing: IT infrastructure, IT flexibility, and IT effectiveness. These IT capabilities help

stimulate firms' innovation dynamic capabilities, which, in turn, increases innovation performance.

The research also provides decision makers in both business and government with action lists. These action lists, shown in Table 7.4 and 7.5, are suggested as a consequence of the research findings from the 203 responses from Saudi firms, as well as from the findings from the interviews conducted.

Table 7.4: Recommendations for managers

1.	Managers in SMEs should devote more resources for R&D activities.
2.	The firms' R&D activities should incorporate collaboration with suppliers and customers as the research shows that a higher R&D expenditure is only correlating with research institutes as a source for innovation activities.
3.	Managers should internationalize their searching and scanning activities for knowledge, skills, and alliances. The research shows that internationalization orientation is positively correlated with firms' innovation dynamic capabilities. Hence, the dependence on local knowledge is not sufficient to improve the firm's innovation performance.
4.	The learning practices inside the organizations should be enhanced. The acquisition of external knowledge should become routine inside the firm. The knowledge should be freely circulated among departments in order improve the firm's ability to process knowledge.
5.	Managers should implement a culture that encourages engorges experimentation and prototyping by combining newly acquired knowledge with existing knowledge.
6.	Managers should balance the firms' activities of experimentation and maximising profit from existing products or services. Over-emphasis on experimentation may put the firm under financial pressure. On the other hand, over-emphasis on profit maximising from existing products or services may prevent the firm from coping with technology shifts and changes in markets.
7.	Managers should consider flexibility when investing in IT as the research shows that IT flexibility is central to the innovation dynamic capabilities. Hence, assessing the investment in IT in terms of adaptability and scalability is essential for the evaluation process in order to avoid an over-emphasis on IT's ability to improve productivity and reduce costs.
8.	Managers should include the assessment of the innovation practices inside their firms as key performance indicators (KPIs). This research suggests three dimensions for KPIs: the recognition capacity of opportunities and external knowledge, absorptive capacity, and ambidextrous capacity. The measurement used in this research represents innovation practices that may act as guidelines for developing KPIs for innovation practices.

Table 7.5: Recommendations for government policy

1.	The government should stimulate the communication channels among the business sector, universities, and government agencies. These three pillars represent the knowledge infrastructure of the national innovation system.
2.	The government should put more effort into providing the updated market data and make it accessible to firms. This research shows that firms face difficulties in reaching market intelligence. Hence, this makes it more challenging for firms to understand customers' preferences and status of markets.
3.	The research shows that the firms' innovation practices are enhanced when they are able to reach international sources of knowledge and skills. The government should facilitate the ability of firms to reach such sources and encourage foreign consultants' agencies in the Saudi market.
4.	The government support for firms (especially SMEs) should go beyond simple financial support and target the enhancement of firms' innovation capabilities. For instance, the government should encourage stronger ties for supply chains, and measures to encourage firms' R&D activities.
5.	The government is urged to promote the partnerships between SMEs and universities. This may expose SMEs to an effective knowledge infrastructure and enhance their R&D activities.
6.	The government is urged to implement an innovation performance that goes beyond the number of patents. It is important to measure how many of these patents are able to generate economic advantages.

7.7 Research Limitations

Although the researcher invested all available time and effort, limitations nevertheless exist. First, innovation is a very complex concept, and this study focuses only on the firm-level perspective rather than the individual level. As a result of this scope of analysis, this study aims to examine the practices that firms use to take advantage of available resources, including human capital. Yet, this study did not include employee characteristics or skills, although the individual-level perspective is also important in the study of innovation performance and will provide a clearer picture of how firms may increase their innovation prosperity. However, including both firm-level and individual-level data would have made the research objectives impractical due to the limited time and resources available. Based on the literature, the firm-level perspective seems to be less explored and lacks empirical research (Keupp et al., 2012; Gupta et al., 2006).

The data collected are cross-sectional, which means that the independent and dependent variables were measured at the same time. Although this kind of data is well-accepted in organizational research, it still has limitations in providing the path-dependent nature of a cause-and-effect relationship. Furthermore, the data itself is only based on firms

registered in the Riyadh Chamber of Commerce and Industry. Therefore, there are limitations to generalising the results to other cities, and Saudi Arabia as a whole.

Methodologically, although the researcher put maximum effort into utilising good mixed-methods, the calls for quantitative study and the limited availability of time, resources, and accessibility resulted in a greater weight placed on the quantitative approach and a limited number of interviews, which may lead to limitations in the qualitative study. Analytically, the researcher did not adopt the structural equation modelling (SEM) technique to analyse the data. This resulted from the limited amount of data available, as SEM requires a higher sample size for accurate results. Although the multiple linear regression method provided a good level of accuracy, confirming such results using SEM would lead to more rigorous conclusions.

7.8 Recommendations for Future Research

As usual, research triggers other questions and areas of interest. This research has limitations that can be addressed in future work. The following are recommendations for future research directions, which may be of interest to future researchers:

- The innovation dynamic capabilities identified in this research represent basis for a key performance indicator for firms' innovating performance. Other research may extend this work by developing KPI tools using the innovation dynamic capabilities studied in this research to better support firms to monitor their innovation practices. In order to take this researches further in the direction of innovation assessments, decision criteria, or innovation scorecards, it is recommended that a weighting score for dynamic capabilities identified is developed based on the behaviour of high innovation performance firms. Recommended methodologies might be fuzzy logic principles or an analytic hierarchy process. High and low innovation performance firms can be distinguished using the same criterion presented in this research.
- Future work is highly recommended to complement this study by adding the individual dimensions to the research model. Studying the mechanisms of implementing employees' practices and resistance to such implementation will likely to have an important value for both academia and industries.
- At the macro-level, it is important to better understand the challenges that inhibit the cooperation of firms with external parties' for innovation activities in order to have a

better policy regarding boosting the knowledge economy. The research results show that the R&D expenditure of Saudi firms is only significantly correlated with the usage of research institutes as a source of innovation activities. Other research shows the importance of customers, suppliers, consultants, and even competitors for innovation success (Pittaway et al., 2004). This indicates that Saudi firms may not have a high enough integration with their supply chains to achieve product/process improvement. This may encourage other researchers to investigate Saudi firms' internal R&D practices, orientation, and management mindset, and how these are related to the level of cooperation with other parties for better innovation performance.

- Analysing other data sets from the GCC region and other developed countries will be valuable in order to confirm and generalise the results found in this research.
- In the area of IT, this study proposed three capabilities that facilitate a firm's dynamic capabilities. It is interesting to understand how information system solutions may implement such capabilities in their service provision. This might be of high interest, especially for small and medium-sized enterprises that might have limited access to financial capital.
- In terms of information system design and implementation, the inclusion of a firm's innovation performance in the equation, while providing solutions, is important in the current knowledge economy. Considering the identified IT capabilities proposed in this research as pillars of the design of IT solutions, such as enterprise resource planning (ERP), will result in better support for the continuous innovation process of organizations.

7.9 Conclusion

This research, at its core, was undertaken to understand how firms could increase their innovation performance. An intensive literature review was conducted with a focus on the firm level. In a thematic fashion, the literature integrates three main areas of knowledge - systems of innovation, dynamic capabilities, and IT - and places the flow of knowledge as the essence of the integration. As a result, a research model was conceptualised. Methodologically, the research is quantitative-dominant. The data were collected from the Riyadh Chamber of

Commerce and Industry. Using responses from 203 firms, the data were analysed and the research model was revised and validated through qualitative research.

It is found that SMEs have lower R&D performance compared to SMEs in other countries. It is also founded that low innovation performance Saudi firms face difficulties in innovation practices, especially internationalization orientation, potential, and realised absorptive capacity, and have a lower explorative innovation strategy. On the other hand, the small number of higher innovation performance Saudi firms have better ability in attaining innovation practices, especially internationalization orientation, as well as better ability in balancing explorative and exploitative innovation strategies. It is further noted that R&D expenditure only correlates with the use of research institutes as an external sources for innovation activities, yet there is no correlation with other sources, such as customers and suppliers, which are reported as important in other countries.

Higher knowledge sources and higher internationalization orientation are important for better recognising external knowledge. When valuable external knowledge is recognised, absorptive capacity routines play a significant role in knowledge acquisition, assimilation, transformation, and exploitation, and ambidextrous capacity plays an essential role in the successful commercialisation of innovation.

Moreover, IT capabilities are important to facilitate knowledge flow and progression inside firms. The IT infrastructure that connects firms with external knowledge sources and manages knowledge inside the firm, while providing flexibility and effectiveness at the same time, is significant to stimulate a firm's ability to sense and seize opportunities as they emerge. The few Saudi firms that showed higher innovation dynamic capabilities and better IT capabilities were able to enjoy higher innovation performance. This suggests that, even in developing countries, higher innovation performance may be achieved by focusing on knowledge development and extending the search for knowledge and opportunity on an international level.

Bibliography

Abernathy, W., & Clark, K. B. (1985). Mapping the winds of creative destruction. *Research Policy*, *14*, 3–22.

Aboulnasr, K., Narasimhan, O., Blair, E., & Chandy, R. (2008). Competitive response to radical product innovations. *Journal of Marketing, 72*(3), 94–110.

Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly, 45*(3), 425–455.

Ahuja, G., & Lampert, C.M., (2001). Entrepreneurship in the large corporation: A longitudinal study of how established firms create breathrough inventions. *Strategic Management Journal, 22*(6–7), 521–543.

Aladwani, A. M. (2003). Key Internet characteristics and e-commerce issues in Arab countries. *Information Technology & People, 16*(1), 9-20.

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues, *MIS Quarterly, 25*(1), 107–136.

Alcacer, J., & Gittelman, M. (2006). Patent citations as a measure of knowledge flows: The influence of examiner citations. *Review of Economics and Statistics, 88*(4), 774–779.

Alcacer, J., Gittelman, M., & Sampat, B. (2009). Applicant and examiner citations in U.S. patents: An overview and analysis. *Research Policy, 38*(2), 415–427.

AlGhamdi, R., Drew, S., & Alshehri, M. (2011). Strategic government initiatives to promote diffusion of online retailing in Saudi Arabia. *In Digital Information Management (ICDIM)*, 2011 Sixth International Conference on (217-222). IEEE.

Afuah, A. (2003). Innovation Management: Strategies, Implementation and Profits. New York: Oxford University Press.

Allison, P. D. (1999). Multiple regression: A primer. Thousand Oaks, CA: Pine Forge Press.

Almeida, P., & Kogut, B. (1999). Localization of knowledge and the mobility of engineers in regional networks. *Management Science, 45*(7), 905-917.

Almirall, E., & Casadesus-Masanell, R. (2010). Open versus closed innovation: A model of discovery and divergence. *Academy of Management Review, 35*(1), 27–47.

Aloini, D., & Martini, A. (2013). Exploring the exploratory search for innovation: A structural equation modelling test for practices and performance. *International Journal of Technology Management*, *61*(1), 23-46

Alonso, I. A., Verdu´n, J. C., & Caro, E. T. (2010). Information technology to help drive business innovation and growth. In T. Sobh & K. Elleithy (Eds.), *Innovations and Advanced Techniques in Systems, Computing Sciences and Software Engineering* (pp. 527–32). Netherlands: Springer.

Alshumaimri, A., Aldridge, T., & Audretsch, D. B. (2010). The university technology transfer revolution in Saudi Arabia. *The Journal of Technology Transfer, 35*(6), 585-596.

Aluja, A., Blanch, A., & García, L. F. (2005). Dimensionality of the Maslach Burnout Inventory in school teachers. *European Journal of Psychological Assessment*, *21*(1), 67–76.

Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science, 20*(4), 696–717.

Aral, S., & Weill, P. (2007). IT assets, organizational capabilities, and firm performance: How resource allocations and organizational differences explain performance variation. *Organization Science, 18*(5), 763-780.

Arikan, A. T. (2009). Interfirm knowledge exchanges and the knowledge creation capability of clusters interfirm knowledge exchanges and the knowledge creation capability of clusters. *Academy of Management Review*, *34*(4), 658–676.

Auh, S., & Menguc, B. (2005). Balancing exploration and exploitation: The moderating role of competitive intensity. *Journal of Business Research, 58*(12), 1652-1661.

Bagozzi, R.P. and Yi, Y. (1988) "On the Evaluation of Structural Equation Models", *Academy of Marketing Science, 16* (1), pp. 74-94.

Baiman, S., & Rajan, M. V. (2002). The Role of Information and Opportunism in the Choice of Buyer-Supplier Relationships. *Journal of Accounting Research, 40*(2), 247-278.

Baker, W. E., & Sinkula, J. M. (2005). Market orientation and the new product paradox. *Journal of Product Innovation Management*, *22*(6), 483–502.

Baker, W. E., & Sinkula, J. M. (2007). Does market orientation facilitate balanced innovation programs? An organizational learning perspective. *Journal of Product Innovation Management*, *24*, 316–334.

Baumol, W. J. (2005). Entrepreneurship and invention: Toward their microeconomic value theory. *Joint Center AEI-Brookings Joint Center for Regulatory Studies*, 5-38.

Bapuji, H., & Crossan, M. (2004). From questions to answers: Reviewing organizational learning research. *Management Learning, 35*(4), 397–417.

Barczak, G., Sultan, F., & Hultink, E. J. (2007). Determinants of IT usage and new product performance. *Journal of Product Innovation Management*, *24*(6), 600.

Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. *Management Decision*, *47*(8), 1323–1339.

Barki, H., & Pinsonneault, A. (2005). A model of organizational integration, implementation effort, and performance. *Organization Science, 16*(2), 165–179.

Barnett, W. P., Greve, H. R., & Park, D. Y. (1994). An evolutionary model of organizational performance. *Strategic Management Journal*, *15*(S1), 11–28.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120.

Bartlett, J. E., Kotrlik, J. W., & Higgins, C. C. (2001). Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal, 19*(1), 43–50.

Baskerville, R., Pawlowski, S., & McLean, E. (2000, December). Enterprise resource planning and organizational knowledge: patterns of convergence and divergence. *In Proceedings of the twenty first international conference on Information systems*, 396-406, Association for Information Systems.

Baum, J. A. C., Calabrese, T., & Silverman, B. S. (2000). Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal, 21*(3), 267–294.

Bechara, J., & Van de Ven, A. H. (2011). Triangulating philosophies of science to understand complex organizational and managerial problems. *Research in the Sociology of Organizations, 32*, 343–364.

Becker, M. C., (2004). Organizational routines: A review of the literature. *Industrial and Corporate Change, 13*(4), 643–677.

Bhatt, G., Emdad, A., Roberts, N., & Grover, V. (2010). Building and leveraging information in dynamic environments: The role of IT infrastructure flexibility as enabler of organizational responsiveness and competitive advantage. *Information & Management, 47*(7), 341-349.

Beije, P. (1998). *Technological change in the modern economy: Basic topics and development*. Cheltenham: Edward Elgar.

Benitez-Amado, J., Llorens-Montes, F. J., & Perez-Arostegui, M. N. (2010). Information technology-enabled intrapreneurship culture and firm performance. *Industrial Management & Data Systems, 110(4)*, 550-566.

Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review, 28*(2), 238- 256.

Bergeron, F., Raymond, L., & Rivard, S. (2004). Ideal patterns of strategic alignment and business performance. *Information and Management, 41*(8), 1003–1020.

Bessant, J. (2008). Dealing with discontinuous innovation: The European experience. *International Journal of Technology Management*, *42*(1), 35–50.

Bessant, J., & Tidd, J. (2007). Innovation and Entrepreneurship. England: John Wiley and Sons.

Bessant, J., & Venables, T. (Eds.). (2010). *Creating wealth from knowledge: Meeting the innovation challenge*. UK: Elgard Publishing.

Bessant, J., & Von Stamm, B. (2008). *Search strategies for discontinuous innovation: theoretical findings and practical relevance.* Proceedings of the European Academy of Management (Euram), 16-19.

Bessant, J., Lamming, R., Noke, H., & Phillips, W. (2005). Managing innovation beyond the steady state. *Technovation*, *25*(12), 1366–1376.

Biemans, W. G. (1991). User and third-party involvement in developing medical equipment innovations. *Technovation, 11*(3), 163-182.

Blaikie, N. (1993). Approaches to social enquiry. Cambridge: Polity Press.

Blaikie, N. (2000). Designing Social Research. Cambridge: Polity Press.

Blind, K., Edler, J., Frietsch, R. and Schmoch, U. (2006). Motives to patent: empirical evidence from Germany. *Research Policy, 35*(5), 655–672.

Bougrain, F., & Haudeville, B. (2002). Innovation, collaboration and SMEs internal research capacities. *Research Policy, 31*(5), 735-747.

Borges, M., Hoppen, N., & Luce, F. B. (2009). Information technology impact on market orientation in e-business. Journal of Business Research, 62(9), 883-890.

Breschi, S. (2000). The geography of innovation: A cross-sector analysis. *Regional Studies, 34*(3), 213-229.

Breschi, S., Lissoni, F., & Malerba, F. (2003). Knowledge-relatedness in firm technological diversification. *Research Policy, 32*(1), 69–87.

Brown, S. L., & Eisenhardt, K. M. (1997). The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly, 42*, 1–34.

Bryman, A., & Bell, E. (2007). Business research methods (2nd ed.). Bath: Oxford University Press.

Bryman, A., & Cramer, D. (2011). Quantitative data analysis with IBM SPSS 17, 18 & 19: A guide for social scientists. Hove: Routledge.

Buckley, P. J., Clegg, J., & Wang, C. (2002). The impact of inward FDI on the performance of Chinese manufacturing firms. *Journal of International Business Studies, 33*(4), 637–655.

Burgelman, R. A., Christensen, C. M., & Wheelright, S. C. (2006). *Strategic management of technology and innovation.* New York: McGraw Hill Irwin.

Byrd, T. A., & Turner, D. E. (2000). Measuring the Flexibility of Information Technology Infrastructure: Exploratory Analysis of a Construct. *Journal of Management Information Systems, 17*(1), 167–208.

Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial marketing management, 31*(6), 515-524.

Cao, Q., Gedajlovic, E., & Zhang, H. (2009). Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science, 20*(4), 781–786.

Carroll, G. R., Bigelow, L. S., Seidel, M. L., & Tsai, L. B. (1996). The fates of De Novo and De Alio producers in the American Automobile Industry 1885–1981. *Strategic Management Journal, 17*(S1), 117-137.

Carroll, G.R. & Hannan, M.T. (2000), The Demography of Corporations and Industries, Princeton University Press, Princeton, NJ.

Carlsson, B. (2006). Internationalization of innovation systems: A survey of the literature. Research Policy *35(1),* 56-67.

Carlsson, B., & Eliasson, G.. (1994). The Nature and Importance of Economic Competence. Industrial and Corporate Change *3*(3)*,* 687 -711.

Carlsson, B., Jacobsson, S., Holmén, M., & A. Rickne. (2002). Innovation systems: analytical and methodological issues. Research Policy *31(2),* 233-245.

Carr, N.G. (2003). IT doesn't matter. *Harvard Business Review, 81*(5), 41–49.

Cassell, C., & Symon, G. (1994). Qualitative methods in organizational research: A practical guide. London: Sage.

Cepeda-Carrion, G., Cegarra Navarro, J. G., & Jimenez-Jimenez, D. (2010). The effect of absorptive capacity on innovativeness: Context and information systems capability as catalysts. *British Journal of Management, 23*(1), 110–129.

Chan, Y. E., Huff, S. L., Barclay, D. W., & Copeland, D. G. (1997). Business strategy orientation, information systems orientation and strategic alignment. *Information Systems Research, 8*(2), 125–150.

Chan, Y. E., Sabherwal, R., & Thatcher, J. B. (2006). Antecedents and outcomes of strategic IS alignment: An empirical investigation. *IEEE Transactions on Engineering Management, 53*(1), 24–47.

Chan, Y., & Reich, B. (2007). IT alignment—What have we learned?. *Journal of Information Technology, 22*(4), 297–315.

Chandy, R. K., & Tellis, G. J. (1998). Organizing for radical product innovation: The overlooked role of willingness to cannibalize. *Journal of Marketing Research, 35*(4), 474-487.

Chang, Y. C., Chang, H. T., Chi, H. R., Chen, M. H., & Deng, L. L. (2012). How do established firms improve radical innovation performance? The organizational capabilities view. *Technovation*, *32*(7), 441–451.

Chang, Y. Y., Hughes, M., & Hotho, S. (2011). Internal and external antecedents of SMEs' innovation ambidexterity outcomes. *Management Decision, 49*(10), 1658-1676.

Chen, J., Chen, Y., & Vanhaverbeke, W. (2011). The influence of scope, depth, and orientation of external technology sources on the innovative performance of Chinese firms. *Technovation*, *31*(8), 362-373.

Chen, C. J., & Huang, J. W. (2009). Strategic human resource practices and innovation performance—The mediating role of knowledge management capacity. *Journal of Business Research*, *62*, 104–114.

Chen, M., Su, K., & Tsai, W. (2007). Competitive tension: The awareness-motivation-capability perspective. *Academy of Management Journal, 50*(1), 101.

Chen, M. (1996). Competitor analysis and interfirm rivalry: Toward a theoretical integration. *Academy of Management Review, 21*(1), 100–134.

Chen, W. S., & Hirschheim, R. (2004). A paradigmatic and methodological examination of information systems research from 1991 to 2001. *Information Systems Journal, 14*(3), 197–235.

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press.

Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2008). *Open innovation: Researching a new paradigm*. Oxford University Press.

Choo, C. W. (2005). Information failures and organizational disasters. *Sloan Management Review, 46*(3), 8–10.

Christensen, C. M. (1992). Exploring the limits of the technology S-curve: Part II: Architectural technologies. *Production and Operations Management*, *1*(4), 358–366.

Christensen, C. M. (1997). *The innovator's dilemma*. Cambridge, MA: Harvard Business School Press.

Churchill, G. A., & Iacobucci, D. (2004). Marketing research: Methodological foundations (9th ed.). Mason, OH: Thomson/South-Western.

Clemons, E. K., & Row, M. C. (1991). Sustaining IT advantage: The role of structural differences. *MIS Quarterly, 15*(3), 275–92.

Cohen, W. M., & Levinthal, D. A. (1989). Innovation and learning: The two faces of R&D. *Economic Journal, 99*, 569–596.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–152.

Cohen, W. M., & Levinthal, D. A. (1994). Fortune favors the prepared firm. *Management Science, 40*(2), 227–251.

Collins, J. D., & Hitt, M. A. (2006). Leveraging tacit knowledge in alliances: The importance of using relational capabilities to build and leverage relational capital. *Journal of Engineering and Technology Management, 23*(3), 147–167.

Collis, J., & Hussey, R. (2003). Business research: A practical guide for undergraduate and postgraduate students (2nd ed.). Basingstoke: Palgrave.

Conway, J. M., & Huffcutt, A. I. (2003). A review and evaluation of exploratory factor analysis practices in organizational research. *Organizational Research Methods*, *6*(2), 147–168.

Cooke, P. (1996). The new wave of regional innovation networks: Analysis, characteristics and strategy. *Small Business Economics, 8*(2), 159-171.

Cooke, P., & Schienstock, G. (2000). Structural competitiveness and learning regions. *Enterprise and Innovation Management Studies*, *1*(3), 265–280.

Coombs, J., & Bierly, B. (2006). Measuring technological capability and performance. *R&D Management, 36*(4), 421-438.

Cooper, A.C., Gimeno-GAscon, F.J. and Woo, A.C.Y. (1994), Initial human and financial capital as predictors of new venture performance, *Journal of Business Venturing, 9*(5), 371-95.

Cooper, B. L., Watson, H. J., Wixom, B. H., & Goodhue, D. L. (2000). Data warehousing supports corporate strategy at First American Corporation. *MIS Quarterly. 24*(4), 547–567.

Cornford, T., & Smithson, S. (1996). *Project research in information systems.* London: Macmillan Press Ltd.

Corso, M., & Paolucci, E. (2001). Fostering innovation and knowledge transfer in product development through information technology. *International Journal of Technology Management, 3*(1–3), 126–48.

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches. SAGE Publications, Inc.

Creswell, J. W., & Clark, V. L. P. (2006*).* Designing and conducting mixed methods research. Thousand Oaks, CA: Sage publications.

Crossan, M. M., Lane, H. W., White, R. E. (1999). An organizational learning framework: from intuition to institution. *The Academy of Management Review, 24*(3), 522-537.

Croteau, A., & Bergeron, F. (2001). An information technology trilogy: Business strategy, technological deployment and organizational performance. *Journal of Strategic Information Systems, 10*(2), 77–99.

Croteau, A., Solomon, S., Raymond, L., & Bergeron, F. (2001). Organizational and technological infrastructures alignment. *Proceedings of the Hawaii International Conference on Systems Sciences* Los Alamitos, CA: IEEE Computer Society Press.

Cua, K. O., McKone, K. E., & Schroeder, R. G. (2001). Relationships between implementation of TQM, JIT, and TPM and manufacturing performance. *Journal of Operations Management*, *19*(6), 675–694.

D'Aveni, R. A. 1994. Hypercompetition: Managing the dynamics of strategic maneuvering. New York: Free Press.

Dahlander, L., & Gann, D. M. (2010). How open is innovation?. *Research Policy, 39*(6), 699-709.

Dahmén, E. (1988). Development blocks in industrial economics. *Scandinavian Economic History Review, 36*(1): 3–14

Dale Stoel, M., & Muhanna, W. A. (2009). IT capabilities and firm performance: A contingency analysis of the role of industry and IT capability type. *Information & Management, 46*(3), 181-189.

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic management journal, 23*(12), 1095-1121.

Das, T. H. (1983). Qualitative research in organizational behaviour. *Journal of Management Studies, 20*, 301–314.

Das, T. K., & Teng, B. S. (2002). The dynamics of alliance conditions in the alliance development process. *Journal of Management Studies, 39*(5), 725–746.

Datta, A. (2012). Information technology based knowledge capability and commercialization of innovations: Modeling the impacts on ambidexterity and absorptive capacity. *Strategic Management Review, 6*(1), 75–97.

Davenport, S. (2005). Exploring the role of proximity in SME knowledge-acquisition. *Research Policy*, *34*, 683–701.

Davenport, T. H. (1993). *Process innovation: Reengineering work through information technology.* Boston: Harvard Business School Press.

Davenport, T. H., & Harris, J. G. (2007). *Competing on analytics*. Cambridge, MA: Harvard Business School Press.

Davenport, T. H., Prusak, L., & Strong, B. (2008). Putting ideas to work: Knowledge management can make a difference— but it needs to be more pragmatic. *MIT Sloan Management Rev. Bus. Insights Online*, *47*(3).

Davenport, T. H., L. Prusak, B. Strong. 2008. Putting ideas to work: Knowledge management can make a difference— but it needs to be more pragmatic. *MIT Sloan Management Review*. *Bus. Insights Online, 47(3)* Retrieved from: http://ai.arizona.edu/mis480/other_materials/4_Putting-Ideas-to-Work.pdf

Day, G. S., & Schoemaker, P. J. H. (2006). Peripheral vision: Detecting the weak signals that will make or break your company. Boston, MA: Harvard Business School Press.

De Backer, K., & Cervantes, M. (2008). Open innovation in global networks. OECD.

De Clercq, D., Sapienza, H. J., Yavuz, R. I., & Zhou, L. (2012). Learning and knowledge in early internationalization research: Past accomplishments and future directions. *Journal of Business Venturing, 27*(1), 143-165.

De Coster, R., & Butler, C. (2005). Assessment of proposals for new technology ventures in the UK: characteristics of university spin-off companies. Technovation, *25*(5), 535-543.

De Jong, J. P., & Freel, M. (2010). Absorptive capacity and the reach of collaboration in high technology small firms. *Research Policy, 39*(1), 47-54.

Dean, T.J., Brown, R.L. and Bamford, C.E. (1998), Differences in large and small firm responses to environmental context: strategic implications from a comparative analysis of business formations, *Strategic Management Journal, 19*(8), 709-28.

Denzin, N. Y. K., & Lincoln, Y. S. (1998). *Collecting and interpreting qualitative materials*. Thousand Oaks, CA: SAGE Publications.

Department of Trade and Industry. (2004). Succeeding through innovation, creating competitive advantage through innovation: A guide for small and medium scale business. London: Department of Trade and Industry.

Devaraj, S., & Kohli, R. (2003). Performance impacts of information technology: Is actual usage the missing link? *Management Science., 49*(3), 273–289.

DeVellis, R. F. (2003). Scale development: Theory and applications: Applied social research Methods (2nd ed.). London: Sage.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review, 31*(3), 659–669.

Doherty, N. F., & Terry, M. (2009). The role of IS capabilities in delivering sustainable improvements to competitive positioning. *The Journal of Strategic Information Systems*, *18*, 100–116.

Dong, J. Q. (2010). How does information technology enable innovation in supply chains? *Information Systems In ICIS (p. 16)*.

Doz, Y. L. (1996). The evolution of cooperation in strategic alliances: Initial conditions or learning processes. *Strategic Management Journal*, *17*, 55–83.

Durmusoglu, S. S., Calantone, R. F., & Sambamurthy, V. (2006). Is more information technology better for new product development? *Journal of Product & Brand Management*, *15*(7), 435–441.

Dussauge, P., Garrette, B., & Mitchell, W. (2000). Learning from competing partners: Outcomes and duration of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal*, *21*(2), 99–126.

Duysters, G., & de Man, A.-P. (2005). Collaboration and innovation: A review of the effects of mergers, acquisitions and alliances on innovation. *Technovation, 25*(12), 1377–1387.

Dyer, J. H., & Hatch, N. W. (2006). Relation-specific capabilities and barriers to knowledge transfers: Creating advantage through network relationships. *Strategic Management Journal, 27*(8), 701–719.

Easterby-Smith, M., Lyles, M. A., & Peteraf, M. A. (2009). Dynamic capabilities: Current debates and future directions. *British Journal of Management, 20*(s1), S1-S8.

Edquist, C. (1997) Systems of Innovation: Technologies, Institutions and Organizations. London: Routledge.

Eisenhardt, K. (1989). Making fast strategic decision in high-velocity environments. *Academy of Management Journal, 32*(3), 543–576.

Eisenhardt, K., & Martin, J. (2000). Dynamic capabilities: What are they? *Strategic Management Journal, 21*, 1105–1121.

Eisenhardt, K. M., C. B. Schoonhoven (1996). Resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science, 7*(2), 136-150.

Ernst, D. (2002). Global production networks and the changing geography of innovation systems. Implications for developing countries. *Economics of Innovation and New Technology, 11*(6), 497-523.

Faems, D., Van Looy, B., & Debackere, K. (2005). Interorganizational collaboration and innovation: Toward a portfolio approach. *Journal of Product Innovation Management, 22*(3), 238–250.

Fang, S. R., Chou, C. H., Yang, S. M., & Ou, C. C. (2012). Enhancing innovation through learning: the roles of market orientation and interorganizational knowledge stores. *Technology Analysis & Strategic Management, 24*(3), 285-298.

Feeny, D. F., & Ives, B. (1990). In search of sustainability: Reaping long-term advantage from investments in information technology. *Journal of Management Information Systems, 7,* 27–46.

Ferrier, W. J. (2001). Navigating the competitive landscape: The drivers and consequences of competitive aggressiveness. *Academy of Management Journal*, *44*(4), 858–877.

Ferrier, W. J., Smith, K. G., & Grimm, C. M. (1999). The role of competitive action in market share erosion and industry dethronement: A study of industry leaders and challengers. *Acad. Management Journal., 42*(4) 372–388.

Fischer, M. M., Varga A. (2002). Technological innovation and interfirm cooperation: an exploratory analysis using survey data from manufacturing firms in the metropolitan region of Vienna. *International Journal of Technology Management, 24*(7), 724-742.

Field, A. (2009). Discovering statistics using SPSS (3rd ed.). London: Sage Publications.

Fink, L. (2010). How do IT capabilities create strategic value? Toward greater integration of insights from reductionistic and holistic approaches. *European Journal of Information Systems, 20*(1), 16-33.

Finkelstein, S., & Haleblian, J. (2002). Understanding acquisition performance: The role of transfer effects. *Organization Science, 13*(1), 36–47.

Flatten, T. C., Engelen, A., Zahra, S. A., & Brettel, M. (2011). A measure of absorptive capacity: Scale development and validation. *European Management Journal*, *29*(2), 98–116.

Fleming, L. (2001). Recombinant uncertainty in technological search. *Management Science, 47*(1), 117–132.

Floyd, S. W., & Lane, P. J. (2000). Strategizing throughout the organization: Managing role conflict in strategic renewal. *Academy of Management Review, 25*(1), 154-177.

Flynn, M., Dooley, L., O'Sullivian, D., & Cormican, K. (2003). Idea management for organizational innovation. *International Journal of Innovation Management*, *7*(4), 417–442.

Forbes, D. P., & Milliken, F. J. (1999). Cognition and corporate governance: Understanding boards of directors as strategic decision-making groups. *Academy of Management Review, 24*(3), 489-505.

Fosfuri, A., & Tribó, J. A. (2008). Exploring the antecedents of potential absorptive capacity and its impact on innovation performance. *Omega*, *36*, 173–187.

Foster, R., & Kaplan, S. (2001). Creative destruction: Why companies that are built to last underperform the market—and how to successfully transform them. New York: Currency.

Francis, J., & Collins-Dodd, C. (2000). The impact of firms' export orientation on the export performance of high-tech small and medium-sized enterprises. *Journal of International Marketing, 8*(3), 84–103.

Freeman, C., (1988). Japan: a new national system of innovation. In: Dosi, et al. (Eds.), Technical Change and Economic Theory. London: Francis Pinter, 330–348.

Freeman, C. (1995). The 'National System of Innovation'in historical perspective. *Cambridge Journal of economics, 19*(1), 5-24.

Freeman, C., & Soete, L. (1997). The Economics of Industrial Innovation (3rd ed.). Abingdon: Routledge.

Frenz, M., & Ietto-Gillies, G. (2009). The impact on innovation performance of different sources of knowledge: Evidence from the UK Community Innovation Survey. *Research Policy*, *38*(7), 1125-1135.

Galliers, R. (2007). Strategizing for agility: Confronting information systems inflexibility in dynamic environments. In K. C. Desouza (Ed.), *Agile information systems* (1-15). New York: Butterworth-Heinemann.

Galunic, D. C., & Eisenhardt, K. M. (1996). The evolution of intracorporate domains: Divisional charter losses in high-technology, multidivisional corporations. *Organization Science, 7*(3), 255–282.

Gamlin, J. N., Yourd, G., & Patrick, V. (2007). Unlock creativity with 'active' idea management. *Research Technology Management*, *50*(1), 13–16.

Garud, R., P. R. Nayyar. 1994. Transformative capacity: Continual structuring by intertemporal technology transfer. *Strategic Management Journal, 15*(5), 365-385.

Gassmann, O. (2006). Opening up the innovation process: Towards an agenda. *R&D Management*, *36*(3), 223–228.

Gattiker, T. F., & Goodhue, D. L. (2005). What happens after ERP implementation: understanding the impact of interdependence and differentiation on plant-level outcomes. *MIS quarterly, 29*(3), 559-585.

Gemünden, H. G., Heydebreck, P., & Herden, R. (1992). Technological interweavement: a means of achieving innovation success. *R&D Management, 22*(4), 359-376.

Gemünden, H. G., Ritter, T., & Heydebreck, P. (1996). Network configuration and innovation success: An empirical analysis in German high-tech industries. *International Journal of Research in Marketing, 13*(5), 449-462.

George, G. (2005). Learning to be capable: Patenting and licensing at the Wisconsin Alumni Research Foundation 1925–2002. *Industrial and Corporate Change*, *14*, 119–151.

Geroski, P. (2000). Models of technology diffusion. *Research Policy, 29*(4), 603–626.

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal, 47*(2), 209–226.

Global innovation index (2013). Retrieved from: www.globalinnovationindex.org/content.aspx?page=gii-full-report-2013#pdfopener

Gnyawali, D. R., & Srivastava, M. K. (2013). Complementary effects of clusters and networks on firm innovation: A conceptual model. *Journal of Engineering and Technology Management, 30*(1), 1–20.

Goffin, K., & Mitchell, R. (2005). *Innovation management: Strategy and implementation using the pentathlon framework* (2nd ed.) Palgrave Macmillan.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), 185–214.

Gomes-Casseres, B., Hagedoorn, J., & Jaffe, A. B. (2006). Do alliances promote knowledge flows? *Journal of Financial Economics, 80*(1), 5–33.

Goodman, P. S., & Darr, E. D. (1996). Exchanging best practices through computer-aided systems. *The Academy of Management Executive, 10*(2), 7-18.

Gosain, S., Malhotra, A., & El Sawy, O. A. (2004). Coordinating for flexibility in e-business supply chains. *Journal of Management Information Systems, 7*(3), 7–45.

Grandori, A. (1997). An Organizational assessment of interfirm coordination Modes. *Organization Studies, 18*(6), 897 -925.

Grandori, A., G. Soda. (1995). Inter-firm networks: Antecedents, mechanisms and forms. *Organization Studies, 16*(2), 183 -214.

Granstrand, O. (1998). Towards a theory of the technology-based firm. *Research Policy, 27*(5), 465–489.

Grant, R. M., & Baden-Fuller, C. (2004). A knowledge accessing theory of strategic alliances. *Journal of Management Studies, 41*(1), 61–84.

Gupta, A. K., & Govindarajan, V. (2000). Knowledge flows within multinational corporations. *Strategic management journal, 21*(4), 473-496.

Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The interplay between exploration and exploitation. *Academy of Management Journal, 49*(4), 693–706.

Hagedoorn, J., G. Duysters. (2002). External sources of innovative capabilities: The preferences for strategic alliances or mergers and acquisitions. *Journal of Management Studies, 39*(2), 167-188.

Hagedoorn, J., & Schakenraad, J. (1994). The effect of strategic technology alliances on company performance. *Strategic Management Journal, 15*(4), 291–309.

Hagel, J. (2002). Out of the box. Boston: Harvard Business School Press.

Hair, J. F., Black, W. C., & Babin, B. J. (2010). Multivariate data analysis: A global perspective. Pearson Education Ltd.

Haleblian, J., & Finkelstein, S. (1999). The influence of organizational acquisition experience on acquisition performance: A behavioral learning perspective. *Administrative Science Quarterly, 44*(1), 29–56.

Hamel, G. (1991). Competition for competence and inter-partner learning within international strategic alliances. *Strategic Management Journal, 12,* 83–103.

Hamel, G., & Getz, G. (2004). Funding growth in an age of austerity. *Harvard Business Review, 82*(7–8), 76–84.

Han, J. K., Kim, N., & Srivastava, R. K. (1998). Market Orientation and Organizational Performance: Is Innovation a Missing Link?. *The Journal of Marketing, 62*(4), 30-45.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organizational subunits. *Administrative Science Quarterly*, *44*, 82–111.

Hansen, M. T., & Birkinshaw, J. (2007). The innovation value chain. *Harvard Business Review,. 85*(6), 121–130.

Harris, L., Coles, A.M. Dickson, K. (2000). Building innovation networks: Issues of strategy and expertise. *Technology Analysis & Strategic Management, 12*(2), 229-241.

Harry, M.J. & Schroeder, R. (2000). Six sigma: The breakthrough management strategy revolutionizing the world's top corporations. Currency: New York

Häusler, J., Hohn, H.W., Lütz, S. (1994). Contingencies of innovative networks: A case study of successful interfirm R & D collaboration. *Research Policy, 23*(1), 47-66.

He, Z. L., & Wong, P. K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science, 15*(4), 481–494.

Helfat, C. E., & Peteraf, M. A. (2003). The dynamic resource-based view: Capability lifecycles. *Strategic Management Journal*, *24*, 997–1010.

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J., & Winter, S. G. (2007). *Dynamic capabilities: Understanding strategic change in organizations*. Malden, MA: Blackwell Publishing.

Henard, D.H., & Szymanski, D.M. (2001). Why some new products are more successful than others. *Journal of Marketing Research, 38*(3), 362–75.

Henderson, R. (1994). Managing Innovation in the Information Age. *Harvard Business Review* 72(1), 100-106.

Henderson, R., & Clark, K. (1990). Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly, 35*, 9–31.

Hing, P. P., Yip, M. W., & Lau, D. (2013). An investigation into critical success factors of knowledge management implementation in TQM organizations in Malaysia. *International Journal of Customer Relationship Marketing and Management*, *4*(1), 41-52.

Hirschheim, R., & Sabherwal, R. (2001). Detours in the path toward strategic information systems alignment. *California Management Review., 44*(1), 87–108.

Hitt, M., Keats, B., & DeMarie, S. (1998). Navigating in the new competitive landscape: Building strategic flexibility and competitive advantage in the 21st century. *Academy of Management Executive, 12*(4), 22–41.

Holsapple, C. W., & Joshi, K. D. (2002). Knowledge manipulation activities: Results of a Delphi study. *Information Management, 39*(6), 477–490.

Holsapple, C. W., & Singh, M. (2003). The knowledge chain model: Activities for competitiveness. Expert systems with applications, *20(*1), 77-98.

Hong, P., Doll, W. F., Nahm, A. Y., & Li, X. (2004). Knowledge sharing in integrated product development. *European Journal of Innovation Management*, *7*(2), 102–112.

Hotho, J., Becker-Ritterspach, F., & Saka-Helmhout, A. (2010). Enriching absorptive capacity through social interaction. *British Journal of Management, 23*(3), 383-401.

Huang, C. J., & Liu, C. J. (2005). Exploration for the relationship between innovation, IT and performance. *Journal of Intellectual Capital, 6*(2), 237–252.

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science, 2*(1), 88–115.

Huggins, R., & Strakova, L. (2012). Knowledge-based economic development in emerging regions: policy issues and implications in the Balkan Peninsula. *Regional Studies*, *46*(7), 961-975.

Hughes, M., Martin, S. L., Morgan, R. E., & Robson, M. J. (2010). Realizing product-market advantage in high-technology international new ventures: The mediating role of ambidextrous innovation. *Journal of International Marketing*, *18*(4), 1-21.

Hult, G. T. M., & Ketchen D. J. K. (2001). Does market orientation matter?: A test of the relationship between positional advantage and performance. *Strategic Management Journal, 22*(9), 899–906.

Iansiti, M., & Clark, K. B. (1994). Integration and dynamic capability: Evidence from product development in automobiles and mainframe computers. *Industrial and Corporate Change, 3*, 557–605.

Ibrahim, M. A. (2013). Financial development and economic growth in Saudi Arabian economy. *Applied Econometrics and International Development*, *13(1)*, 133–144.

Inauen, M., & Schenker-Wicki, A. (2011). The impact of outside-in open innovation on innovation performance. *European Journal of Innovation Management, 14*(4), 496–520.

Inkpen, A. C., & Tsang, E. W. K. (2008). Learning and strategic alliances. *Academy of Management Annals, 1*, 479–512.

Iqbal, A. (2011). Creativity and innovation in Saudi Arabia: An overview. *Innovation: Management, policy & practice*, *13*(3), 376–390.

Ireland, R. D., Hitt, M. A., Camp, S. M., & Sexton, D. L. (2001). Integrating entrepreneurship and strategic management actions to create firm wealth. *Academy of Management Executive, 15*(1), 49–63.

Jaffe, A. B, Trajtenberg, M., & Fogarty, M. S. (2000). Knowledge spillovers and patent citations: Evidence from a survey of inventors. *American Economic Review, 90*(2), 215–218.

Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1993). Geographic localization of knowledge spillovers as evidenced by patent citations. *Quarterly Journal of Economics, 108*(3), 577–598.

Jansen, J. J. P., Bosch, F. A. J., & Volberda, H. W. (2005). Managing potential and realized absorptive capacity: How do organizational antecedents matter? *Academy of Management Journal, 48*(6), 999–1015.

Jansen, J. J., Tempelaar, M. P., Van den Bosch, F. A., & Volberda, H. W. (2009). Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization Science, 20*(4), 797–811.

Jaworski, B. J., & Kohli, A. K. (1993). Market orientation: Antecedents and consequences. *The Journal of Marketing, 57*(3), 53–70.

Jick, T. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly, 24*(4), 602–611.

Jimenez-Jimenez, D., Valle, R. S., & Hernandez-Espallardo, M. (2008). Fostering innovation: The role of market orientation and organizational learning. *European Journal of Innovation Management*, *11*(3), 389–412.

Johnson, R., Onwuegbuzie, A., & Turner, L. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*(2), 112–133.

Joshi, K. D., Chi, L., Datta, A., & Han, S. (2010). Changing the competitive landscape: Continuous innovation through IT-enabled knowledge capabilities. *Information Systems Research, 21*(3), 472-495.

Kaplan, S., & Henderson, R. (2005). Inertia and incentives: Bridging organizational economics and organizational theory. *Organization Science, 16*(5), 509–521.

Karim, S. (2009). Business unit reorganization and innovation in new product markets. *Management Science*, *55*, 1237–1254.

Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal, 45*(6), 1183–1194.

Kearns, G. S., & Lederer, A. (2003). A resource-based view of strategic it alignment: How knowledge sharing creates competitive advantage. *Decision Sciences, 34*(1), 1–29.

Kearns, G. S., & Sabherwal, R. (2007). Strategic alignment between business and information technology: A knowledge- based view of behaviors, outcome, and consequences. *Journal of Management Information Systems, 23*(3), 129–162.

Ketelhohn, N. (2006). The role of clusters as sources of dynamic externalities in the US semiconductor industry. *Journal of Economic Geography, 6*(5), 679.

Keupp, M. M., Palmié, M., & Gassmann, O. (2012). The strategic management of innovation: A systematic review and paths for future research. *International Journal of Management Reviews*, *14*(4), 367–390.

Khilji, S. E., Mroczkowski, T., & Bernstein, B. (2006). From invention to innovation: Toward developing an integrated innovation model for biotech firms. *Journal of Product Innovation Management*, *23*(6), 528-540.

Kibbeling, M., der Bij, H., & Weele, A. (2013). Market orientation and innovativeness in supply chains: Supplier's impact on customer satisfaction. *Journal of Product Innovation Management, 30(3),* 500-515.

Kim, G., Shin, B., Kim, K. K., & Lee, H. G. (2011). IT capabilities, process-oriented dynamic capabilities, and firm financial performance. Journal of the Association for Information Systems, 12(7), 487-517

Kim, J. (1997). From imitation to innovation: The dynamics of Korea's technological learning. Cambridge, MA: Harvard Business School Press.

Kim, L. (1997). The dynamics of Samsung's technological learning in semiconductors. *California Management Review, 39*(3), 86–100.

Kirner, E., Kinkel, S., & Jaeger, A. (2009). Innovation paths and the innovation performance of low-technology firms: An empirical analysis of German industry. *Research Policy*, *38*(3), 447–458.

Kirzner, I. M. (1978). Competition and entrepreneurship. University of Chicago Press.

Knight, G. A., & Cavusgil, S. T. (2004). Innovation, organizational capabilities, and the born-global firm. *Journal of International Business Studies, 35*(2), 124–141.

Ko, D. G., Kirsch, L. J., & King, W. R. (2005). Antecedents of knowledge transfer from consultants to clients in enterprise system implementations. *MIS Quarterly, 29*(1), 59–85.

Koellinger, P. (2008). The relationship between technology, innovation, and firm performance: Empirical evidence from e-business in Europe. *Research Policy, 37*(8), 1317-1328.

Kogut, B. (1985). Designing global strategies: Profiting from operational flexibility. *Sloan Management Review, 27*(1), 195-213.

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science, 3*(3), 383–397.

Kohli, A. K., Jaworski, B. J., & Kumar, A. (1993). MARKOR: A measure of market orientation. *Journal of Marketing Research, 30(4)*, 467–477.

Kohli, R., & Devaraj, S. (2003). Measuring information technology payoff: A meta-analysis of structural variables in firm-level empirical research. *Information Systems Research, 14*(2), 127–145.

Koka, B.J., Madhavan, R., Prescott, J.H., (2006). The evolution of interfirm networks: Environmental effects on patterns of network change. *Academy of Management Review, 31*(3), 721–737.

Kollmann, T., Kuckertz, A. and Stöckmann, C. (2007) Keeping the dream alive – ambidextrous management and entrepreneurial growth companies, *Paper Presented at the Academy of Management Annual Meeting*, Philadelphia, PA.

Komninos, N. (2008). *Intelligent cities and globalisation of innovation networks* (1st ed.). Routledge Taylor & Francis.

Konsynski, B. R., & McFarlan, F. W. (1990). Information partnerships-shared data, shared scale. *Harvard Business Review, 68*(5), 114-120.

Kostopoulos, K., Papalexandris, A., Papachroni, M., & Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research*, *64*, 1335–1343.

Lagendijk, A. (1999). Good practices in SME Cluster initiatives: Lessons from the 'Core' regions and beyond. (Research Report). *Centre for Urban and Regional Development Studies*, University of Newcastle, Retrieved from: www.ru.nl/publish/pages/514805/lag99-adapt2.pdf

Lagendijk, A., & Lorentzen, A. (2007). Proximity, knowledge and innovation in peripheral regions. On the intersection between geographical and organizational proximity. *European Planning Studies*, *15*, 457–466.

Lane, P. J., & Lubatkin, M. H. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal, 19*(5), 461–477.

Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review, 31*(4), 833–863.

Lane, P. J., Salk, J. E., & Lyles, M. A. (2001). Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal, 22*(12), 1139–1161.

Laurindo, F. J. B., & Carvalho, M. M. (2005). Changing product development process through information technology: A Brazilian case. *Journal of Manufacturing Technology Management, 16*(3), 312–327.

Laursen, K., & Foss, N. J. (2003). New human resource management practices, complementarities and the impact on innovation performance. *Cambridge Journal of Economics*, *27*(2), 243–263.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovative performance among UK manufacturing firms. *Strategic Management Journal*, *27*(2), 131–150.

Lavie, D., & Rosenkopf, L. (2006). Balancing exploration and exploitation in alliance formation. *Academy of Management Journal*, *49*(4), 797–818.

Lavie, D., Kang, J., & Rosenkopf, L. (2011). Balance within and across domains: The performance implications of exploration and exploitation in alliances. *Organization Science*, *22*(6), 1517-1538.

Leana, C. R., & Barry, B. (2000). Stability and change as simultaneous experiences in organizational life. *The Academy of Management Review, 25*, 753–759.

Lee, J. D., Han, J. S., & Baek, C. W. (2010). Impact of R&D intensity on the firm growth: Evidence from Korean manufacturing firms. *In Technology Management for Global Economic Growth (PICMET),* 2010 Proceedings of PICMET'10: (1-7). IEEE.

Lee, Z., & Lee, J. (2000). An ERP implementation case study from a knowledge transfer perspective. *Journal of information technology, 15*(4), 281-288.

Lee, J. N. (2001). The impact of knowledge-sharing, organizational capability and partnership quality on IS outsourcing success. *Information and Management, 38*(5), 323–335.

Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, *31*(2), 224–236.

Leonard-Barton, D. (1995). Wellsprings of knowledge: Building and sustaining the source of innovation. Cambridge, MA: Harvard Business School Press.

Levin, D. Z., & Cross, R. (2004). The strength of weak ties you can trust: The mediating role of trust in effective knowledge transfer. *Management Science, 50*(11), 1477–1490.

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic management journal, 14(S2)*, 95-112.

Li, Y., Zhou, N., & Si, Y. (2010). Exploratory innovation, exploitative innovation, and performance: Influence of business strategies and environment. *Nankai Business Review International*, *1*, 297–316.

Liebeskind, J. P., A. L. Oliver, L. Zucker, M. Brewer. (1996). Social networks, learning, and flexibility: Sourcing scientific knowledge in new biotechnology firms. *Organization Science, 7*(4), 428-443.

Lichtenthaler, U. (2009). Absorptive capacity, environmental turbulence, and the complementarity of organizational learning processes. *Academy of Management Journal, 52*, 822–846.

Lichtenthaler, U., & Lichtenthaler, E. (2009). A capability-based framework for open innovation: Complementing absorptive capacity. *Journal of Management Studies, 46*(8), 1315–1338.

Lin, C., Wu, Y. J., Chang, C., Wang, W., & Lee, C. Y. (2012). The alliance innovation performance of R&D alliances—the absorptive capacity perspective. *Technovation, 32*(5), 282-292.

Link, A. N., Siegel, D. S., & Bozeman, B. (2006). An empirical analysis of the propensity of academics to engage in informal university technology transfer. *Industrial and Corporate Change*, *16*(4), 641–655.

Liyanage, S. (1995). Breeding innovation clusters through collaborative research networks. *Technovation, 15*(9), 553-567.

Lu, Y., & Ramamurthy, K. (2011). Understanding the link between information technology capability and organizational agility: An empirical examination. *MIS Quarterly, 35*(4), 931-954.

Lubatkin, M. H., Simsek, Z., Ling, Y., & Veiga J. F. (2006). Ambidexterity and performance in small- to medium-sized firms: The Pivotal role of top management team behavioral integration. *Journal of Management, 32*(5), 646–672.

Lundvall, B.A. (1992). National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London: Pinter Publishers.

Lyytinen, K., Mathiasen, L. and Ropponen, J. (1998). Attention Shaping and Software Risk – A categorical analysis of four classical risk management approaches, *Information Systems Research 9*(3), 233–255.

Lyytinen, K., Newman, M., & Al-Muharfi, A. R. A. (2009). Institutionalizing enterprise resource planning in the Saudi steel industry: A punctuated socio-technical analysis. *Journal of Information Technology, 24(4)*, 286-304.

MacCormack, A., Verganti, R., & Iansiti, M. (2001). Developing products 'internet time': The anatomy of a flexible development process. *Management Science, 47*(1), 133–150.

Macher, J. T., & Mowery, D. C. (2009). Measuring dynamic capabilities: practices and performance in semiconductor manufacturing. *British Journal of Management, 20*(s1), S41-S62.

Madsen, T. K., & Servais, P. (1997). The internationalization of born globals: An evolutionary process*? International Business Review, 6*(6), 561–583.

Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal, 13*(5), 363–380.

Makadok, R. 2001. Toward a synthesis of the resource-based and dynamic-capability views of rent creation. *Strategic Management Journal, 22*(5), 387-401.

Malhotra, A., Gosain, S., & El Sawy, O. A. (2005). Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation. *MIS Quarterly, 29*(1), 145–187.

Malhotra, A., Gosain, S., & El Sawy, O. A. (2007). Leveraging Standard Electronic Business Interfaces to Enable Adaptive Supply Chain Partnerships. *Information Systems Research, 18*(3), 260–279.

March, J. G. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science, 2*(1), 71–87.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing—The business perspective. *Decision Support Systems*, *51*, 176–189.

Martinez-Roman, J. A., Gamero, J., & Tamayo, J. A. (2011). Analysis of innovation in SMEs using an innovative capability-based non-linear model: A study in the province of Seville (Spain). *Technovation*, *31*(9), 459–475.

Marwaha, S., & Willmot, P. (2006). Managing IT for scale, speed, and innovation. *McKinsey Quarterly, 3*, 1–8.

Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource- based analysis. *MIS Quarterly, 4*, 487–505.

Matusik, S. F., Heeley, M. B. (2005). Absorptive capacity in the software industry: identifying dimensions that affect knowledge and knowledge creation activities. *Journal of Management 31*(4), 549 -572.

McCann, B. T., & Folta, T. B. (2011). Performance differentials within geographic clusters. *Journal of Business Venturing, 26*(1), 104–123.

Melville, N., Kraemer, K., & Gurbaxani, V. (2004). Review: Information technology and organizational performance: An integrative model of it business value. *MIS Quarterly, 28*(2), 283–322.

Meyer, C. B., & Stensaker, I. G. (2006). Developing capacity for change. *Journal of Change Management, 6*, 217–231.

Mihalache, O. R., Jansen, J. J., Van Den Bosch, F. A., & Volberda, H. W. (2012). Offshoring and firm innovation: The moderating role of top management team attributes. *Strategic Management Journal, 33*(13), 1480-1498.

Min, S., Song, S., & Keebler, J. S. (2002). An Internet-mediated market orientation (IMO): Building a theory. *Journal of Marketing Theory and Practice*, *10*(2), 1-11.

Mingers, J. (2001). Combining IS research methods: Towards a pluralist methodology. *Information Systems Research, 12*(3), 240–259.

Modon: Saudi Industrial Property Authority (2013). About MODON. Retrieved from: http://www.modon.gov.sa/english/aboutus/strategy/pages/default.aspx

Morris, M.H., Kuratko, D.F. and Covin, J.G. (2008), Corporate Entrepreneurship and Innovation, South-Western Cengage Learning, Mason, OH.

Morse, J., & Mitcham, C. (2002). Exploring qualitatively derived concepts: Inductive-deductive methods. *International Journal of Qualitative Methods, 1*(4), 1–18.

Mowery, D. C., & Oxley, J. E. (1995). Inward technology transfer and competitiveness: The role of national innovation systems. *Cambridge Journal of Economics., 19*(1), 67–93.

Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1996). Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, *17*, 77–91.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review, 23*(2), 242–266.

Nambisan, S. (2003). Information systems as a reference discipline for new product development. *MIS Quarterly, 27*(1), 1–18.

Nerkar, A., & Shane, S. (2007). Determinants of invention commercialization: An empirical examination of academically sourced inventions. *Strategic Management Journal, 28*(11), 1155-1166.

Nau, D. (1995). Mixing methodologies: Can bimodal research be a viable post-positivist tool? *The Qualitative Report, 2*(3), 1–5.

Nelson, R.R. (1993). National Systems of innovation: A comparative analysis. Oxford: Oxford University Press.

Nelson, K. M., & Ghods, M. (1998). Measuring technology flexibility. *European Journal of Information Systems, 7*(4), 232–240.

Nelson, R. R., & Winter, S. G. (1982). An evolutionary theory of economic change. Cambridge, MA: Belknap Press, Harvard University Press.

Netemeyer, R. G., Bearden, W. O., & Shama, S. (2003). *Scaling procedures: Issues and applications.* Thousand Oaks, CA: Sage.

Nevo, S., & Wade, M. (2011). Firm-level benefits of IT-enabled resources: A conceptual extension and an empirical assessment. *The Journal of Strategic Information Systems*, *20*, 403–418.

Nieto, M. J., & Santamaria, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation, 27*(3), 367–377.

Nonaka, I. N., & Konno, N. (1998). The Concept of 'Ba': Building a Foundation for Knowledge Creation. *California Management Review, 40*(3), 40–54.

Nooteboom, B., Vanhaverbeke, W., Duysters, G., Gilsing, V., & van den Oord, A. (2007). Optimal cognitive distance and absorptive capacity. *Research Policy, 36*(7), 1016–1034.

Nunnally, J. (1978). Psychometric theory (2nd ed.). New York: McGraw-Hill.

O'Connor, G.C. (2008). Major innovation as a dynamic capability: A systems approach. *Journal of Product Innovation Management*, *25*(4), 313–330.

O'Reilly, C. A., & Tushman, M. L. (2004). The ambidextrous organization. *Harvard Business Review, 82*(4), 74–81, 140.

O'Reilly, C. A., & Tushman, M. L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in Organizational Behavior, 28*(0), 185–206.

Oh, W., & Pinsonneault, A. (2007). On the assessment of the strategic value of information technologies: Conceptual and analytical approaches. *MIS Quarterly, 31*(2), 239–265.

Onsman, A. (2010). Dismantling the perceived barriers to the implementation of national higher education accreditation guidelines in the Kingdom of Saudi Arabia. *Journal of Higher Education Policy and Management*, *32*, 511–519.

O'Regan, N., A. Ghobadian, M. Sims. (2006). Fast tracking innovation in manufacturing SMEs. *Technovation 26*(2), 251-261.

Overby, E., Bharadwaj, A., & Sambamurthy, V. (2006). Enterprise agility and the enabling role of information technology. *European Journal of Information Systems, 15*, 120–131.

Oxley, J., Wada, T. (2009). Alliance structure and the scope of knowledge transfer: Evidence from U.S.- Japan agreements. *Management Science, 55*(4), 635–649.

Pallant, J. (2011). SPSS survival manual: A step by step guide to data analysis using SPSS (4th ed.). Open University Press.

Patnayakuni, R., Rai, A., & Seth, N. (2006). Relational antecedents of information flow integration for supply chain coordination. *Journal of Management Information Systems, 23*(1), 13–49.

Patton, M. (2002). Qualitative research and evaluation methods. Thousand Oaks, CA: Sage Publications.

Pavlou, P. A., & El Sawy, O. A. (2006). From IT Leveraging competence to competitive advantage in turbulent environments: The case of new product development. *Information Systems Research, 17*(3), 198–227.

Payne, G., & Payne, J. (2004). *Key concepts in social research.* London: Sage.

Perez, M. P., Sanchez. A. M. (2002). Lean Production and Technology Networks in the Spanish Automotive Supplier Industry. MIR: Management International Review 42(3), 261-277.

Perez-Nordtvedt, L., Kedia, B. L., Datta, D.K., & Rasheed, A. A. (2008). Effectiveness and efficiency of cross-border knowledge transfer: An empirical examination. *Journal of Management Studies, 45*(4), 714–744.

Peter, J.P. (1979). Reliability: A review of psychometric basics and recent marketing practices. *Journal of Marketing Research, 16*(1), 6–17.

Phelps, C.C. (2010). A longitudinal study of the influence of alliance network structure and composition on firm exploratory innovation. *Academy of Management Journal, 53*(4), 890-913.

Piergiovanni, R., & Santrelli, E. (2001), Patents and geographic localization of R&D slipovers in french manufacturing. *Regional Studies, 35*(8), 697–207.

Pinsonneault, A., & Kraemer, K. L. (2002). Exploring the role of IT in organizational downsizing: A tale of two American cities. *Organization Science, 13*(2), 191–208.

Pinsonneault, A., & Rivard, S. (1998). Information technology and the nature of managerial work: From the productivity paradox to the Icarus paradox? *MIS Quarterly, 22*(3), 287-311.

Pittaway, L., M. Robertson, K. Munir, D. Denyer, A. Neely. (2004). Networking and innovation: a systematic review of the evidence. *International Journal of Management Reviews, 5*(3), 137-168.

Podolny, J. M., Stuart, T. E., & Hannan, M. T. (1996). Networks, knowledge, and niches: Competition in the worldwide semiconductor industry, 1984–1991. *American Journal of Sociology, 102*(3), 659–689.

Popadiuk, S., & Choo, C., W. (2006). Innovation and knowledge creation: How are these concepts related? *International Journal of Information Management,* 26(4), 302–312.

Porter, M. E. (1980). *Competitive strategy: Techniques for analyzing industries and competitors.* New York: Free Press.

Porter, M. E. (1990). *The competitive advantage of nations*. Free Press, New York.

Porter, M. E. (1998). Clusters and the new economics of competition. *Harvard Business Review, 76*(6), 77–90.

Porter, M. E., & Stern, S. (2001). Innovation: Location matters. *MIT Sloan Management Review, 42*(4), 28–36.

Porter, M., & Ketels, C. (2003). UK competitiveness: Moving to the next stage. *Management Research Forum, Summary Report*. London: E.S.R.C.

Pouder, R., & St. John, C. (1996). Hot spots and blind spots: Geographical clusters of firms and innovation. *Academy of Management Review, 21(4),* 1192–1225.

Powell, T. C., & Dent-Micaleff, A. (1997). Information technology as competitive advantage: The role of human, business, and technology resources. *Strategic Management Journal, 18*(5), 375–405.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116–145.

Prahalad, C., & Krishnan M. (2002). The dynamic synchronization of strategy and information technology. *Sloan Management Review, 43*(4), 24–33.

Preston, D. S., & Karahanna, E. (2009). Antecedents of IS strategic alignment: A nomological network. *Information Systems Research, 20*(2), 159–179.

Priem, R. L., J. E. Butler (2001). Is the Resource-Based "View" a Useful Perspective for Strategic Management Research?. *The Academy of Management Review 26*(1), 22-40.

Probst, G., & Raisch, S. (2005). Organizational crisis: The logic of failure. *The Academy of Management Executive, 19*(1), 90–105.

Pullen, A. J., Weerd-Nederhof, P. C., Groen, A. J., & Fisscher, O. A. (2012). Open innovation in practice: Goal complementarity and closed NPD networks to explain differences in innovation performance for SMEs in the medical devices sector. *Journal of Product Innovation Management*, *29*(6), 917–934.

Rai, A., Patnayakuni, R., & Seth, N. (2006). Firm performance impacts of digitally enhanced supply chain integration capabilities. *MIS Quarterly, 30*(2), 225–246.

Raisch, S., & Birkinshaw, J. (2008). Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of Management, 34*, 375–409.

Ragatz, G. L., Handfield, R. B, Scannell, T. V. (1997). Success factors for integrating suppliers into new product development. *Journal of Product Innovation Management, 14*(3), 190-202.

Ravichandran, T., Lertwongsatien, C. (2005). Effect of information systems resources and capabilities on firm performance: a resource-based perspective. *Journal of management information systems, 21*(4), 237-276.

Real, J. C., Leal, A., & Roldán, J. L. (2006). Information technology as a determinant of organizational learning and technological distinctive competencies. *Industrial Marketing Management*, *35*(4), 505–521.

Reid, S. E., & De Brentani, U. (2004). The fuzzy front end of new product development for discontinuous innovations: A theoretical model. *Journal of Product Innovation Management*, *21*(3), 170–184.

Rivkin, J. W., & Siggelkow, N. (2003). Balancing search and stability: Interdependencies among elements of organizational design. *Management Science, 49*, 290–311.

Roberts, N., Galluch, P. S., Dinger, M., & Grover, V. (2012). Absorptive capacity and information systems research: Review, synthesis, and directions future research. *MIS Quarterly*, *36*(2), 625–648.

Robey, D., Ross, J. W., & Boudreau, M. C. (2002). Learning to implement enterprise systems: an exploratory study of the dialectics of change. *Journal of Management Information Systems, 19*(1), 17-46.

Rogers, E. M. (1995). *Diffusion of innovation* (4th ed.). New York: The Free Press.

Rosenkopf, L., & Almeida, P. (2003). Overcoming local search through alliances and mobility. *Management Science, 49*(6), 751–766.

Roth, P. L. (1994). Missing data: A conceptual review for applied psychologists. *Personnel psychology*, *47*(3), 537–560.

Sabherwal, R., I. Becerra-Fernandez. (2010). Business Intelligence: Practices, technologies, and management. John Wiley and Sons, Inc., Hoboken, NJ

Sabherwal, R., & Chan, Y. E. (2001). Alignment between business and IS strategies: A study of prospectors, analyzers and defenders. *Information Systems Research, 12*(1), 11–33.

Sabherwal, R., & Sabherwal, S. (2005). Knowledge management using information technology: Determinants of short-term impact on firm value. *Decision Science. 36*(4), 531–567.

Sabherwal, R., Hirschheim, R., & Goles, T. (2001). The dynamics of alignment: Insights from a punctuated equilibrium model. *Organization Science, 12*(2), 179–197.

Sadowski, B., & Duysters, G. (2008). Strategic technology alliance termination: An empirical investigation. *Journal of Engineering and Technology Management*, *25*(4), 305–320.

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly, 27*(2), 237–263.

Sampson, R. C. (2007). R&D alliances and firm performance: The impact of technological diversity and alliance organization on innovation. *Academy of Management Journal, 50*(2), 364–386.

Sanchez, R. (1995). Strategic flexibility in product competition. *Strategic Management Journal*, *16*, 135–59.

Saraf, N., Langdon, C. S., & Gosain, S. (2007). IS application capabilities and relational value in interfirm partnerships. *Information Systems Research, 18*(3), 320–339.

Sarkees, M., Hulland, J., & Prescott, J. (2010). Ambidextrous organizations and firm performance: The role of marketing function implementation. *Journal of Strategic Marketing*, *18*, 165–184.

Saunders, M., Thornhill, A., & Lewis, P. (2007). Research Methods for Business Students (4th ed.). Englewood Cliffs, NJ: Financial Times/ Prentice Hall.

Schildt, H., Keil, T., & Maula, M. (2012). The temporal effects of relative and firm-level absorptive capacity on interorganizational learning. *Strategic Management Journal, 33*, 1154–1173

Schilling, M. A., Vidal, P., Ployhart, R. E., & Marangoni, A. (2003). Learning by doing something else: Variation, relatedness, and the learning curve. *Management Science, 49*(1), 39–56.

Schreyogg, G., M. Kliesch-Eberl. (2007). How dynamic can organizational capabilities be? Towards a dual process model of capability dynamization. *Strategic Management Journal 28*(9), 913-933.

Schumpeter, J. A. (1934). The Theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle. Harvard College: Transaction Publishers.

Scott, J. (2000). Facilitating interorganizational learning with information technology. *Journal of Management Information Systems, 17*(2), 81–113.

Serrano-Bedia, A. M., López-Fernández, M. C., & García-Piqueres, G. (2012). Complementarity between innovation activities and innovation performance: Evidence from Spanish innovative firms. *Journal of Manufacturing Technology Management*, *23*(5), 557–577.

Sharma, D. D., & Blomstermo, A. (2003). The internationalization process of born globals: A network view. *International Business Review*, *12*, 739–753.

Sheremata, W. A. (2000). Centrifugal and centripetal forces in radical new product development under time pressure. *The Academy of Management Review, 25*(2), 389-408.

Shin, J. C., Lee, S. J., & Kim, Y. (2012). Knowledge-based innovation and collaboration: A triple-helix approach in Saudi Arabia. *Scientometrics*, *90*(1), 311–326.

Smith, D. (2010). *Exploring innovation*. Berkshire UK: McGraw-Hill Education.

Smith, W. K., & Tushman, M. L. (2005). Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science, 16*(5), 522-536.

Sofka, W., & Grimpe, C. (2010). Specialized search and innovation performance: Evidence across Europe. *R&D Management*, *40*(3), 310–323.

Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic management journal, Special issue(17)*, 45-62.

Spithoven, A., Clarysse, B., & Knockaert, M. (2011). Building absorptive capacity to organize inbound open innovation in traditional industries. *Technovation*, *31*, 10–21.

Srivardhana, T., & Pawlowski, S. D. (2007). ERP systems as an enabler of sustained business process innovation: A knowledge-based view. *Journal of Strategic Information Systems, 16*(1), 51–69.

Srivastava, M. K., & Gnyawali, D. R. (2011). When do relational resources matter? Leveraging portfolio technological resources for breakthrough innovation. *Academy of Management Journal, 54*(4), 797–810.

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships?. *MIS Quarterly, 28*(1), 45-73.

Sun, P. Y. T., Anderson, M. H.. (2010). An examination of the relationship between absorptive capacity and organizational learning, and a proposed integration. *International Journal of Management Reviews 12*(2), 130-150.

Suzuki, J., & Kodama, F. (2004). Technological diversity of persistent innovators in Japan: Two case studies of large Japanese firms. *Research Policy, 33*(3), 531–549.

Szulanski, G. (1996). Exploring internal stickiness: Impediments to the transfer of best practice within the firm. *Strategic Management Journal, 17*, 27–43.

Tabachnick, B. G., & Fidell, L.S. (2007). Using multivariate statistics (5th ed.). Boston: Pearson Education.

Tallman, S., Jenkins, M., Henry, N., & Pinch, S. (2004). Knowledge, clusters, and competitive advantage. *Academy of Management Review, 29*(2), 258–271.

Tallon, P. P. (2000). A process-oriented assessment of the alignment of information systems and business strategy: Implications for IT business value (Unpublished doctoral dissertation). University of California, Irvine.

Tallon, P. P. (2007). Does IT pay to focus? An analysis of IT Business value under single and multi-focused business strategies. *Journal of Strategic Information Systems, 16*(3), 278–300.

Tallon, P. P. (2008). A process-oriented perspective on the alignment of information technology and business strategy. *Journal of Management Information Systems, 24*(3), 231–272.

Tallon, P. P., & Pinsonneault, A. (2011). Competing perspectives on the link between strategic information technology alignment and organizational agility: Insights from a mediation model. *MIS Quarterly*, *35*(2), 463–484.

Tang, X., & Rai, A. (2012). The moderating effects of supplier portfolio characteristics on the competitive performance impacts of supplier-facing process capabilities. Journal of Operations Management, 30(1), 85-98.

Tarafdar, M., & Gordon, S. R. (2007). Understanding the influence of information systems competencies on process innovation: A resource-based view. *The Journal of Strategic Information Systems, 16*, 353–392.

Tashakkori, A., & Teddlie, C. (1998). Mixed methodology: Combining qualitative and quantitative approaches. London: Sage.

Taylor, A., Greve, H. R. (2006). Superman or the fantastic four? Knowledge combination and experience in innovative teams. *The Academy of Management Journal*, 49(4), 723-740.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28*(13), 1319–1350.

Teece, D.J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*, 509–33.

Tether, B. S., & Tajar, A. (2008). Beyond industry-university links: Sourcing knowledge for innovation from consultants, private research organizations and the public science-base. *Research Policy, 37*(6–7), 1079–1095.

Tidd, J., & Bessant, J. (2011). Managing innovation: integrating technological, market and organizational change. England: John Wiley & Sons.

Timbrell, G., Andrews, N., & Gable, G. (2007). Impediments to inter-firm transfer of best practice in an enterprise systems context. *Australasian Journal of Information Systems, 9*(1), 116-126

Tippins, M. J., & Sohi, R. S. (2003). IT competency and firm performance: Is organizational learning a missing link?. *Strategic Management Journal, 24*, 745–61.

Tiwana, A., & Konsynski, B. (2010). Complementarities between organizational IT architecture and governance structure. *Information Systems Research, 21*(2), 288–304.

Tiwana, A., & McLean, E. R. (2005). Expertise integration and creativity in information systems development. *Journal of Management Information Systems,* 22(1), 13–43.

Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review*, *32*(3), 774–786.

Trippl, M. (2010). Developing cross-border regional innovation systems: Key factors and challenges. Tijdschrift voor economische en sociale geografie, *101*(2), 150-160.

Tomlinson, P. R. (2010). Co-operative ties and innovation: Some new evidence for UK manufacturing. *Research Policy*, *39*(6), 762-775.

Trkman, P., McCormack, K., De Oliveira, M. P. V., & Ladeira, M. B. (2010). The impact of business analytics on supply chain performance. *Decision Support Systems, 49*(3), 318-327.

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal, 44*(5), 996–1004.

Tsai, K. H. (2009). Collaborative networks and product innovation performance: Toward a contingency perspective. *Research Policy, 38*(5), 765-778.

Tushman, M. L., Anderson, P. C., & O'Reilly, C. (1997). Technology cycles, innovation streams, and ambidextrous organizations: Organization renewal through innovation streams and strategic change. *Managing Strategic Innovation and Change*, 3–23.

Tushman, M. L., & O'Reilly, C. A. O. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review, 38*(4), 8–30.

Uyarra, E. (2010). What is evolutionary about 'regional systems of innovation'? Implications for regional policy. *Journal of evolutionary economics, 20*(1) 115-137.

Van den Bosch, F., Volberda, H., & Boer, M. (1999). Coevolution of firm absorptive capacity and knowledge environment: Organizational forms and combinative capabilities. *Organization Science, 10*(5), 551–568.

Vera, D., M. Crossan (2004). Strategic leadership and organizational learning. *The Academy of Management Review, 29*(2), 222-240.

Verona, G., & Ravasi, D. (2003). Unbundling dynamic capabilities: An exploratory study of continuous product innovation. *Industrial and Corporate Change, 12*, 577–606.

Villalonga, B., & McGahan, A. M. (2005). The choice among acquisitions, alliances and divestitures. *Strategic Management Journal, 26*(13), 1183–1208.

Volberda, H. W. (1996). Toward the flexible form: How to Remain vital in hypercompetitive environments. *Organization Science, 7*, 359–374.

Volberda, H. W., & Lewin, A. Y. (2003). Co-evolutionary dynamics within and between firms: From evolution to co-evolution. *Journal of Management Studies, 40*(8), 2105–2130.

Volberda, H., Foss, N., & Lyles, M. (2010). Absorbing the concept of absorptive capacity: How to realize its potential in the organizational field, *Organization Science*, *21*(4), 931–951.

Von Hippel, P. T. (2004). Biases in SPSS 12.0 missing value analysis. *The American Statistician*, *58*(2), 160-164

Vázquez, R., Santos, M. L., & Alvarez, L. I. (2001). Market orientation, innovation and competitive strategies in industrial firms. *Journal of Strategic Marketing, 9*(1), 69-90.

Wade, M., & Hulland, J. (2004). The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly, 28*(1), 107–42.

Wadhwa, A., Kotha, S. (2006). Knowledge creation through external venturing: Evidence from the telecommunications equipment manufacturing industry. *The Academy of Management Journal, 49*(4), 819-835.

Walsh, J. P., & Ungson, G. R. (1991). Organizational memory. *Academy of Management Review, 16*(1), 57-91.

Wang, C. L., Ahmed, P. K., & Rafiq, M. (2008). Knowledge management orientation: Construct development and empirical validation. *European Journal of Information Systems, 17*(3), 219–235.

Wang, L., & Ahmed, K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews, 9*(1), 31–51.

Wang, Y. L., Ellinger, A. D., & Wu, Y. C. J. (2013). Entrepreneurial opportunity recognition: An empirical study of R&D personnel. *Management Decision*, *51*(2), 248–266.

Wang, C. L., & Rafiq, M. (2012). Ambidextrous Organizational Culture, Contextual Ambidexterity and New Product Innovation: A Comparative Study of UK and Chinese High-tech Firms. *British Journal of Management*, *25*(1), 58-76

Weber, R. (2004). The rhetoric of positivism versus interpretivism: A personal view. *MIS Quarterly, 28*(1), iii-xii.

Weill, P., Subramani, M., & Broadbent, M. (2002). Building IT infrastructure for strategic agility. *Sloan Management Review, 44*(1), 57–65.

Welch, L.S., & Luostarinen, R. (1993). Inward and outward connections in internationalization. *Journal of International Marketing, 1*, 46–58.

Westland, P. J. C. (2008). *Global innovation management: A strategic approach*. New York, NY: Palgrave Macmillan.

Whittington, K. B., Owen-Smith, J., & Powell, W. W. (2009). Networks, propinquity, and innovation in knowledge-intensive industries. *Administrative Science Quarterly, 54*(1), 90–122.

Wiggins, R. R., & Ruefli, T. W. (2002). Sustained competitive advantage: Temporal dynamics and the incidence and persistence of superior economic performance. *Organization Science, 13(1)*, 82–105.

Winter, S. G. (2003). Understanding dynamic capabilities. *Strategic Management Journal, 24*(10), 991–995.

Woiceshyn, J., U. Daellenbach. 2005. Integrative capability and technology adoption: evidence from oil firms. *Industrial and Corporate Change, 14(2)* 307 -342.

Wolff, J. A., & Pett, T. L. (2000). Internationalization of small firms: an examination of export competitive patterns, firm size, and export performance. *Journal of Small Business Management, 38*(2), 34-47.

Wren, B. M., Souder, W. E., & Berkowitz, D. (2000). Market orientation and new product development in global industrial firms. *Industrial Marketing Management*, *29*(6), 601-611.

Xu, Q., & Ma, Q. (2008). Determinants of ERP implementation knowledge transfer. *Information and Management, 45*(8), 528–539.

Yin, R. (2009). Case study research: Design and methods (4th ed.). London: Sage Publications.

Zaheer, A., & Venkatraman, N. (1994). Determinants of electronic integration in the insurance industry: an empirical test. *Management science, 40*(5), 549-566.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review, 27*(2), 185–203.

Zahra, S. A., Ireland, R. D., & Hitt, M. A. (2000). International expansion by new venture firms: International diversity, mode of market entry, technological learning, and performance. *Academy of Management Journal, 43*(5), 925–950.

Zahra, S. A., Sapienza, H.J., Davidsson. P. (2006). Entrepreneurship and dynamic capabilities: A review, model and research agenda. *Journal of Management Studies 43*(4), 917-955.

Zeng, S. X., Xie, X. M., & Tam, C. M. (2010). Relationship between cooperation networks and innovation performance of SMEs. *Technovation, 30*(3), 181-194.

Zhang, M., Sarker, S., & Sarker, S. (2008). Unpacking the effect of IT capability on the performance of export-focused SMEs: a report from China. *Information Systems Journal, 18*(4), 357-380.

Zhang, M. J. (2007). An empirical assessment of the performance impacts of IS support for knowledge transfer. *International Journal of Knowledge Management, 3*(1), 66–85.

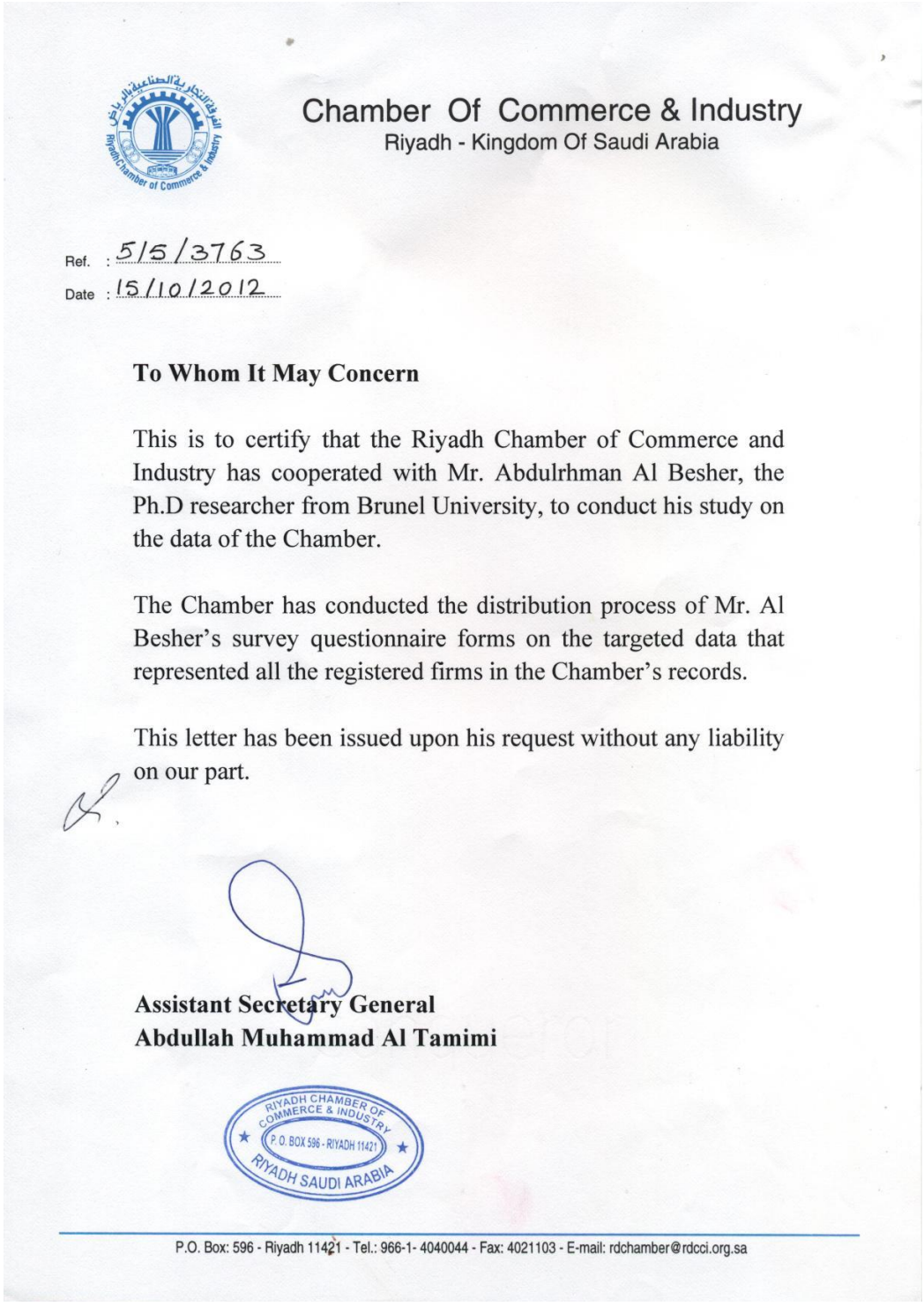
Zhang, M. J. (2011). Firm-level performance impact of IS support for product innovation. *European Journal of Innovation Management, 14*(1), 118–132.

Zhou, K. Z., Yim, C. K., & Tse, D. K. (2005). The effects of strategic orientations on technology- and market-based breakthrough innovations. *Journal of Marketing, 69*(2), 42–60.

Zhou, L., Wu, W., & Luo, X. (2007). Internationalization and the performance of born-global SMEs: The mediating role of social networks. *Journal of International Business Studies, 38*(4), 673–690.

Zott, C. (2003). Dynamic capabilities and the emergence of intraindustry differential firm performance: insights from a simulation study. *Strategic Management Journal 24*(2), 97-125.

Appendix A: Letter of Approval from The Riyadh Chamber of Commerce and Industry



Chamber Of Commerce & Industry
Riyadh - Kingdom Of Saudi Arabia

Ref. : 515/3763
Date : 15/10/2012

To Whom It May Concern

This is to certify that the Riyadh Chamber of Commerce and Industry has cooperated with Mr. Abdulrhman Al Besher, the Ph.D researcher from Brunel University, to conduct his study on the data of the Chamber.

The Chamber has conducted the distribution process of Mr. Al Besher's survey questionnaire forms on the targeted data that represented all the registered firms in the Chamber's records.

This letter has been issued upon his request without any liability on our part.

Assistant Secretary General
Abdullah Muhammad Al Tamimi

RIYADH CHAMBER OF COMMERCE & INDUSTRY
P. O. BOX 596 - RIYADH 11421
RIYADH SAUDI ARABIA

P.O. Box: 596 - Riyadh 11421 - Tel.: 966-1- 4040044 - Fax: 4021103 - E-mail: rdchamber@rdcci.org.sa

Appendix B: Survey Questionnaire

Survey on Innovation Performance in Saudi Firms

Survey on Innovation Performance in Saudi Firms

هذا الاستبيان هو جزء من دراسة الدكتوراه لباحث في جامعة برونيل البريطانية. تم تصميم هذه الاستبانة بعناية فائقة لاستيضاح مدى تأثير القدرة المعلوماتية للمنشات التجارية على استقطاب معلومات ومعرفة تساعدها على ابتكار و تطوير منتجاتها وخدماتها. مشاركتك ستستغرق تقريبا **٩ دقائق** وهي محل تقدير وشكر. حيث ان الاستطلاع له قيمة جوهرية لكل من البحوث العلمية والدراسات التجارية. مشاركتك اختيارية و لن يتم نشر اي اسماء لأفراد او شركات في هذه الدراسة

This survey is part of a study conducted by a PhD researcher at Brunel University. The questionnaire is carefully designed to better understand how information technology (IT) can enhance organizations' ability to absorb and utilize new knowledge and enhance their innovation and performance. It will take about **9 minutes** and your contribution is highly appreciated. The results should have practical value for both business and academia. Your participation is strictly voluntarily. The data will be published in an anonymized form in which no organization or individual is identified.

***1. فضلا اختر اللغة التي تناسبك**

Please select the language that you prefer

- ◯ اللغة العربية
- ◯ English

Survey on Innovation Performance in Saudi Firms

(1/4) Organization Profile:

Please select the answer that best describes your organization. Some questions require that you provide financial data.

26. How many employees does your organization have?

- ◯ Less than 10.
- ◯ 10–50.
- ◯ 51–250.
- ◯ 251–500.
- ◯ 501–1,000.
- ◯ More than 1,000.

27. Please select the industry that best describes your business.

- ☐ Advertising and Marketing
- ☐ Agriculture
- ☐ Banking
- ☐ Construction
- ☐ Education
- ☐ Food and Beverage
- ☐ Furniture and Decoration
- ☐ Medical Sector
- ☐ Hotel and Holidays
- ☐ Information Technology (IT)
- ☐ Insurance
- ☐ Other (please specify)
- ☐ Logistic
- ☐ Mining
- ☐ Manufacturing
- ☐ Media and Publishing
- ☐ Oil and Petrochemicals
- ☐ Real Estate
- ☐ Retail
- ☐ Telecom
- ☐ Transportation
- ☐ Utilities

28. How long has your organization been in existence?

- ◯ Less than a year.
- ◯ 1–3 years.
- ◯ 3–5 years.
- ◯ 5–10 years.
- ◯ More than 10 years.

29. What is the market coverage of your organization?

- ◯ International
- ◯ National
- ◯ Regional

Survey on Innovation Performance in Saudi Firms

30. Please indicate your job title.

- ◯ GM/CEO
- ◯ Chief Financial Officer
- ◯ Chief Operations Officer
- ◯ Chief Information Officer/IT Director
- ◯ Other (please specify)

31. Approximately how much of your organization's annual budget is dedicated to research and development (R&D) as a percentage of sales?

%

32. Approximately how much of your organization 's annual budget (in Saudi riyals) is dedicated to information technology (IT), including outsourcing?

SR.

33. During the past three years, what is the performance of introducing the following as a percentage of your total sales ?
(e.g. products new to region is doing about 3% of our total sales)

- Products/services new to the world have achieved %
- Products/services new to Saudi Arabia have achieved %
- Products/services new to your organisation have achieved %
- Improved existing products/services have achieved %

Survey on Innovation Performance in Saudi Firms

(2/4) Networking and Strategy:

Using a scale from 1 to 7, please rate to what extent do you agree with the following statements (1: Not used at all; 7: Very highly used)

34. We use the following as major sources for information and knowledge for innovation activities:

	Not used at all	2	3	4	5	6	Very highly used
Suppliers	◯	◯	◯	◯	◯	◯	◯
Customers	◯	◯	◯	◯	◯	◯	◯
Research institutes (e.g., universities, research centers)	◯	◯	◯	◯	◯	◯	◯
Consultants	◯	◯	◯	◯	◯	◯	◯
Competitors	◯	◯	◯	◯	◯	◯	◯
Other please specify below	◯	◯	◯	◯	◯	◯	◯

.

Using a scale from 1 to 7, please rate to what extent do you agree with the following statements (1: Strongly disagree; 7: Strongly agree)

35. Market Orientation and Internationalization

	Strongly disagree	2	3	4	5	6	Strongly agree
We do a lot of in-house market research.	◯	◯	◯	◯	◯	◯	◯
The fundamental shifts in our industry (e.g., competition, technology, regulation) are periodically analyzed.	◯	◯	◯	◯	◯	◯	◯
We frequently review changes in our customers' product/service preferences.	◯	◯	◯	◯	◯	◯	◯
We periodically review the likely effect of changes in our business environment on customers.	◯	◯	◯	◯	◯	◯	◯
We utilize advanced and new knowledge from foreign countries.	◯	◯	◯	◯	◯	◯	◯
We develop alliances with foreign partners.	◯	◯	◯	◯	◯	◯	◯
We aggressively seek foreign markets.	◯	◯	◯	◯	◯	◯	◯
We utilize advanced management skills from foreign countries.	◯	◯	◯	◯	◯	◯	◯

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36. Innovation Strategy: Objectives for undertaking innovation projects in the last 3 years were to:

	Strongly disagree	2	3	4	5	6	Strongly agree
Introduce new generation of products/services.	◯	◯	◯	◯	◯	◯	◯
Extend products/services range.	◯	◯	◯	◯	◯	◯	◯
Open up new markets.	◯	◯	◯	◯	◯	◯	◯
Enter new technology fields.	◯	◯	◯	◯	◯	◯	◯
Improve existing products/services quality.	◯	◯	◯	◯	◯	◯	◯
Improve production/processes flexibility.	◯	◯	◯	◯	◯	◯	◯
Reduce production/processes cost.	◯	◯	◯	◯	◯	◯	◯
Improve yield or reduce material consumption.	◯	◯	◯	◯	◯	◯	◯

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(3/4) External Knowledge Acquisition and Exploitation:

Using a scale from 1 to 7, please rate to what extent do you agree with the following statements (1: Strongly disagree; 7: Strongly agree)

37. Based on the use of external sources (e.g. personal networks, consultants, internet, professional journals, academic publications, market research) please rate the following statements.

	Strongly disagree	2	3	4	5	6	Strongly agree
The search for relevant information concerning our industry is everyday business in our organization.	◯	◯	◯	◯	◯	◯	◯
We have effective routines in identifying and acquiring information from sources within our industry.	◯	◯	◯	◯	◯	◯	◯
We are able to deal with information beyond our industry.	◯	◯	◯	◯	◯	◯	◯

38. Knowledge Sharing and Usage:

	Strongly disagree	2	3	4	5	6	Strongly agree
We have effective routines to interchange new developments, problems, and achievements.	◯	◯	◯	◯	◯	◯	◯
In our organization, ideas and concepts are communicated cross-departmentally.	◯	◯	◯	◯	◯	◯	◯
In our organization, there is a quick information flow, e.g., if a business unit obtains important information, it communicates this information promptly to all other business units or departments.	◯	◯	◯	◯	◯	◯	◯
We can successfully integrate our existing knowledge with new information and knowledge acquired.	◯	◯	◯	◯	◯	◯	◯
Our employees have the ability to structure and use collected knowledge.	◯	◯	◯	◯	◯	◯	◯
Our employees successfully link existing knowledge with new insights.	◯	◯	◯	◯	◯	◯	◯
We are effective in exploiting internal and external information and knowledge into processes, products, or services.	◯	◯	◯	◯	◯	◯	◯
Our organization has the ability to work more effective by adopting new knowledge and information.	◯	◯	◯	◯	◯	◯	◯
Our organization supports the development of prototyping and testing new processes or services.	◯	◯	◯	◯	◯	◯	◯

39. Business Environmental Turbulence:

	Strongly disagree	2	3	4	5	6	Strongly agree
There is intense competition for market share in this product market.	◯	◯	◯	◯	◯	◯	◯
In our business, forecasting demand for products/services is very difficult.	◯	◯	◯	◯	◯	◯	◯
In our business, the technology in our products/services is changing rapidly.	◯	◯	◯	◯	◯	◯	◯
In our business, customers' preferences change all of the time.	◯	◯	◯	◯	◯	◯	◯

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(4/4) Information Technology (IT)

Using a scale from 1 to 7, please rate to what extent do you agree with the following statements (1: Strongly disagree; 7: Strongly agree)

40. IT Infrastructure:

	Strongly disagree	2	3	4	5	6	Strongly agree
The technology infrastructure needed for developing and tailoring products/services to match customers' needs is present and in place today.	◯	◯	◯	◯	◯	◯	◯
The organization's data is effectively protected from losses or any vulnerability through security and risk management services.	◯	◯	◯	◯	◯	◯	◯
Information is shared seamlessly across our organization, regardless of the location.	◯	◯	◯	◯	◯	◯	◯
The technology infrastructure enables us to perform real-time collaborative work.	◯	◯	◯	◯	◯	◯	◯

41. IT sensing capability:

	Strongly disagree	2	3	4	5	6	Strongly agree
The technology infrastructure needed to electronically link our organization with external business parnters (e.g. customers, supplier, alliances) is present and in place today.	◯	◯	◯	◯	◯	◯	◯
Our IT help us in determining customer requirements (e.g. products, preferences, pricing and quantity).	◯	◯	◯	◯	◯	◯	◯
Our IT enables us to develop detailed analyses of our present business situation.	◯	◯	◯	◯	◯	◯	◯
Our IT is effective in providing information that supports prudent decision-making.	◯	◯	◯	◯	◯	◯	◯

42. IT flexibility

	Strongly disagree	2	3	4	5	6	Strongly agree
Our IT is highly scalable.	◯	◯	◯	◯	◯	◯	◯
Our IT can quickly accommodate changes in business requirements.	◯	◯	◯	◯	◯	◯	◯
Functionality can be quickly added to critical applications based on end-user requests.	◯	◯	◯	◯	◯	◯	◯
We have a climate that is supportive of trying out new ways of using IT.	◯	◯	◯	◯	◯	◯	◯

43. IT effectiveness.

	Strongly disagree	2	3	4	5	6	Strongly agree
Our IT is effective in reducing costs and improving labor productivity in our business operations	◯	◯	◯	◯	◯	◯	◯
Our IT improve the efficiency of our day-to-day business operations.	◯	◯	◯	◯	◯	◯	◯
Our IT is effective in supporting our marketing and sales processes.	◯	◯	◯	◯	◯	◯	◯
There is integration of business strategic planning and IT planning.	◯	◯	◯	◯	◯	◯	◯

44. Approximately what is the total annual turnover (in Saudi Riyals) of your organization in the last fiscal year?

SR.

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45. Historically, what is the typical annual sales growth of your organization as a percentage?

%

46. Any comment on the obstacles that your organization faces in acquiring knowledge and technology from outside the country?

47. Any comment on the obstacles that your organization faces in collaborating with organizations and research institutes outside the country?

48. Please add any other comments that you feel are relevant.

49. Please provide your email address so that we can send you access information when results are published.

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معلومات عن المنشأة التجارية (1/4)

ارجو اختيار افضل جواب مناسب لوضع المنشأة. بعض الاسئلة تحتاج لوضع بعض الارقام المالية

2. كم هو اجمالي عدد موظفي المنشأة؟

- ◯ اقل من 10
- ◯ 10–50.
- ◯ 51–250.
- ◯ 251–500.
- ◯ 501–1,000.
- ◯ اكثر من 1,000

3. الرجاء اختيار افضل وصف يناسب نشاط المنشأة

- ☐ الدعاية والاعلان
- ☐ الزراعة
- ☐ البنوك والخدمات المالية
- ☐ الانشاء
- ☐ التعليم
- ☐ الاطعمة والمشروبات
- ☐ الاثاث والديكور
- ☐ الخدمات العلاجية والصحية
- ☐ السياحة والفنادق
- ☐ تقنية المعلومات
- ☐ التأمين
- ☐ الخدمات اللوجستية
- ☐ التنقيب والمعادن
- ☐ التصنيع
- ☐ النشر والاعلام
- ☐ النفط والبتروكيماويات
- ☐ العقارات
- ☐ التجزئة
- ☐ الاتصالات
- ☐ النقل
- ☐ الخدمات كالمياه و الكهرباء
- ☐ اخر. الرجاء التوضيح

4. كم هو عمر المنشأة حتى الان؟

- ◯ اقل من سنة
- ◯ 1–3 سنوات.
- ◯ 3–5 سنوات.
- ◯ 5–10 سنوات.
- ◯ اكثر من عشر سنوات

5. ما نطاق السوق الذي تعمل به منشأتكم

- ◯ العالم
- ◯ السعودية
- ◯ المنطقة

6. ماهو منصبك الوظيفي؟

- ◯ المدير العام (GM/CEO)
- ◯ مدير التشغيل (Chief Operations Officer)
- ◯ اخر. الرجاء التوضيح
- ◯ المدير المالي (Chief Financial Officer)
- ◯ مدير تقنية المعلومات (Chief Information Officer/IT Director)

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7. كم يشكل الانفاق على الابحاث والتطوير في منشأتكم كنسبة من اجمالي المبيعات السنوية؟

٪

8. كم تشكل تقريبا الميزانية السنوية المنفقة (بالريال السعودي) على تقنية المعلومات بما فيها عقود الاستضافات والصيانة؟

ريال سعودي

9. ما افضل مااستطاع ان يحققه كل من التالي (كنسبة من اجمالي مبيعاتكم السنوية) خلال السنوات الثلاث الماضية؟

٪ طرح منتجات أو خدمات جديدة على مستوى العالم	
٪ طرح منتجات أو خدمات جديدة على السعودية	
٪ طرح منتجات أو خدمات جديدة على منشأتنا لكنها متوفرة لدى شركات اخرى في المنطقة	
٪ طرح منتجات أو خدمات موجودة لدى المنشأة مسبقا بعد ادخال تحسينات عليها	

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الترابط والاستراتيجية (2/4)

الى اي مدى توافق على كفاءة منشأتكم في القيام بالانشطة التالية بمقياس من 1 الى 7 (1: لا يستخدم ، 7: يستخدم كثيرا),

10. الابتكار والتطوير في منشأتنا يعتمد على التالي كمصدر للمعلومات:

	لا يستخدم	2	3	4	5	6	نستخدمه بكثافه عالية جدا
الموردين	○	○	○	○	○	○	○
العملاء	○	○	○	○	○	○	○
منشات الابحاث كالجامعات او مراكز التقنية المتقدمة او مراكز الابحاث الاخرى	○	○	○	○	○	○	○
الاستشاريين	○	○	○	○	○	○	○
المنافسين	○	○	○	○	○	○	○
اخرى. الرجاء التوضيح ادناه	○	○	○	○	○	○	○

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الى اي مدى توافق على كفاءة منشأتكم في القيام بالانشطة التالية بمقياس من 1 الى 7 (7: موافق بشدة ، 1: اعترض بشدة),

11. استشعار حركة السوق و الميول الدولي

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
منشأتنا تقوم بذاتها بعمل دراسات وابحاث مفصلة عن السوق ولا تعتمد فقط على الدراسات الخارجية	○	○	○	○	○	○	○
نحلل بشكل دوري اي تغيرات في قطاعنا التجاري (كتحركات المنافسين، التقنيات والاليات المستخدمة، التنظيم القانوني).	○	○	○	○	○	○	○
نحقق ونراجع باستمرار في اي تغير في رغبة العملاء وما يفضلونه	○	○	○	○	○	○	○
نتابع وبشكل دوري كل ما يؤثر على عملائنا من تغيرات في نشاطنا التجاري وطبيعة السوق	○	○	○	○	○	○	○
نحن نستخدم معلومات واليات جديدة ومتقدمة من دول اجنبية	○	○	○	○	○	○	○
نقوم بتحالفات واتفاقيات تعاون مع شركاء ومنشات في دول اجنبية	○	○	○	○	○	○	○
نسعى بقوة لدخول الاسواق الاجنبية	○	○	○	○	○	○	○
نحن نستخدم مهارات ادارية متقدمة من دول اجنبية	○	○	○	○	○	○	○

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12. استراتيجية التطوير:

خلال السنوات الثلاث الماضية الجهد والمال المبذول على الابتكار والتطوير كان يهدف الى التالي

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
طرح جيل جديد من المنتجات او الخدمات	○	○	○	○	○	○	○
اضافة مزايا جديدة لمنتجاتنا وخدماتنا الحالية	○	○	○	○	○	○	○
استحداث او دخول سوق جديد	○	○	○	○	○	○	○
ادخال تقنية جديدة في منشأتنا لتحسين الاداء	○	○	○	○	○	○	○
تحسين جودة منتجاتنا وخدماتنا	○	○	○	○	○	○	○
زيادة مرونة عمليات انتاج المنتجات او تقديم الخدمات	○	○	○	○	○	○	○
تقليل تكاليف التشغيل	○	○	○	○	○	○	○
زيادة الانتاجية او تقليل استهلاك المواد المستخدمة في المنتجات والخدمات	○	○	○	○	○	○	○

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تنمية المعرفة و المعلومات والاستفادة منها (3/4)

الى اي مدى توافق على كفاءة منشأتكم في القيام بالانشطة التالية بمقياس من 1 الى 7 (7: موافق بشدة ، 1: اعترض بشدة),

13. في الانشطة التالية يقصد بمصادر المعلومات المصادر التي من خارج المنشأة (كالعلاقات الخاصة، الاستشاريين والشركاء المهمين، الانترنت، المجلات العلمية، احصاءات السوق). فما مدى تقييمكم للانشطة التالية:,

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
البحث عن معلومات ذات علاقة بنشاطنا التجاري هو عمل يومي في منشأتنا	◯	◯	◯	◯	◯	◯	◯
لدينا روتين فعال لتحديد واستحواذ المعلومات من مصادر في قطاعنا التجاري	◯	◯	◯	◯	◯	◯	◯
نستطيع التعامل بشكل سلس مع معلومات تتعدى نطاق قطاعنا التجاري	◯	◯	◯	◯	◯	◯	◯

14. مشاركة المعلومات والمعرفة وتطبيقاتها

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
في منشأتنا لدينا روتين فعال لتبادل التطورات و المشاكل و الانجازات	◯	◯	◯	◯	◯	◯	◯
في منشأتنا الافكار والمفاهيم والاقتراحات والتصاميم الاولية يتم تدوريها بشكل فعال بين الاقسام	◯	◯	◯	◯	◯	◯	◯
في منشأتنا توجد سرعة عالية في تدفق المعلومات. ان حصلت احدى الوحدات على معلومة مهمة يتم ايصالها فورا الى جميع الوحدات والاقسام الاخرى	◯	◯	◯	◯	◯	◯	◯
نستطيع بنجاح ان نربط و نكامل المعلومات والمعرفة الجديدة التي نحصل عليها مع معلوماتنا ومعارفنا السابقة	◯	◯	◯	◯	◯	◯	◯
لدى موظفينا القدرة على فرز وترتيب واستخدام المعلومات المتوفرة	◯	◯	◯	◯	◯	◯	◯
لدى موظفينا القدرة على توظيف المعلومات والمعارف المتوفرة لخدمة لرؤى جديدة	◯	◯	◯	◯	◯	◯	◯
لدينا فعالية عالية في تحويل المعلومات والمعارف المتوفرة مسبقا والمستحوذ عليها حديثا الى منتجات او خدمات او اليات انتاج	◯	◯	◯	◯	◯	◯	◯
لدى منشأتنا القدرة على العمل بكفاءة اكبر بتبني معلومات و معارف جديدة	◯	◯	◯	◯	◯	◯	◯
تدعم منشأتنا تطوير التصاميم الاولية التجريبية وايضا تجريب خدمات جديدة او عمليات انتاج جديدة	◯	◯	◯	◯	◯	◯	◯

15. اضطراب النشاط التجاري ككل

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
توجد منافسة قوية في سوق الخدمات او المنتجات التي نقدمها	◯	◯	◯	◯	◯	◯	◯
في قطاعنا التجاري نجد صعوبة بالغة في التنبؤ بقوى الطلب على المنتجات والخدمات	◯	◯	◯	◯	◯	◯	◯
في قطاعنا التجاري يوجد تغير سريع في التقنية والاليات المستخدمة لانتاج المنتجات وتقديم الخدمات	◯	◯	◯	◯	◯	◯	◯
في قطاعنا التجاري هناك تغير مستمر في رغبة العملاء وما يفضلونه	◯	◯	◯	◯	◯	◯	◯

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القسم الاخير: تقنية المعلومات

الى اي مدى توافق على كفاءة منشأتكم في توفير التالي بمقياس من 1 الى 7 (7: موافق بشدة ، 1: اعترض بشدة),

16. توفير البنية التحتية لتقنية المعلومات:

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
التقنية اللازمة لتطوير منتجات او خدمات تناسب احتياجات عملائنا متوفرة وجاهزة الان للعمل	◯	◯	◯	◯	◯	◯	◯
جميع بيانات المنشأة محمية بشكل فعال من الضياع او اي مخاطر اخرى عن طريق البات الامان وحماية المعلومات	◯	◯	◯	◯	◯	◯	◯
نستطيع بكل سهولة الوصول لمعلومات وبيانات المنشأة ومشاركتها بغض النظر عن الموقع	◯	◯	◯	◯	◯	◯	◯
بنية تقنية المعلومات تمكننا من العمل بشكل جماعي وبسرعة لحظية	◯	◯	◯	◯	◯	◯	◯

17. قدرة تقنية المعلومات

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
التقنية اللازمة لربط منشأتنا بشركائها (الموردين، العملاء، الحلفاء) متوفرة وجاهزة للعمل الان	◯	◯	◯	◯	◯	◯	◯
التقنية اللازمة لمساعدنا في التعرف على احتياجات عملاءنا (المنتجات، الاسعار، الكميات، الرغبات) متوفرة وجاهزة للعمل الان	◯	◯	◯	◯	◯	◯	◯
التقنية للازمة لعمل تحليل كامل ومفصل لحالة منشأتنا المالية والتجارية متوفرة وجاهزة للعمل الان	◯	◯	◯	◯	◯	◯	◯
التقنية المتوفرة حاليا في منشأتنا فعالة في اعطاء معلومات تساعدنا في اتخاذ القرارت الصائبة	◯	◯	◯	◯	◯	◯	◯

18. مرونة تقنية المعلومات

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
نستطيع زيادة حجم بنية وانظمة تقنية المعلومات (بسهولة) في حال ازدياد حجم العمليات او المستخدمين	◯	◯	◯	◯	◯	◯	◯
بنية تقنية المعلومات في منشأتنا تستطيع (بسهولة) استيعاب التغيرات في متطلبات نشاطنا التجاري	◯	◯	◯	◯	◯	◯	◯
يمكن (وبسرعة عالية) اضافة وظائف جديدة لانظمة المعلومات حسب طلب المستخدمين	◯	◯	◯	◯	◯	◯	◯
بيئة عملنا تشجع على تجريب طرق جديدة للاستفادة من تقنية المعلومات	◯	◯	◯	◯	◯	◯	◯

19. كفاءة التقنية المتوفرة

	اعترض بشدة	2	3	4	5	6	اوافق بشدة
تقنية المعلومات لدينا فعالة في تقليل التكاليف وتحسين كفاءة الموظفين في عملياتنا التجارية	◯	◯	◯	◯	◯	◯	◯
تقنية المعلومات لدينا تساعدنا في رفع كفاءة عملياتنا التجارية اليومية	◯	◯	◯	◯	◯	◯	◯
تقنية المعلومات لدينا فعالة في دعم عمليات البيع والتسويق	◯	◯	◯	◯	◯	◯	◯
يوجد تكامل تام بين التخطيط الاستراتيجي للمنشأة والتخطيط لتقنية المعلومات	◯	◯	◯	◯	◯	◯	◯

20. كم تقريبا هو اجمالي الايرادات (بالريال السعودي) للسنة المالية الماضية؟

ريال سعودي

21. كم تقريبا معدل نمو المبيعات (كنسبة منوية) في السنة المالية الماضية

%

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22. هل تود التعليق على المعوقات التي تواجهها الشركة في الاستحواذ على معارف وتقنيات جديدة من خارج المنطقة

23. هل تود التعليق على الصعوبات التي تواجهها المنشأة في التعاون مع منشات ومراكز ابحاث من خارج السعودية

24. هل من تعليقات اخرى تود اضافتها؟

25. الرجاء وضع عنوانك الالكتروني الرسمي لنتمكن من ارسال الية الوصول لنتيجة الاستطلاع عند نشرها

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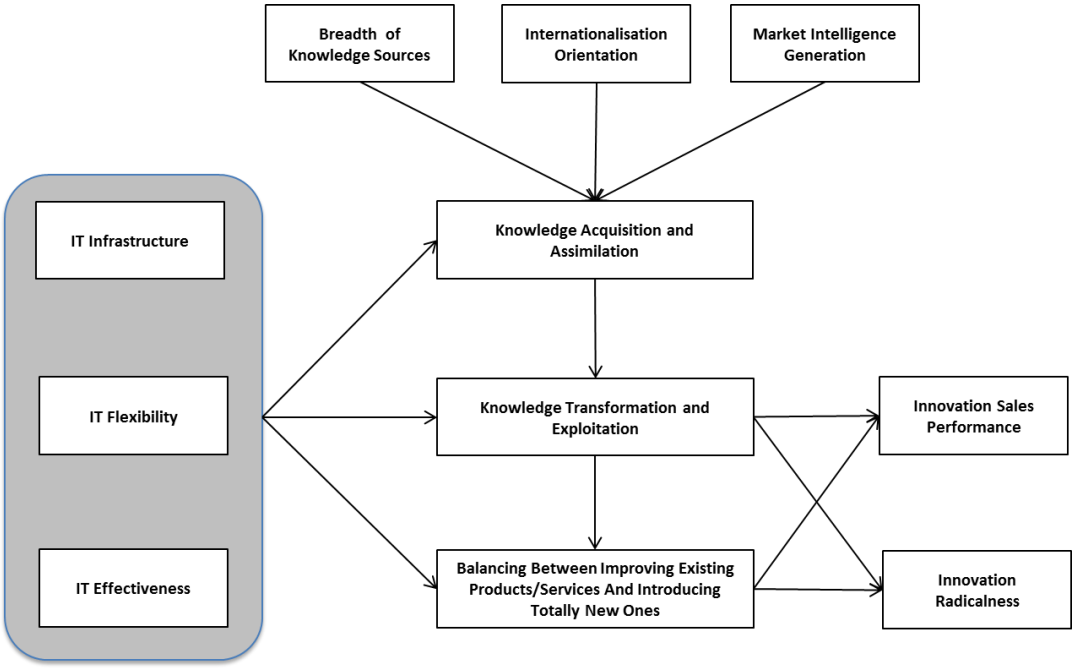
Thank you very much for your time. شكرا جزيلا على التكرم ببعض وقتك

Appendix C: Interviews Questionnaire

Note: This is the translated version.

Q1	General Information about the Firm and the Interviewee
1.1	Job title?
1.2	Number of years experience in this sector?
1.4	Number of employees you are managing?
Q2	Impact of Market Changes on Firm's Performance
2.1	How do you describe the Saudi Market in terms of competition, product offerings, and customers' expectations?
2.2	What is the effect of the current market condition, such as competition, product offerings, and customers' expectations, on the Saudi firms' behaviours?
2.3	What do you think motivates Saudi firms to engage in innovation activities to remain competitive in the local and probably international market?
2.4	How can Saudi firms cope with the fast progress in technology and the globalisation of markets?
2.5	What sources are available in Saudi Arabia that may assist Saudi firms in keeping up-to-date with knowledge related to business process, offerings, and management?
2.6	Do you think that Saudi firms can easily reach international sources for knowledge and skills? Why might this be important for competition?
Q3	Absorptive Capacity and Innovation Strategy
3.1	How do you think Saudi firms can structure themselves to acquire and use new knowledge?
3.2	What is your opinion of the management and employees' skills available in the Saudi market in terms of new knowledge learning?
3.3	How do you think firms may be encouraged to try new approaches to product offerings?
3.4	Do you think that extermination of new products and services are part of the culture of Saudi firms? Why do think this important?

3.5	What strategy do you think may better suit the Saudi market—improving existing products and services or launching new innovation products and services?
Q4	Information Technology
4.1	What role does information technology play in enhancing firms' innovation performance?
4.2	Dose the Saudi technology infrastructure satisfy Saudi firms' requirements to handle and manage information effectively?
4.3	How can firms maximise their benefits from investing in information technology to enhance their innovation capability and performance in general?
Q5	The Perception of Innovation Dynamic Capability Model



Innovation Dynamic Capabilities Model.

Q6	Open Comments
6.1	Are there any comments you would like to add on how Saudi firms can improve their innovation performance?
6.2	Any other comments you would like to add?

Thank you for your time and participation in this interview.