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The Role of International Collaboration

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EXTERNAL SEARCH STRATEGIES BY EMERGING ECONOMY FIRMS: THE ROLE OF INTERNATIONAL COLLABORATION

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A thesis submitted to the degree of Doctor of Philosophy

University of Bath

School of Management

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Abbreviation

BERD	= Business enterprise expenditure on research and development
CHN	= China
CIS	= Community innovation survey
EU	= European Union
FDI	= Foreign direct investment
GERD	= Gross domestic expenditure on research and development
GDP	= Gross domestic product
IND	= India
LDV	= Limited dependent variable
NACE	= European classification of economic activities
OECD	= Organization for economic co-operation and development
OLS	= Ordinary least square
PhD	= Doctor of philosophy
R&D	= Research and development
Turkstat	= Turkish Statistical Institute
US	= United State
USD	= United States Dollar
VIF	= Variance inflation factor

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Abstract

This research explores the linkages between the breadth and depth of search strategies and innovation performance from the perspective of emerging economy firms. The unique characteristics of such firms influence the success of search and they can leverage international collaboration to increase the benefits from their search strategies. This thesis contributes to the innovation search agenda by investigating search strategies by emerging economy firms and employing international collaboration as a contingency factor. This study first distinguishes international collaboration depending on the partners' national contexts, i.e. collaboration with partners from emerging economies and collaboration with partners from developed economies, in order to examine its effects on the link between search strategies and innovation performance. Second, this research distinguishes international collaboration according to partner types, i.e. international market-based and science-based partners in order to investigate its effects on the link between search strategies and different types of innovation performance. The constructed model was tested using data drawn from the Turkish Innovation Survey, which included 659 innovative firms from 19 two digit-level manufacturing and service industries.

The empirical results indicate that an emerging economy firm searching the external environment broadly and deeply is not likely to yield innovative products. It is, rather, the collaboration with international partners that enables these firms to increase their innovativeness. However, the results suggest that firms need to trade-off across search strategies depending on which national context they collaborate with. More specifically, firms fare better if they follow a search breadth strategy when they collaborate with partners from other emerging economies. In contrast, they perform better if they follow a search depth strategy when they collaborate with partners from developed economies. Moreover, the findings also point to the importance of international collaboration partner types for increasing the benefits of search strategies on different types of innovation performance. That is, the effect of search breadth strategy on radical innovation performance is enhanced with

international market-based partners, not with science-based ones. In addition, the impact of search depth strategy on radical innovation performance is enhanced with international science-based partners, whereas its effect on incremental innovation performance is enhanced when collaborating with international market-based partners.

Chapter 1

Introduction

Innovation is critical for firms to gain and sustain competitive advantage (Eisenhardt & Martin, 2000; Rosenkopf & Nerkar, 2001; Teece, 2007). As Brown and Eisenhardt point out "innovation is among the essential processes for success, survival, and renewal of organizations" (1995: 344). Innovation increases the ability of firms to establish or enhance their position in new areas. Research in strategy has for a long time highlighted the importance of accessing knowledge sources beyond the firm's boundaries for innovation success (Nelson & Winter, 1982; Henderson & Cockburn, 1994; Rosenkopf & Nerkar, 2001; Katila & Ahuja, 2002; Phene, Fladmoe-Linquist, & Marsh, 2006). Moreover, the issue of understanding factors that affect innovation performance has been salient. In particular, the search literature differentiates between the breadth and depth of the search for exploring the impact of firms' openness to external knowledge on innovation performance (Laursen & Salter, 2006). With the former search strategy, firms seek to improve innovation performance by accessing a large number of knowledge sources, such as suppliers, customers, universities and others in the innovation system. Regarding the latter, firms attempt to leverage the intensity/focus by which knowledge sources are used. This thesis contributes to the search literature by exploring the relationship between these search strategies and innovation performance from the perspective of emerging economy firms. In particular, the aim is to provide understanding in relation to how emerging economy firms search effectively by investigating the impact of different contextual factors on the link between the breadth and depth of search and innovation performance.

This research interest fits into an important discussion highlighting the context specificity of innovation search strategies (Katila, 2002; Laursen & Salter, 2006; Zhang & Li, 2010; Laursen, 2012). According to Laursen and Salter (2006: 133),

"search strategies are influenced by the richness of technological opportunities available in the environment". Thus, the success of search differs for firms from economies when the local context varies in terms of customers, opportunities, and institutions (Chen & Miller, 2007; Vissa, Greve, & Chen, 2010; O'Brien & David, 2014). It is of particular importance to investigate search strategies by emerging economy firms, for this context affects the availability of the information as well as how a firm accesses the information or knowledge (Zhang & Li, 2010; Li, Zang, & Lyles, 2013; Asakawa, Song, & Kim, 2014). Emerging economy firms face a number of specific challenges when engaging in search. They are likely to have internal and external resource scarcity and limitations in their absorptive capacities. Due to their lack of absorptive capacities, investing considerable time, money and managerial attention for search can be too costly for them (Li et al., 2013; Asakawa et al., 2014). Additionally, uncertainty in emerging economies and lack of institutional support can also cause high search cost (Zhang & Li, 2010; Li et al., 2013). The unique characteristics suggest that emerging economy firms are systematically different from developed economy firms. Thus, this study takes into account the country of origin and investigates firms from an emerging economy context.

These unique features of emerging economy firms draw attention to the importance of international knowledge for their innovation success and the salience of accessing knowledge across nations has been highlighted in both the international business and innovation search literatures. The former suggests that emerging economy firms interact with foreign partners, because they provide critical resource inputs and experience as well as influence how these resources can be used (e.g. Hitt, Dacin, Levitas, Arregle, & Borza, 2000; Mahmood & Mitchell, 2004; Steensma et al., 2005; Chung & Yeaple, 2008; Li, Chen, & Shapiro, 2010; Liu et al., 2010; Kafouros & Forsans, 2012). Innovation search literature has also recognized the importance of searching for opportunities in different regions and nations for firms' innovation success (e.g. Ahuja & Katila, 2004; Phene et al., 2006; Sidhu, Commandeur, & Volberda, 2007; Li-Ying, Wang, & Salomo, 2014). Ahuja and Katila (2004) introduced the term "geographic search", which they defined as searching knowledge beyond firms' national boundaries. Building on their work, in this research it is argued that international collaborations enable emerging economy firms to expand

their search scope and hence, increase their abilities to be innovative. In particular, collaboration becomes important in this relationship since it provides a strong bond between the local firm and knowledge provider (Ahuja, 2000; Hagedoorn et al., 2000; Hagedoorn, 2002; Levin & Barnard, 2013). Collaboration is typically based on a formal and specified agreement and therefore, plays a pipeline role in transferring knowledge (Kang & Kang, 2009, 2014; Laursen & Salter, 2014; Singh et al., 2015). Strong ties and close interactions across partners lead firms to have advantages in transferring knowledge from their partners. Therefore, this study takes international collaboration as a contingency of search strategies and investigates its effects in two different ways.

Firstly, international collaboration based on partners' national context is differentiated. Katila (2002) has suggested that how firms search cannot be studied in isolation from where they search. The effects of search on innovation performance can vary depending on context (Zhang & Li, 2010). Thus, this study explores the moderating effect of the context of collaboration, including collaborations with developed economy partners and collaborations with other emerging economy partners, on the link between search strategies and innovation performance. Different contexts are characterised by unique environmental features and therefore, vary in the type of knowledge they provide (Levinthal & March, 1993; Chen & Miller, 2007). Developed economies are characterised by a strong institutional background and a higher level of technological advancement. By contrast, emerging economies typically have a weak institutional background and a lower level of technological development (Hoskisson et al., 2000). These differences across developed economy and emerging economy contexts lead firms to face different opportunities and problems, thus having different motives for collaborating with partners from each context (Tsang, 1999; Li & Zhong, 2003; Luo & Tung, 2007; Schmiele, 2012). As highlighted by scholars of international business, firms are more likely to access novel and complex technological and managerial capabilities when the level of economic development is higher than firms' home nations (Hitt et al., 2000; Tsang & Yip, 2007; Schmiele, 2012). Thus, in terms of motives, firms are likely to focus on refining their existing products when they collaborate with emerging economy partners, whereas they are likely to develop new capabilities and resources when they

collaborate with developed economy partners. The systematic differences in terms of motives for collaboration and the level of technological developments differently influence the ability of emerging economy firms to absorb new knowledge from those contexts (Cohen & Levinthal, 1990). In terms of problems, firms face difficulties in accessing knowledge due to the environmental uncertainties their partners have. Demand uncertainty, unpredictable changes in rules and regulations can threaten firms' abilities to access knowledge from certain contexts (Luo, 2003b). Therefore, depending on the collaboration context, emerging economy firms get more benefit following certain search strategies aimed at producing innovative products.

Secondly, this study differentiates international collaboration based on the nature of partner types. This involves drawing on the characteristics of partners rather than the characteristics of the national context. Previous studies have looked at different factors affecting search strategies, such as product complexity (Almirall & Casadesus-Masanell, 2010), the novelty of innovation (Laursen & Salter, 2006), industry membership (Grimpe & Sofka, 2009) as well as project and manager types (Salge et al., 2013). Extant literature on search has argued that it is important to incorporate the effects of different kinds of knowledge into the relationship between search strategies and different types of innovation performance (Sofka & Grimpe, 2010; Laursen, 2011; Chen, Chen, & Vanhaverbeke, 2011; Kohler, Sofka, & Grimpe, 2012). Partner types are important particularly for accessing different kinds of knowledge and different kinds of innovations (Faems et al., 2005; Todtling et al., 2009; Vanhaverbeke, Du, Leten, & Aalders, 2014). Hence, this study explores the moderating effect of international collaboration partner types, namely, international market-based and science-based partners, on the link between search strategies and different types of innovation performance. Search breadth and search depth strategies influence both radical and incremental innovation performance. Radical innovations require deeper search and departure from existing products, whereas incremental innovations require broader search and refinement of existing products (Laursen & Salter, 2006). Regarding which, market-based and science-based partners can provide the knowledge essential for increasing radical and incremental innovation performance (Faems et al., 2005). However, it is important to acknowledge that each

type of partner differs in the kind of knowledge provide and the way it can be accessed by the firm (Cohen & Levinthal, 1990; Lane, Koka, & Pathak, 2006). For instance, universities provide basic scientific knowledge and require long-term interactions, whereas customers provide applied market knowledge and need only short-term interactions. From this it is reasonable to assume that firms can face challenges regarding their ability to absorb certain kinds of knowledge and thereby, potentially excessive search costs (Cohen & Levinthal, 1990). This implies that the pay-offs from search strategies can show differences depending on partner types. In this research, it is thus argued that the extent of radical and incremental innovation performance is affected by the interaction between search strategies and collaboration partner types.

1.1 Research Objectives, Framework and Question

The research objective of the current study is to unpack the relationship between external search strategies and innovation performance by building a theoretical framework based on a contingency approach. First, the unique characteristics of emerging economy firms are considered so as to investigate the relationship between search strategies and innovation performance. Second, the contingency effects of firms' international collaboration in terms of different types of collaboration contexts and different types of collaboration partners on the link between search strategies and innovation performance are examined. Accordingly, the aim is to provide: 1) a profound understanding of the search processes of emerging economy firms and 2) a comprehensive understanding of the impact of different contingency factors on the relationship between search strategies and innovation performance. In sum, this study examines the link between external search strategies and innovation performance by investigating the moderation effects of different features of international collaboration from the perspective of emerging economy firms (see Figure 1-1). The framework is explained below.

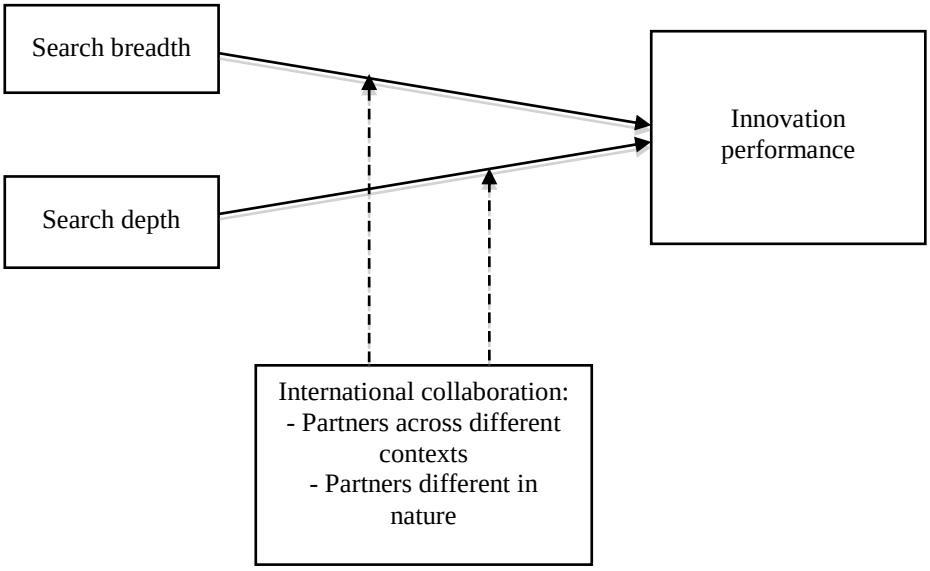

Figure 1-1 Proposed Theoretical Framework

Emerging Economy Firms and International Collaboration

This research focuses on emerging economy firms and is important for two reasons. First, it highlights the importance of foreign knowledge for the search strategies of emerging economy firms. Extant literature on search literature has recognized the importance of the international origin of knowledge for firms' innovation success (Ahuja & Katila, 2004; Phene et al., 2006; Sidhu et al., 2007; Coombs et al., 2009; Li-Ying et al., 2014). Emerging economy firms typically lag behind in technology and management skills as well as institutional development relative to developed economy firms. Such firms thus leverage knowledge from other nations in order to increase the chances of accessing new knowledge sources and opportunities (Hitt et al., 2000; Hitt, Li, & Worthington, 2005; Chung & Yeaple, 2008). Emerging economy firms can gain access to international knowledge by forming collaboration agreements with their foreign partners. Second, research on the search strategies of emerging economy firms offers learning opportunities for developed economy firms (Hitt et al., 2005; Li et al., 2013). In particular, in order to leverage opportunities in emerging economies, developed economy firms need to adapt to a new competitive landscape. Consequently, there is a need to examine and learn about the search strategies that emerging economy firms are engaging in.

Partners across Different Contexts

The effects of the context of collaboration on the relationship between search strategies and innovation performance are explored. As knowledge is expected to evolve in a distinctive and different manner in each context, it is of interest to understand to what extent firms' collaboration with partners from developed economies and with partners from other emerging economies shape emerging economy firms' search strategies. Hence, this research involves investigating whether it makes a difference for an emerging economy firm to collaborate with other emerging economy partners rather than with those from developed economies in terms of the impact of search strategies on innovation performance. This added perspective of international collaboration contributes to the understanding of the conditions under which search breadth and search depth create value.

Partner Types

The effects of collaboration partner types on the relationship between search strategies and different types of innovation performance are explored. Existing studies on search have recognized the importance of the knowledge type firms access in addition to their search breadth and search depth strategies (Sofka & Grimpe, 2010; Laursen, 2011; Chen et al., 2011; Kohler et al., 2012). Partner types provide specific knowledge, which is of particular importance for producing different types of innovation performance (Faems et al., 2005; Nieto & Santamaria, 2007; Todtling et al., 2009). Accordingly, it is assumed that international market-based and science-based partners differently influence the link between the breadth and depth of search and radical and incremental innovation performance.

Based on the above research objectives and the proposed research framework, the following research question is put forward:

How do emerging economy firms search effectively to be innovative?

This main question is addressed along with three sub-questions, which will be deconstructed into a series of hypotheses in Chapter 2.

1. What is the impact of the breadth and depth of search on innovation performance of emerging economy firms?

2. What is the impact of the context of collaboration on the relationship between the breadth and depth of search and innovation performance?

3. What is the impact of partner types on the relationship between the breadth and depth of search and different types of innovation performance?

1.2 Research Contributions

By adopting this research framework, the aim is to contribute to the innovation search literature. Firstly, this research enhances the understanding of whether unique characteristics of emerging economy firms differently shape their search patterns when striving to be innovative. Extant literature has argued that emerging economy firms have certain characteristics, which can affect the success of search (Vissa et al., 2010; Li et al., 2013; Asakawa et al., 2014). However, these authors have investigated firms' search strategies from the perspective of developed economy firms (Rosenkopf & Nerkar, 2001; Katila & Ahuja, 2002; Laursen & Salter, 2006). Consequently, taking into account the characteristics of emerging economy firms advances the literature on innovation search. Secondly, this study advances comprehension regarding the importance of international knowledge for innovation by incorporating international collaboration into the link between search strategies and innovation performance (Ahuja & Katila, 2004; Phene et al., 2006; Sidhu et al., 2007; Li-Ying et al., 2014). Existing studies focusing on external search strategies have not considered the importance of international knowledge sources (Li-Ying et al., 2014; Asakawa et al., 2014). In particular, this dimension of search has significant importance for emerging economy firms (Li et al., 2013). Thus,

integrating international collaboration into the analysis between the breadth and depth of search and innovation performance extends the extant literature on search strategies. Thirdly, this work reveals the importance of collaboration for improving the effects of search strategies on innovation performance. Previous studies have focused on search strategies while investigating firms' openness to external knowledge (Laursen & Salter, 2006; Leiponen & Helfat, 2010). However, certain characteristics of emerging economy firms suggest that collaboration can play a pipeline role in transferring knowledge and thus, increase the positive effects of search strategies on innovation performance.

Fourthly, this research contributes to the understanding of the context specificity of innovation search by examining the impact of different collaboration contexts on the link between external search strategies and innovation performance. Innovation search literature has recognized the importance of context for firms' search patterns (Katila, 2002; Zhang & Li, 2010). However, it has not investigated to what extent firms' optimal search strategies differ depending on different contexts. With regard to this, this study is the first to investigate international collaboration as a contingency of search strategies. This study distinguishes between two different collaboration contexts, namely, collaboration in developed and collaboration in emerging economies, since systematic differences between these two are likely to affect the success of search strategies.

Fifthly, this study contributes to innovation search by examining the moderating impact of collaboration partner types on the link between search strategies and different types of innovation performance. Previous studies have investigated different conditions under which search strategies are most beneficial, such as project type, product novelty and project leader experience (Laursen & Salter, 2006; Grimpe & Sofka, 2009; Almirall & Casadesus-Masanell, 2010; Salge et al., 2013). In addition to these factors, the literature on search has highlighted the importance of including knowledge type into the analysis of search strategies and different types of innovation performance (Sofka & Grimpe, 2010; Chen et al., 2011; Kohler et al., 2012). With regard to this, for the current research two types of collaboration

partners, international market-based and science-based, are distinguished since the type of knowledge they provide has a different influence on radical and incremental innovation performance. In addition, the capabilities each partner type requires vary and as a consequence, each will differentially influence the success of search strategies for producing different types of innovation performance.

Six and finally, this research makes a methodological contribution by providing supplementary analysis to examine non-linear regression models. Previous studies that have used limited dependent variable models, such as Tobit and Probit, have yielded contradictory results (Hoetker, 2007; Wiersema & Bowen, 2009). Moreover, these studies obtained biased results and hence, invalid inferences been drawn, thereby introducing uncertainty regarding the meaning of these prior research findings. This study contributes to this stream of methodological inquiry by examining a set of statistical issues likely to occur in the analysis of Tobit or Probit regressions; illustrating the essential methods for analysing and interpreting the results from such models.

1.3 Structure of the Thesis

The thesis has been organized into six chapters. After this brief introduction, in Chapter 2 the relevant existing literature that covers the theoretical principles of innovation search literature is discussed. To begin with, the importance of search for external knowledge is explained, which is followed with an explanation of the unique characteristics of emerging economy firms. This leads the discussion aimed at uncovering the effects of search strategies on innovation performance from the perspective of emerging economy firms. Subsequently, the role of international collaboration in accessing critical knowledge for firms is considered. Next, international collaboration is discussed, firstly, in terms of the different characteristics of partners' national context, thereby justifying the rationale underlying the hypothesized linkages. Secondly, such collaboration is discussed in terms of different characteristics of partner types, including international market-

based and science-based partners. Subsequently, hypotheses are developed regarding this aspect.

Chapter 3 contains the methodology, in which the research paradigm, research design and research methods along with the analytical strategy being employed for this research are explained and justified. To begin with, the ontological and epistemological stance adopted is set out. Then, key methodological decisions are described, including the choice of survey research and use of Turkey as a research context. This is followed by detailed explanation of the used data and the overall structure of the firms included in this research. Operational measures for particular concepts discussed in the literature review are explained as well as the procedures for the analysis.

Chapter 4 presents empirical results. First, it provides the descriptive results and statistics related to the constructs used in this research, which is followed by the results of a series of regression analyses. Regarding which, first, the relationship between the breadth and depth of search strategies and innovation performance is identified. Next, the test results for the moderating effects of partners' national contexts, including developed economy collaborations versus emerging economy collaborations on the link between search strategies and innovation performance are presented. Subsequently, the results for the moderation effects of types of collaboration partners on the relationship between search strategies and different types of innovation performance are provided and explained. Finally, a series of robustness and sensitivity checks are introduced, which is followed by a summary of the findings.

Chapter 5 contains discussion that involves synthesizing the results from Chapter 4 to evaluate the overall results of the study in light of extant studies. Moreover, implications from this thesis for theoretical development regarding the relationship between search strategies and innovation performance with different contingency factors are discussed. Then, managerial and policy level implications regarding this relationship are explained.

In the final chapter, Chapter 6, conclusions to the analysis of the proposed research framework are presented. First, the key contributions from incorporating the role of international collaboration in the search literature for emerging economy firms and its implications for the wider context of strategic management are explicated. In addition, the research limitations are considered and suggestions for potential future avenues of investigation are put forward.

CHAPTER 2

Theory Development and Hypotheses

The main objective of this chapter is, firstly, to review the current literature relating to external knowledge and innovation performance linkages so as to identify the gaps. Subsequently, there is explanation of specific characteristics of emerging economy firms and then, the effects of external search strategies - search breadth and search depth - on innovation performance are unpacked, particularly from the perspective of such firms. Secondly, the aim is to discuss the importance of international collaboration for the linkage between search strategies and innovation performance. Then, the discussion continues by explaining the effects of the context of international collaboration on the relationship between search strategies and innovation performance. For this research, firstly, international collaboration is differentiated based on whether the partners are from emerging economies only or one is located in a developed economy. In this regard, whether the characteristics of collaboration contexts shape the relationship between search strategies and innovation performance is investigated (see Figure 2-1).

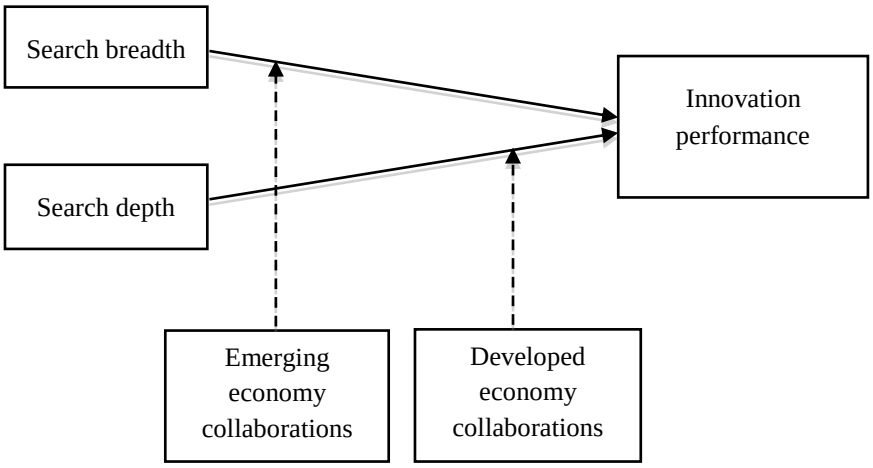

Figure 2-1 The Impact of the Context of Collaboration

Finally, the aim is to identify to what extent different partner types influence the link between search strategies and different types of innovation performance. This research, secondly, differentiates international collaboration based on partner types in terms of market-based and science-based partners. With regard to this, the effects of international partner types on the link between search strategies and different types of innovation performance are examined (see Figure 2-2).

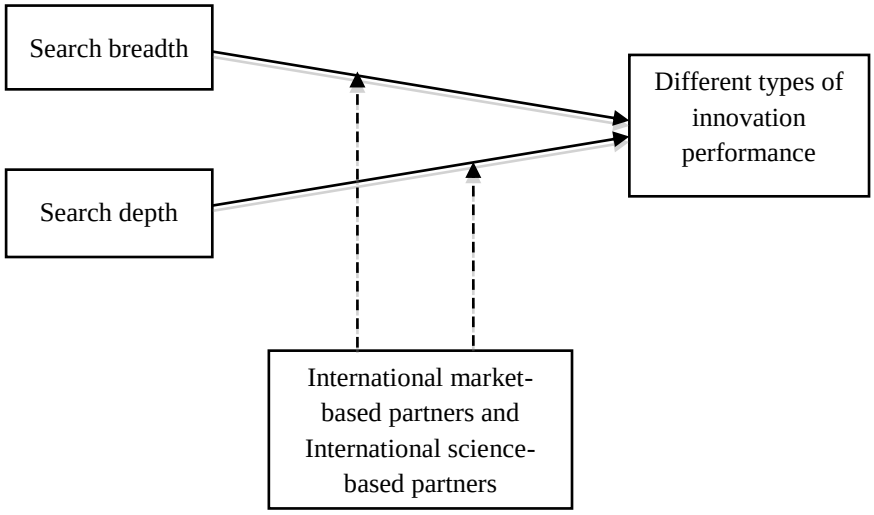

Figure 2-2 The Impact of Collaboration Partner Types

2.1 Innovation and External Knowledge Search

Innovation refers to new combinations of components or the recombination of an established system to link together existing components of the product in a new way (Henderson & Clark, 1990; Kogut & Zander, 1992; Kogut & Zander, 1996; Fleming, 2001; Rosenkopf & Nerkar, 2001). Inventors bring together components in novel, previously unthought of ways. Recombining existing component knowledge by a firm leads to, at least to the firm involved, a new knowledge configuration (Van den Bosch et al., 1999). Scholars contend that knowledge is one of the principal inputs for innovation (Nelson & Winter, 1982; Kogut & Zander, 1992; Grant, 1996; Rosenkopf & Almeida, 2003). Firms either need to accumulate component

knowledge internally over time or integrate it from outside their boundaries in order to create innovative products and services (Cohen & Levinthal, 1989; Huber, 1991). While firms certainly benefit from internally developed knowledge, possessing all that is necessary internally might not be possible and/or efficient especially for conducting the recombinatory process of innovation (Henderson & Clark, 1990; Kogut & Zander, 1996; Rosenkopf & Nerkar, 2001). Relying on inside developments and developing competences within current domains can lead to core rigidities and competency traps over time (Levitt & March, 1988; Leonard-Barton, 1992). That is, producing knowledge in-house might not provide sufficient inspiration or variety to enable the combinations of knowledge required to produce innovation (Rosenkopf & Nerkar, 2001; Rosenkopf & Almeida, 2003). Powell et al. (1996) suggest that no single firm has all the internal capabilities for success in innovation. Similarly, Shan and Song (1997) assert that firms in industries characterised by rapid technological change will find their competitive advantage eroded, if they rely solely on internally existing capabilities. While these studies point out the risks of relying on internal capabilities, others establish a link between the use of external knowledge and innovation (Allen & Cohen, 1969; Mueller, 1966; Fleming & Sorenson, 2001; Rosenkopf & Nerkar, 2001; Chesbrough, 2003).

Increasingly, scholars and practitioners are documenting that valuable knowledge could reside outside of the firm boundaries (Cohen & Levinthal, 1990; Chesbrough, 2003). Firms benefit from accessing as well as integrating external knowledge to be able to produce innovative products (Leonard-Barton, 1995; Rigby & Zook, 2002; Rosenkopf & Almeida, 2003; Miller et al., 2007). Utilising available and accessible external knowledge becomes crucial, particularly due to the rising costs of research and development along with resource constraints within or outside of a firm (Nelson & Winter, 1982; Levitt & March, 1988; Rosenkopf & Almeida, 2003). Moreover, external knowledge, by definition, brings elements of novelty and diversity compared to that available inside the firm (Cohen & Levinthal, 1990; Chesbrough, 2003). Further, involving external knowledge domains increases the probability of recognising opportunities and new alternatives (Katila & Ahuja, 2002; Laursen & Salter, 2006). Consequently, firms add new variations into their knowledge pool and solve innovation problems more easily (March, 1991). Accordingly, this allows the

firm to overcome competency traps that limit its ability to access and build on new paradigms (Levitt & March, 1988; Levinthal & March, 1993).

In order to demonstrate the importance of accessing external knowledge for innovation success, prior studies have investigated different concepts, such as network relationships (Ahuja, 2000), open innovation (Chesbrough, 2003), user innovation (von Hippel, 1988), knowledge spillovers (Cassiman & Veugelers, 2002), alliances (Rosenkopf & Almeida, 2003) and knowledge transfer among organisational units (Miller et al., 2007). In addition to these perspectives, the evolutionary economics and strategic management of innovation literatures have stressed the importance of search for solving problems and creating new products (Nelson & Winter, 1982; Rosenkopf & Nerkar, 2001; Katila & Ahuja, 2002; Fleming & Sorenson, 2004). Innovation search refers to "an organization's problem-solving activities that involve the creation and recombination of technological ideas" (Katila & Ahuja, 2002: 1184). Firms search typically by working and interacting with a variety of parties and organisations. They build and sustain links with users, suppliers, competitors and a wide range of different institutions inside the innovation system in order to search (von Hippel, 1988). This helps firms to find sources of variety and extends their scope by exploring those external knowledge sources (Cohen & Levinthal, 1990; Fleming, 2001; Rosenkopf & Nerkar, 2001; Katila, 2002; Katila & Ahuja, 2002). Different opportunities can result from firms' interactions with various external parties. More specifically, firms' interactions with a relatively large number of firms and organisations enable them to gather and channel information regarding other firms' products, resources and capabilities, what problems they face in product innovation and how they can solve them (Katila, 2002).

A growing literature on search distinguishes between different types. Regarding which, Katila and Ahuja (2002) use two notions of search, scope, i.e. how widely the firm explores new knowledge, and depth, i.e. how the firm reuses its existing knowledge. Following Katila (2002) and Katila and Ahuja (2002), Laursen and Salter (2006) introduce the concepts of search breadth and search depth strategies.

With the former, firms seek to improve innovation performance by accessing a large number of knowledge sources, such as customers, suppliers and universities. Regarding the latter, firms attempt to leverage the intensity by which those knowledge sources are used. Investigating search strategies has become key to efforts to explain innovation performance (Katila, 2002; Katila & Ahuja, 2002; Laursen & Salter, 2006; Patel & Van der Have, 2010; Garriga et al., 2013; Terjesen & Patel, 2015). These studies have shifted attention towards to the variety of search channels used by the firm in its search activities and each actor in the innovation system is considered as a search channel (Laursen, 2012). There have also been studies that make a clear distinction between the knowledge spaces that firms use to produce innovative products. Regarding which, Katila (2002) conceptualises a firm's search space as internal (knowledge created within the organisation), intra-industry (knowledge created within the organisation's industry) and extra-industry (knowledge created outside the industry). Additionally, Ahuja and Katila (2004) and Phene et al. (2006) introduce geographic search space, highlighting that search can occur inside or outside national boundaries, describing this as national or international search space.

However, previous research on innovation search that has examined the effects of external knowledge search on innovation performance has not considered two important points. The first is that it has not taken into account the characteristics of emerging economy firms that impact on their search success (Vissa et al., 2010; Li et al., 2013; Asakawa et al., 2014). Previous studies have investigated how environmental conditions affect external knowledge search by taking into account the availability of technological opportunities (Hitt et al., 2000; Ahuja & Katila, 2004), the degree of turbulence in the environment (Sidhu et al., 2007; Terjesen & Patel, 2015), and the search activities of other firms in the industry (Cohen & Levinthal, 1990; Levinthal & March, 1993). In addition to these factors, although it has been acknowledged that the different characteristics of the environment, such as the emerging economy context, influence the ability of firms to search and access knowledge sources, this has yet to be researched in detail (Levinthal & March, 1993; Laursen & Salter, 2006; Chen & Miller, 2007). As Greve's study suggests, "cultural and institutional differences may cause differences, and investigation of such issues

should be encouraged" (2003: 697). However, prior studies on innovation search have mostly been focused on developed economy firms (Rosenkopf & Nerkar, 2001; Katila & Ahuja, 2002; Laursen & Salter, 2006; Phene et al., 2006; Love et al., 2014). Therefore, investigation into how firms' search behaviours differ when they reside in a context surrounded by a lack of internal and external resources as well as capabilities, such as in emerging economies, is considered salient (Li et al., 2013; Asakawa et al., 2014). As the nature of the institutional and economic context is likely to have an impact on the success of search, it is therefore important to take this into account when applying innovation search theory to an emerging economy context (Zhang & Li, 2010; Li et al., 2013). In doing so, this study constitutes an important first step towards improving our understanding of how emerging economy firms search differently and yet, effectively.

The second oversight is that existing studies have not considered the international aspect of external knowledge search for innovativeness (Ahuja & Katila, 2004; Phene et al., 2006; Sidhu et al., 2007; Li-Ying et al., 2014). As the sizeable literature on geographic diversification and international business suggests (Chang, 1995; Hitt et al., 1997), search can also occur in different geographic regions or nations. In this vein, Ahuja and Katila (2004) identify geographic search as the degree to which firms' search activities cross geographic boundaries. They point out that firms can link into multiple regional and national networks and hence, gain information not available locally. Additionally, Phene et al. (2006) too, draw attention to geographical search origin, which covers the national and international contexts. Sidhu et al. (2007) also conceptualise exploratory and exploitative search in terms of spatial search, thereby drawing attention to the importance of international knowledge. In general, these studies have proposed that search may be spatial, hence highlighting the importance of international knowledge for innovation success (e.g. Sidhu et al., 2007; Hohberger, 2014). That is, they have suggested that firms search for opportunities in different nations and consequently, influence firms' innovation performance. However, these studies have not considered how accessing international knowledge shapes the impact of search on innovation and not including the effects of heterogeneous foreign knowledge sources in search strategies can result in opportunities being missed (Ahuja & Katila, 2004; Sidhu et al., 2007; Hohberger,

2014). Recently, Li-Ying et al. (2014) note that international knowledge moderates the relationship between firms' knowledge search along the technical dimension and their subsequent innovation performance. However, accessing international knowledge not only has direct effects on innovation, but also, is expected to have moderating effects as a result of tapping into this knowledge. In the following sections, the characteristics of emerging economy firms are explained followed by discussion on search by such firms and subsequently, hypotheses regarding the impact of external search strategies on innovation performance from the perspective of such firms are proposed.

2.2 Emerging Economy Firms

Emerging economy firms are different from developed economy ones, in particular, because of the different nature of the institutions (Hitt et al., 2000; Khanna, Palepu, & Sindha, 2005; Meyer & Peng, 2005; Wright et al., 2005). Institutions, such as the legal framework, property rights, information systems and regulatory regimes are effective for the functioning of market mechanisms, such as obtaining market information, interpreting regulations and enforcing contracts (Luo, 2003; Meyer et al., 2009). These institutions influence the behaviour of firms and consequently, the resource endowments within and outside of the firm (North, 1990; Newman, 2000; Scott, 2001; Peng, 2003). That is, institutions determine the availability and value of internal and external resources as well as the decision to allocate these resources to innovation activities (Peng & Heath, 1996; Guillen, 2003; Peng, 2003; Taussig & Delios, 2014). In addition to institutions, strategic factors in such contexts are also important since they form a basis for production activities of firms in a specific country. These factors such as endowed (which are used to produce goods or services), advanced (financial resources) and human factors influence the ability of firms to capture economic opportunities (Wan & Hoskisson, 2003). However, emerging economy firms operate in an environment of weak institutions compared to those in developed economies.

Emerging economy firms face different problems to their developed economy counterparts, such as lack of strategic factor markets, lack of property rights, and unstable political structures, which can limit their internal and external knowledge space. Emerging economy firms are typically less resource endowed and they can have difficulties accessing labour, technology, specialized suppliers or customers (Mahmood & Mitchell, 2004; Hitt et al., 2005). They can also face shortages of managerial and financial resources (Peng & Heath, 1996). Regarding the former, emerging economy firms' managers often have little experience and lack the skills needed for running the business in a market economy. In particular, these firms have difficulties in accessing managers working with modern management techniques and processes. In addition, underdeveloped financial markets cause problems regarding the distribution of financial capital and such firms might not be able to access it at reasonable cost (Hitt et al., 2000). The deficit in complementary resources and the issue of resource scarcity can inhibit emerging economy firms' ability to innovate. Moreover, environments with less diverse knowledge are not likely to produce new ideas and new combinations to drive the creation of innovations (Coombs et al., 2009).

Accordingly, the level of technological, managerial capabilities and marketing expertise of emerging economy firms are lower compared to their developed economy counterparts (Hitt et al., 2005; Tsang & Yip, 2007). The latter typically enjoy technological superiority and strong management capabilities (Hitt et al., 2000; Mahmood & Mitchell, 2004; Zhang et al., 2010). In sum, the technology of emerging economy firms is less cutting-edge and resources are less sophisticated compared to those in developed economies (Cuervo-Cazurra & Genc, 2008). These unique characteristics influence emerging economy firms' ability to apply new resources. Specific national contexts, socioeconomic conditions and R&D intensity influence the development of firms' absorptive capabilities to implement new technologies (Lewin et al., 2011). In particular, firms in less R&D intensive environments may adopt low levels of technological innovation and so they develop less elaborated absorptive capacities compared to those in high R&D intensive environments (Lewin et al., 2011). Regarding which, emerging economy firms typically lack internal knowledge and capabilities to engage in extensive R&D activities (Li et al., 2010).

They have the disadvantage of not being able to develop superior absorptive capabilities. Therefore, these firms are characterised by a lack of absorptive capacity compared to those of developed economies (Hitt et al., 2000; Li et al., 2013; Asakawa et al., 2014).

2.3 Search by Emerging Economy Firms

The unique characteristics of emerging economy firms can cause them to experience different problems when they search the external environment. First, they might not have sufficient absorptive capacity to search for distant and innovative knowledge sources (Hitt et al., 2000; Li et al., 2013; Asakawa et al., 2014). Cohen and Levinthal (1989, 1990) argue that absorptive capacity enhances the firm's ability to assimilate and exploit existing knowledge from the external environment. A lack of absorptive capacity can limit the ability of firms to access larger and more advanced sets of technologies. They lack the capacity to learn technologies and managerial practices brought by external knowledge sources, hence blocking them from reaping the benefits of their external search. These firms face challenges, especially when they aim to exploit external knowledge sources by assimilating the new knowledge elements into their existing stock. In particular, there might be too many new ideas to choose between and a poor capacity to make such a choice (Laursen & Salter, 2006). Moreover, knowledge sources outside the boundaries can divert scarce managerial resources and attention away from the core focus of the firm. As a result, some important ideas and information may not be given the required level of attention or effort to bring them into implementation (Ocasio, 1997). Since emerging economy firms have limited firm-specific capabilities for searching, acquiring and integrating even modest search can be challenging and costly for them.

Second, the characteristics of the environment and institutional setting can cause difficulties in searching across knowledge sources. In particular, certain characteristics, such as a volatile environment, political hazards and lack of market institutions to support business and innovation can augment search cost (Zhang & Li, 2010; Li et al., 2013). High risks and uncertainties of innovation activities are likely

to raise transaction and coordination costs (Meyer et al., 2009). The costs in resource deployments and utilization are heightened due to a non-transparent regulatory framework and unpredictable changes of this framework (Luo, 2004). Information scanning, searching, interpretation, monitoring and control become difficult for emerging economy firms. In addition, insufficient government protection of intellectual property rights means emerging economy firms are not able to protect their property rights effectively (Teece, 1986; Zhao, 2006). Thus, there are substantial risks when emerging economy firms are open to the external environment. Unwanted spillovers can provide important information to rivals. That is, leakage of critical knowledge about firms' innovation efforts to competitors is a challenge (Cassiman & Veugelers, 2002), which can result in increasing transaction and coordination costs. In addition, these risks and uncertainties can inhibit external actors' willingness to share their knowledge with such firms. Moreover, inadequate institutional development and restrictive regulations prove to be obstacles to minimising these difficulties (Story et al., 2015). Regardless of the skills and networks possessed by the firms in handling domestic constraints it is always challenging to deal with these issues (Luo & Tung, 2007). Given these constraints, it is critical for them to balance the benefits and costs of information search for product innovation in a volatile and underdeveloped environment.

In addition, emerging economy firms' managers have their attention diverted across a range of different knowledge sources and hence, struggle to focus on the important ones. Further, they have to rely on their ties with the government officials to conduct business and coordinate exchange since its role is substantial in emerging economies owing to the abovementioned institutional void (Peng & Luo, 2000; Li et al., 2008). That is, networking with people with political influence secures resources and influence for emerging economy firms (Peng & Heath, 1996; Li & Atuahene-Gima, 2001; Li & Zhang, 2007). Moreover, as formal institutional constraints, such as laws and regulations, tend to be weak, firms rely on informal means, such as interpersonal ties, to facilitate economic exchange. For, using personal relations provides flexible resource allocation in an environment, where factor mobility is severely confined and governmental interference is rife (Luo, 2003). This excessive focus on interpersonal relations with government officials creates unnecessary challenges for managers in

terms of managing their limited time and attention, because they also need to arrange time to manage their relationships with peers in the industry, such as suppliers, distributor and buyers, in order to access complementary knowledge (Luo, 2003; Mahmood & Mitchell, 2004). Moreover, the attention allocation problem can even lead managers to embrace a short-run strategy, such as imitation, rather than developing really innovative products. This is especially tempting for many emerging economy firms with relatively weak technological capabilities (Wu, 2013).

2.4 External Search Strategies

Laursen and Salter (2006) put forward the concepts of search breadth and search depth as two components of a firm's external search strategies. External search breadth is defined as "the number of external sources or search channels that firms rely upon in their search activities" and external search depth is "the extent to which firms draw deeply from the different external sources or search channels" (Laursen & Salter, 2006: 134). Laursen and Salter's (2006) perspective builds on the previous literature (Katila, 2002; Katila & Ahuja, 2002), by contending that the firm's external innovative search efforts need to include external sources, while previous studies have merely considered search inside the firm and along a technological trajectory. They focus on the search channels in terms of the variety used by the firm in its search activities. Specifically, they consider each search channel as a separate search space, encompassing different institutional norms, habits, and rules, often requiring different organisational practices in order to render the search processes effective within the particular knowledge domain.

Previous studies have examined how different ways of using external sources of knowledge influence innovation performance, according to the search breadth and search depth concepts (e.g. Leiponen & Helfat, 2010; Patel & Van der Have, 2010; Garriga et al., 2013; Terjesen & Patel, 2015). Laursen and Salter (2006) suggest that these search types have an inverse U-shaped relationship with innovation performance. They argue that the benefits of external access may show diminishing returns as the number of accessed external knowledge sources increases. Since this

seminal work, there have been other studies that have found evidence to support the inverse shaped relationship between search and innovation, whilst others have discovered a linear one. Salge et al. (2013) developed a project-level contingency model of open innovation tested in the context of public health-care services. Their research reveals an inverted U-shaped relationship between search openness and new product performance. Wu (2013) distinguishes a firm's search interactions with industry from those with academia and argues that moderate levels of search breadth have better innovation success than with low or high levels. Recently, Garriga et al. (2013) replicated the Laursen and Salter (2006) model, finding that search breadth and depth are inversely related to incremental innovative performance, but not to radical innovation.

On the other hand, Leiponen and Helfat (2010) examine the impact on innovation of breadth in knowledge sources. They find that greater breadth of knowledge sources is associated with greater innovation success at the firm level, and they do not elicit diminishing returns for search breadth. Love et al. (2014) also investigate how previous openness affects the impact that current levels have on innovation performance. While they find evidence that breadth in linkages is associated with higher innovation outputs, unlike Laursen and Salter (2006), they do not discover an inverted U-shaped relationship from individual searches, but they do find some evidence for this once at least five previous external linkage types are reached. These inconsistencies can be attributed to the national context differences and/or different contextual situations (Garriga et al., 2013; Salge et al., 2013). That is, the characteristics of environmental context can lead to different results and should be taken into account while investigating the effects of search strategies on innovation performance (Laursen & Salter, 2006). This issue of inconsistency shows the importance of the contingency approach for external search strategies.

As discussed earlier, these studies have been conducted in developed economy contexts (e.g. The United Kingdom, Sweden, Germany, Finland and Ireland) and have not considered emerging economy contexts. On the other hand, there have been a few studies that have investigated external search strategies in emerging economies

(e.g. Zhang & Li, 2010; Zhang et al., 2014; Li-Ying et al., 2014; Ren et al., 2015). Chiang and Hung (2010) probe the effects of open search breadth and depth strategies on radical and incremental innovation performance for a sample of Taiwanese firms. Zang et al. (2014) also examine how different search strategies affect firms' innovation performance, but this time regarding Chinese high-tech markets. Unlike Laursen and Salter's (2006) findings, their results suggest that a firm processing radical innovation benefits more from open search breadth than open search depth, whereas this is vice versa for a firm processing incremental innovation benefits. In contrast to existing propositions regarding the effects of external search breadth on innovation performance, Li-Ying et al. (2014) suggest that technology search along the technical dimension by Chinese firms has a negative relationship with their subsequent technological innovation performance. However, there are still inconsistencies in terms of the effects of external search on innovation performance and it is thus still important to investigate how emerging economy firms search the external environment (Li et al., 2013; Asakawa et al., 2014). In addition, these studies have used a similar institutional context to test the effects of search strategies on innovation performance. That is, their contexts reflect Asian culture, such as those of China and Taiwan. Therefore, it is of interest to investigate the importance of external knowledge sources for innovation in a context different from this, such as from the perspective of Turkey.

2.4.1 Search Breadth

Firms with a broad search strategy seek to access a wide range of external knowledge sources. This type of external search builds links with users, suppliers, and a wide range of different search channels (von Hippel, 1988). Engagement with these channels may involve interacting with different communities of practice (Katila & Ahuja, 2002; Laursen & Salter, 2014). Broadening external search scope can contribute to firms' innovation performance in several ways. First, accessing a variety of knowledge sources enriches their knowledge pool by adding new elements. That is, it enhances the quantity and diversity of the information that can be accessed. New variations are important in order to have a sufficient amount of

choices for solving problems. Experimenting in many novel areas allows the firm to expand and update its knowledge scope, thus increasing the likelihood of identifying emerging opportunities (Katila & Ahuja, 2002; Zhang & Li, 2010; Jiang et al., 2010), which improves the possibility of finding new useful combinations (Fleming & Sorenson, 2001). An additional reason to pursue breadth of knowledge sources has to do with combining complementary knowledge (Leiponen, 2005). Because innovation often results from knowledge recombination (Henderson & Clark, 1990; Kogut & Zander, 1992), having a greater number of complementary sources of knowledge could improve innovation success. Gaining access to a wide range of sources increases firms' exposure to complementary and heterogeneous knowledge, thus providing more opportunities for recombination of existing ideas from different sources into new products (Rosenkopf & Nerkar, 2001). Second, searching broadly reveals new technological developments to the firm and promotes enhancement of its learning capabilities (Cohen & Levinthal, 1990; Rosenkopf & Nerkar, 2001). Firms need to develop strong absorptive capabilities to assimilate new and varied ideas, subsequently applying them to commercial ends (Zhou & Wu, 2010). Their interactions with a wide range of knowledge sources increase their absorptive capacities and hence, enable them to recognise potential opportunities more easily (Ahuja, 2000; Fabrizio, 2009; Foss et al., 2013).

Despite its benefits, firms can face negative consequences when they search across a wide range of external knowledge sources. The positive effect of search is likely to exhibit diminishing marginal returns as the firm increases the number of search channels (Laursen & Salter, 2006). Absorptive capacity, timing and attention allocation problems have been cited as the reasons for having difficulties when firms leverage knowledge from a wide range of external sources (Koput, 1997; Laursen & Salter, 2006; Wu, 2013). In particular, such behaviour exacerbates the absorptive capacity issue by increasing integration and assimilation problems. Excessive focus on external knowledge sources can hurt firms' integrative capabilities, which are required in order to incorporate acquired resources into their existing knowledge base (Laursen & Salter, 2006). Dependence on external sources of knowledge limits firms' ability to develop their own capabilities, which eventually leads to a failure to transfer the acquired knowledge. In addition, there are too many new ideas to

assimilate and exploit, thus placing constraints on the cognitive ability of R&D personnel to incorporate this new knowledge (Fleming & Sorenson, 2001). Timing and attention problems are other hurdles for firms' carrying out excessive search activities (Ocasio, 1997). For, interacting with other organisations requires significant managerial time and resources to maintain these relationships (Laursen & Salter, 2006; Laursen & Drori, 2012). Increased complexity of managing both the large variety of knowledge and the relationships needed to maintain access to these resources require high marginal costs. Investing time and resources in these activities reduces the time and resources required for actual integration and application of these knowledge elements. In other words, the limited capacity of management to pay attention to many sources of information and processing them could restrict a firm's ability to access large numbers of knowledge sources meaningfully. In sum, beyond a certain threshold, accessing external knowledge sources can undermine innovation production.

Searching broadly is of particular importance for innovation processes in emerging economy contexts where firms face resource scarcity and a lack of institutional support (Hoskisson et al., 2000). In these economies, firms are more inclined towards a network-based strategy for growth (Peng & Heath, 1996). As discussed earlier, the importance of managerial ties with government officials has been emphasised in emerging economies (Peng & Luo, 2000). However, networking with managers at supplier firms or managerial ties with major clients becomes even more essential for emerging economy firms (Meyer et al., 2009). Specifically, increased networking is needed in this situation to counteract the underdeveloped infrastructure in distribution and retailing. Thus, these firms have to depend not only on buyers, but also suppliers, distributors, marketers, and regulators (Luo, 2003). Those firms that are able to extend their firms' interactions to other actors in the market perform better than other firms who are not. However, the positive effects of broad search is likely to exhibit diminishing marginal returns as the firm increases the number of areas explored. This is because search is challenging for emerging economy firms due to the aforementioned lack of absorptive capacity and associated costs. This process is subject to considerable attention and uncertainty since each search area requires extensive effort and time. The limitations in their absorptive capacities can

lead emerging economy firms to spend excessive time and effort to be able to integrate novel ideas (Cohen & Levinthal, 1989, 1990). In addition, the scarcity these firms encounter at the firm level can lead to them having managerial problems while trying to control and monitor a wide range of knowledge sources. In particular, broad search can result in firms spreading their managers' limited attention across different sources of knowledge. These difficulties increase the search cost and outweigh the benefits. Following this line of reasoning, I propose:

Hypothesis 1 (H1): Search breadth has a curvilinear impact (inverted U) on innovation performance for emerging economy firms.

2.4.2 Search Depth

Firms with a deep search strategy intensely explore fewer external sources that they consider to offer important knowledge inputs. This type of search builds deep links with key knowledge sources, such as lead users, suppliers or universities. Firms sustain virtuous exchanges and interactions with a small number of external sources (Laursen & Salter, 2006; Garriga et al., 2013). The intensive and repeated interactions facilitate the development of greater levels of trust, communication, and understanding with an external source, which enables firms to assess the value of such knowledge more easily. In doing so, search depth increases the ease of learning in specialised areas and moreover, firms thereby obtain deep knowledge rather than shallow (Terjesen & Patel, 2015; Cruz-Ganzalez et al., 2015). Additionally, this high level of interaction may augment the actors' incentives to exchange information (Ahuja, 2000). Deep focus enables firms to accumulate their own firm-specific social capital that increases their connectivity effects between external actors (Laursen et al., 2012). Social interactions enable the closeness between firms that facilitates the exchange of the deeper, tacit components of knowledge (Kogut & Zander, 1996; Lane & Lubatkin, 1998). Accordingly, this type of search enables firms to have a deeper understanding since learning happens when information and knowledge are transferred efficiently (Rowley et al., 2000). Firms increase their absorption abilities

and thereby, acquire implicit and specialized knowledge, which enables them to have a richer knowledge base and understanding (Fabrizio, 2009; Terjesen & Patel, 2015).

However, dysfunction can occur in this case as with search breadth, for a firm that relies on too many deep relationships with its external knowledge sources (Laursen & Salter, 2006). In order to draw deep knowledge from any of these sources, firms need to sustain a pattern of interaction over time (Laursen & Salter, 2006). This might cause integration and assimilation problems as each deeply used resource requires highly devoted time and attention, thus resulting in lower innovation success. Moreover, excessive time invested in external knowledge sources could be at the expense of independently pursuing promising research avenues and nurturing internal research skills (Kogut & Zander, 1992). In doing so, this limits absorptive capacity and the development of new products. In addition, over-searching external sources deeply can lead to firms to losing sight of the bigger picture outside. As a consequence, such firms become victims of learning and competency traps, ending up developing core rigidities (Leonard-Barton, 1995). Accordingly, if a firm relies on too many deep relationships, it will exhibit lower innovation performance.

For emerging economy firms, increased trust between external actors is important for determining organizational knowledge transfer (Peng & Heath, 1996). Continuous interactions and strong ties play a crucial role in order to build trust. Searching deeply requires high level of interactions with key external knowledge sources and so develops trust. These intensive interactions coming with a search depth strategy increase firms' willingness to commit their time and efforts to understand new external knowledge (Lane et al., 2001). Hence, emerging economy firms benefit from their search depth strategies, however, becoming too deeply reliant on external knowledge sources exhibits diminishing marginal effects on innovation performance. In particular, such firms may find it difficult to manage this process owing to inadequate absorptive capacity (Hitt et al., 2000; Asakawa et al., 2014). Having deep interactions with many knowledge sources requires substantial resources and capabilities. Since emerging economy firms face resource and capability scarcity search depth will not be rewarding (Garriga et al., 2013; Ren et al., 2015). In

addition, time and effort invested in managing connections with a diverse range of actors can reduce a firm's resources dedicated to maintaining extant relationships over time. In this case, they can face problems relating to poor allocation of managerial attention, which infers that firms operating in emerging economies should only focus on a few sources to draw heavy knowledge, for otherwise dire consequences can occur. Following this line of reasoning, I propose:

Hypothesis 2 (H2): Search depth has a curvilinear impact (inverted U) on innovation performance for emerging economy firms.

2.5 International Collaboration

International collaboration can help emerging economy firms to tackle problems they face when they search, such as resource scarcity and absorptive capacity problems (Li & Atuahene-Gima, 2001; Zhang et al., 2010; Kafouros & Forsans, 2012). Such firms find it possible to access and integrate advanced foreign knowledge in order to overcome resource and capabilities shortage. They have the opportunity to learn from foreign firms (Hitt et al., 2005; Wright et al., 2005; Tsang & Yip, 2007; Li et al., 2013). Those that open up their boundaries to inflows of knowledge and technologies created by organisations from foreign countries are more likely to benefit from external knowledge than those that acquire their knowledge from domestic organisations (Wright et al., 2005; Li et al., 2010; Kafouros & Forsans, 2012; Levin & Barnard, 2013). Acquisition of foreign knowledge not only offers the firm the opportunity to add more advanced elements to this set, but also fundamentally different ones and thereby, increases the likelihood of finding valuable combinations (Phene et al., 2006). Foreign firms can create value for local firms by providing access to critical resources (e.g. technology, marketing), transferring of knowledge and reducing transaction costs (Steensma et al., 2005). In doing so, emerging economy firms can recognize great opportunities and promote their learning (Mahmood & Mitchell, 2004; Zhang et al., 2010; Li et al., 2010; Li et al., 2013).

The importance of accessing international knowledge sources has also been addressed by studies on innovation search literature (Ahuja & Katila, 2004; Phene et al., 2006; Sidhu et al., 2007; Li-Ying et al., 2014). Ahuja and Katila (2004) use the geographic search term to highlight firms' search efforts across national boundaries, through which firms can access knowledge that is new to their own context. In particular, the existence of differences across nations in terms of their technological capabilities and specialisation creates a potential for non-overlapping knowledge bases, thus increasing a firm's chance of discovering novel opportunities (Almeida, 1996; Ahuja & Katila, 2004; Feinberg & Gupta, 2004; Phene et al., 2006; Lavie & Miller, 2008). That is, presence in the international context can raise a firm's awareness of the different areas of the knowledge landscape and thus, provide a set of raw materials for knowledge combinations. The recombinant view suggests that new knowledge is created by combination of new components or new combinations of existing ones (Schumpeter, 1934; Henderson & Clark, 1990; Fleming, 2002). Consequently, the incorporation of knowledge from a different technological context increases the opportunity set of new components that can be utilised. Incorporation of knowledge from a different national context, on the other hand, increases the opportunity set of new combinations that can be tried with existing components. That is, owing to differences in perspectives and cognition, inventors in different national contexts may utilise the same components of knowledge in new ways (Phene et al., 2006).

In particular, many emerging economy firms have made great effort to attract foreign firms and to increase knowledge transfer from international resources. A number of studies have also stressed the importance of knowledge transfer from foreign firms into emerging economies through different mechanisms. The mechanisms through which contact with an emerging country can access knowledge sources from other geographical contexts are foreign direct investment (Spencer, 2008; Zhang et al., 2010) and the multinational corporation (Driffield, Love, & Menghinello, 2009; Meyer & Sinani, 2009; Narula & Dunning, 2000). Other mechanisms, such as exports (Lall, 1998), joint ventures, acquisitions and alliances (Bresman, Birkinshaw, & Nobel, 1999; Gubbi, Aulakh, Ray, Sarkar, & Chittoor, 2010), emphasise contact between firms. Apart from these mechanisms, firms also form collaboration with

external partners from other nations, such as with suppliers, customers and universities, so as to be able to access novel knowledge sources (Ahuja, 2000; Hagedoorn et al., 2000; Hagedoorn, 2002; Hagedoorn & Duyster, 2002; Belderbos et al., 2004; Kang & Kang, 2014; Patel et al., 2014).

Collaboration becomes especially important for emerging economy firms experiencing resource scarcity problems and high search costs when they look for external knowledge sources. This is because it is based on formal agreements and thereby plays a pipeline role (Love & Roper, 2004; Laursen & Salter, 2014; Singh et al., 2015). Formal and specified contracts can reduce transactions costs, provide close and strong interactions and thus facilitate knowledge transfer (Li, Poppo, & Zhou, 2010). Collaboration can enhance innovative performance by providing firms new knowledge and abilities for utilizing and combining it, which increases their ability to produce innovative products (Powell et al., 1996; Ahuja, 2000; Fleming, 2001; Grimpe & Kaiser, 2010). Additionally, it provides the knowledge and ability to combine and reconfigure new knowledge. That is, collaboration provides access to accumulated skills and expertise, which includes the significant tacit and noncodifiable knowledge dimension. Firms acquire partners' technologies and management practices, thus gaining new insights into how to solve the problems in their innovation processes (Powell et al., 1996; Hagedoorn, 2002). With the inflow of new knowledge, firms can produce commercially viable, culturally adaptable and legitimized products for the global markets. In addition, collaboration increases experience and it enables firms to enhance their managers' abilities to manage attention problems (Lavie & Miller, 2008). Managers can recognize more easily which knowledge source is important or not and hence, are likely to spend less time managing this process.

In addition, collaborations provide opportunities for close interactions between partners and specified agreements can foster these (Hansen, 1999; Kang & Kang, 2009, 2014; Laursen & Salter, 2014). This closeness enables firms to have advantages in transferring knowledge (Hansen, 1999), for this process is complex and hence, operates well when ties are close, but not so when the converse is the

case. In particular, passing on highly tacit knowledge, such as know-how, insights and experience, requires deep investment by all parties and firms might need to be involved in continuous interactions (Nonaka, 1994; Szulanski, 1996; Hansen, 1999). Joint development between collaborators exhibits properties of strong ties and close interactions. In doing so, partners develop detailed understanding of each other's knowledge profiles, which increases the motivation and experience to transfer and share tacit knowledge. Accordingly, collaboration acts as pipes through which knowledge can flow (Carnabuci & Operti, 2013; Singh et al., 2015). In particular, it is of importance if firms are acquiring knowledge from international sources, for gaining access to them requires more effort and time due to logistic and coordination issues. By contrast, having weak ties between partners and firms can aggravate the challenges, such as increasing transaction costs and reducing trust between the two sides. Partners might not be willing to share the critical knowledge if they do not know each other. Conversely, strong ties mitigate these problems and enable partners to share not only the knowledge but also critical resources and capabilities (Levin & Barnard, 2013).

This study hence looks at international collaboration as a contingency of search strategies and investigates it in two different aspects. First, it looks at how different types of collaboration contexts influence the relationship between external search strategies and innovation performance. Second, it explores how international collaboration partner types affect the link between search strategies and different types of innovation performance. These aspects are discussed in the next sections (section 2.6 and section 2.7).

2.6 Types of International Collaboration Contexts

Search strategies are not deployed in isolation. The firm's objectives, resources, and market determine whether searching broadly or deeply is more beneficial. In particular, previous studies have highlighted that how firms search depends upon where they search (Katila, 2002; Laursen & Salter, 2006; Zhang & Li, 2010). Idiosyncratic characteristics of different contexts lead firms to embark on new search

paths or to follow certain search patterns (Ahuja & Katila, 2004; Laursen, 2012). They are likely to confront unforeseen opportunities and unexpected problems in each context. Availability of knowledge and resources, variations in regulations and the level of accessed technology can be influential in terms of how firms search (Ahuja & Katila, 2004). It is not only about how they search, but it is also in relation to where they obtain the knowledge (Vissa et al., 2010). That is, the characteristics of knowledge location are important for innovation activities and the success of search strategies (Katila, 2002; Phene et al., 2006). Phene et al. (2006) introduce the national and international search origins and explore to what extent firms' search patterns depend on those contexts. Building on their work, an aim of this study is to consider the impact of the context in which country the partnership is conducted on the link between search strategies and innovation performance. Specifically, emerging economy firms' international collaboration, including collaborations with developed economy partners, and collaborations with other emerging economy partners, is distinguished.

The characteristics of emerging economy firms' collaborations with partners from other emerging economies are systematically different from those with partners from developed ones. That is, the unique features of each nation lead emerging economy firms to have different opportunities and hence, different motives for collaboration. Extant literature on international business has also stressed that the reasons and motives for engagement by emerging economies and developed ones vary (e.g. Tsang, 1999; Kuemmerle, 1999; Wright et al., 2005; Hitt et al., 2005). Consistent with this logic, Hitt et al. suggest that "the types of resources firms seek to leverage and the capabilities they need to learn will vary with their market context (emerging or developed)" (2000: 450). In addition, the unique characteristics of each collaboration context lead to firms to encountering different problems. Emerging economy contexts have underdeveloped market supporting institutions, such as weak laws and poor legal institutions, unlike their developed counterparts, which can thus create problems, such as unpredictability or a volatile environment (Khanna & Palepu, 2000; Luo, 2003b).

Accordingly, the differences in terms of characteristics and nature of engagement influence the ability of firms to assimilate and transfer knowledge from each context differently. Emerging economy firms gain access to novel and advanced knowledge and technology when they collaborate with developed economy partners. In contrast, they do not look for cutting edge technology when they collaborate with emerging economy partners (Luo & Tung, 2007). The absorptive capacity concept suggests that when the novelty increases, the level of absorption declines (Cohen & Levinthal, 1990; Nooteboom et al., 2007). In sum, locational characteristics influence the nature of the knowledge accessed and the ability of firms to acquire such knowledge. That is, firms can benefit from broader or deeper search based on the characteristics of each context. Hence, it is important to look at how emerging economy firms leverage search breadth and search depth strategies when they collaborate with partners from other emerging economies as well as developed ones.

2.6.1 Developed and Emerging Economy Collaborations

Developed economies are characterised by strong institutional arrangements along with economic and social stability. These economies have a market-based institutional framework and consequently, their markets work smoothly (Peng et al., 2008). This level of development enables firms to access the most needed elements of innovation infrastructure (Mahmood & Mitchell, 2004). In contrast, as aforementioned, emerging economies are characterised by weak institutions and economic and social instability (Hitt et al., 2000; Meyer et al., 2009). These economies have underdeveloped market institutions which cause markets to work poorly. Unlike developed economy firms, the situation in emerging economies poses challenges for such firms when trying to access essential knowledge for innovation. Despite emerging economies being associated with a rapid pace of economic development, developed ones offer more in terms of resources, knowledge and technology (Hoskisson et al., 2000; Hitt et al., 2000). These differences lead to emerging economy firms experiencing difficulties in terms of developing their technology and management capabilities.

These characteristics suggest that firms might have different reasons to engage with developed economies compared with emerging economies and different criteria have been used to explain this differential engagement. Tsang (1999) attributes it to learning differences, contending that firms have different objectives of learning when engaging with partners from each context. Emerging economy firms collaborate with developed economy partners to import modern technology and thereby to grow, whereas in contrast, countries with the same technology level come together to share the risk of entering a new market or country. Dacin et al. (1997) link this differential engagement to the differences in the level of economic development across nations. That is, firms have different aims according to whether they collaborate with less or more developed countries on an economic basis. Firms from emerging economies establish partnerships with developed economies to gain access to technology opportunities. On the other hand, developed economy firms collaborate with emerging economy partners to gain access to local knowledge, including customs, business practices and political connections. Singaporean officials collaborated with Chinese partners to gain social capital and develop experience from working in China, whilst the Chinese engaged in this collaboration to transfer knowledge and to learn (Inken & Pien, 2006).

This differential engagement is linked to the differential innovation goals of partnerships involving both emerging and developed economies (Schmiele, 2012; Jacob et al., 2013). Kuemmerle (1999) suggests that knowledge augmentation and knowledge exploitation are the two motives that drive innovation activities abroad. That is, emerging economy firms invest in Western regions to augment their knowledge, seeking to tap into knowledge pools of very high quality and consequently, are the knowledge seekers. These firms take advantage of a country's scientific and knowledge inputs to access cutting-edge technology. In contrast, firms invest in emerging economies to exploit their existing knowledge base. They seek to access important market opportunities that will enable them to convert their resources into high profits and hence, are market seekers aiming to sell their innovations. Emerging economies provide opportunities such as strong sales growth. Moreover, firms that invest in these economies are the efficiency seekers aiming to reduce the costs of their innovation activities. Emerging economies can provide firms

access to cheaper resources (including labour) and innovation inputs, thus allowing them to pursue cost-effective benefits. In sum, firms' innovation activities in emerging economies, such as China, are market driven and development oriented rather than geared towards research (Gassmann & Han, 2004).

These differences in terms of the nature of engagement indicate that emerging economy firms have different reasons for collaborating with developed economy and other emerging economy partners. Emerging economy firms gain access to different types of knowledge depending on partner nations. Hence, they collaborate with developed economy partners in order to acquire basic and cutting-edge technology to create novel combinations of elements (Hitt et al., 2005; Wright et al., 2005; Tsang & Yip, 2007). That is, they seek sophisticated technology and advanced know-how from their partners in developed economies, being eager to close the technological gap in their home context so as to be able to compete in global markets (Luo & Tung, 2007). They have major incentives to acquire new knowledge in the realms of technology and management, which they can convert into effective capabilities. The knowledge from developed economies enables emerging economy firms to create innovative combinations of new knowledge. That is, it provides new ways to combine and use disparate knowledge to achieve unique product advances.

On the other hand, since emerging economies have similar levels of economic development, emerging economy firms do not partner with other such firms to acquire technology or management capabilities (Miotti & Sachwald, 2003). However, they do often collaborate with other emerging economy partners to access knowledge about customers and local markets (Li & Zhong, 2003; Demirbag et al., 2009). Their partners' position in the market allows emerging economy firms to produce a product which is very attractive to local consumers. In addition, emerging economy partners have knowledge about customers who require low-cost products, which can increase firms' ability to produce innovations for such customers. These partners can also provide cost effective access to specialized resources (including labour). In general, emerging economy firms leverage other emerging economy partners' knowledge about markets and customers (Gassman & Han, 2004). They

take advantage of lower operational costs and the availability of natural resources to increase their customer base. This partnership therefore complements and extends firms' current capabilities. Emerging economy firms continue to use their existing resources and technologies. This collaboration helps these firms to modify and customize their products and services in order to respond local demand. That is, emerging economy firms have their base of resources and capabilities to adapt their technologies to local markets and preferences (Hitt et al., 2005).

Additionally, the characteristics of the collaboration context lead to firms having to confront different problems and threats. Emerging economies are typically characterized as having a high volatile environment due to rapid political, economic and institutional changes (Hoskisson et al., 2000). Since their market structure is evolving, high uncertainty and turbulence for actors in this context is inevitable. For instance, unpredictable changes in industry structures are likely to occur (Luo, 2003). Moreover, it is likely that there will be changes in technologies, customer preferences and fluctuations in product demand as well as supplies of materials. Frequent and unpredictable changes of rules and regulations are also likely to happen, thereby creating greater uncertainty when compared to developed economies (Luo, 2003b). These uncertainties can aggravate firms' chances of accessing to information, knowledge and resources (Acquaah, 2007). Further, emerging economy firms collaborating with other emerging economy partners can face the threat of obsolescence. In sum, emerging economy firms can have problems accessing knowledge when they collaborate with other emerging economy partners rather than developed economy partners.

These systematic differences in terms of the nature of engagement for different types of collaboration contexts have implications for emerging economy firms aiming to improve their innovation success. They imply that new knowledge can be accessed regardless of the location of the partner (Alcacer & Chung, 2011; Kim, 2015). In reality, the chances of accessing such knowledge increase when countries are more developed in terms of institutions, customers, and technological development (Hitt et al., 2000; Hitt et al., 2005; Luo & Tung, 2007). As the technological level of a

country is generally related to its economic development, emerging economy firms are likely to get novel and advanced knowledge from developed economy partners rather than emerging economy ones (Tsang & Yip, 2007). Prior evidence shows that knowledge flowing from an economically developed country like Finland is significantly higher than that from China (Li et al., 2007). However, accessing and integrating knowledge from such nations will be difficult, because they offer novel knowledge, which is hard to assimilate (Tallman & Phene, 2007). Systematic differences between emerging and developed partners in terms of the nature and motives of engagement show that emerging economy firms are likely to face difficulties while absorbing knowledge from such contexts (Lane & Lubatkin, 1998; Cohen & Levinthal, 1990). That is, greater distance in terms of the level of technology development makes absorption of knowledge from there more challenging (Nooteboom et al., 2007). In sum, firms that have a low knowledge gap provide less novel knowledge, but the absorption will be easier. In contrast, where there is a large knowledge gap in a collaboration more novel knowledge can be accessed, but absorbing it will be more difficult.

2.6.2 Role of Absorptive Capacity

Absorptive capacity has long been recognized as an important driver of firms' innovative performance (Cohen & Levinthal, 1989, 1990; Henderson & Cockburn, 1994). Cohen and Levinthal define it as the "ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (1990: 128). This view of absorptive capacity emphasises the firm's ability to exploit external knowledge (Lane, Koka & Pathak, 2006). Other related concepts, such as second-order competence (Rosenkopf & Nerkar, 2001) or architectural competence (Henderson & Cockburn, 1994) are also pointed to as enabling integration of external with firm knowledge. R&D expenditure has been used to capture the firm's ability to absorb (Cohen & Levinthal, 1990). It is argued that having higher R&D spending increases a firm's ability to acquire and use external knowledge which, in turn, enhances its innovativeness (Lane & Lubatkin, 1998; Lane et al., 2001). However, studies considering R&D expenditure as the level of absorptive capacity have been criticised

for not taking into account the multidimensionality of this construct (Zahra & George, 2002). That is, the development of absorptive capacity depends on factors, such as a firm's prior experience, knowledge, complementarity and its diversity of knowledge sources (Zahra & George, 2002).

Previous studies have used different criteria to examine firms' absorptive capacities to acquire and assimilate the knowledge from international contexts. Some of them have focused on firm level factors affecting absorptive capacity, whilst others have looked at environmental level ones. For instance, some extant studies have focused on relational mechanisms, whereby tie strength itself has been used to explain the accessibility of the knowledge across nations (Bell & Zaheer, 2007; Levin & Barnard, 2013). That is, knowledge can be more or less accessible depending on the nature of the ties between those exchanging it. Weak ties tend to provide novel knowledge and fresh ideas, because the partners usually operate in different circles (Granovetter, 1973). However, because of the challenges presented by the fact that partners are not co-located, such contacts abroad can restrict knowledge sharing. Strong ties with partners abroad are also as likely to be potential sources of novel knowledge just as much as weaker ones (Levin & Barnard, 2013). This type of tie is important since it develops the trust mechanism which is viewed as a critical driver of knowledge transfer. Strong ties enable partners to learn from each other and become dependent on one another, thereby developing trust. Thus, the social bond between partners harmonises social interaction and facilitates tacit knowledge exchange (Uzzi, 1996, 1997). Other studies have focused on knowledge characteristics while examining the difficulties firms have when accessing geographically distant knowledge sources (Hitt et al., 2005; Tallman & Phene, 2007). Different characteristics, such as product market relatedness, technological similarity and prior ties have been linked to firms' abilities to recognise and value knowledge from geographically distant partners (Reuer & Lahiri, 2014). These studies have emphasised firm level factors, such as knowledge differences and characteristics, as influencing absorptive capacity.

In addition to firm level factors, the context of external knowledge sources becomes important in terms of explaining the concept of absorptive capacity. In other words, a firm's ability to exploit valuable knowledge from different contexts depends not only on its capabilities in R&D, but also on the external context in which the knowledge is located (Phene et al., 2006; Lavie & Miller, 2008; Zhang et al., 2010). In this vein, Lane and Lubatkin (1998) contend that a firm's ability to learn from another depends on the similarity of their knowledge bases, organisational structure, compensation policies, and dominant logics. The wider system that embeds the external knowledge consists of national institutions, culture, and policies which shape education, research, labour behaviour, as well as investment patterns (Freeman, 1995). There are significant differences across contexts in terms of culture, institutions, socioeconomic conditions, university systems and the stock of local knowledge. These differences increase cognitive distance and hence also, the novelty of the knowledge that can be accessed. However, the increase in novelty value leads to a decrease in absorptive capacity (Nooteboom et al., 2007; Gilsing et al., 2008; Bertrand & Mol, 2013). Consistent with this logic, there have been studies that have focused on the external context in which the knowledge is embedded, in order to understand firms' abilities to absorb external sources (Phene et al., 2006; Lavie & Miller, 2008; Li & Vanhaverbeke, 2009). Adopting the concept of absorptive capacity, Phene et al. (2006) show that there are limits to a firm's ability to integrate internationally distant knowledge. Lavie and Miller (2008) also contend that, whilst national differences between the focal firm and its foreign partners create opportunities for accessing unique network resources, these also impose barriers to efficient resource exchange. From the perspective of adaptation literature, it is argued that differences between institutions create barriers to the acceptance and implementation of transferred practices (Jensen & Szulanski, 2004). For example, many United States firms have struggled to understand the principles underlying some Japanese management practices. These differences will limit the firm's ability to identify and assimilate network resources as well as its absorptive capacity.

It is important to note that this wider system also creates differences across contexts in terms of technological development and knowledge capabilities. Regarding which, national systems of innovation literature contends that the nature and volume of

innovation as well as the rate and direction of technological learning vary across contexts (Nelson, 1993; Mowery & Oxley, 1995; Freeman, 1995). The level of knowledge, skills, experience and institutional structures influence countries' accumulation of technological capabilities (Bell & Pavitt, 1997). Accordingly, country characteristics drive firms to take up unique patterns of innovation and technological development (Lundvall, 1992; Nelson, 1993), with the consequence being that their limitations in absorptive capacity can vary from context to context. Some countries offer a potentially more advanced level of knowledge and technology when compared to others. The differences in economic and technological development increase cognitive distance and hence, novelty. However, the level of absorption decreases when the level of cognitive distance increases (Nooteboom et al., 2007).

These economic and technological differences across contexts have been highlighted as existing between developed and emerging economies. In terms of social development, unlike the former, the latter generate innovations that are appropriate for low-income consumers. In terms of economic development, emerging economies have less sophisticated innovation systems, underdeveloped financial markets and less developed suppliers. Developed countries are likely to have greater technological opportunities along with better developed innovation systems and appropriability regimes. The resultant differences in terms of economic and technological aspects can be influential on the type and content of knowledge firms are likely to get from the two focal contexts. Regarding which, emerging economy firms acquiring knowledge from developed economies access greater sources of heterogeneity and novelty than those that acquire knowledge from other emerging economies. Differences in terms of technology increase opportunities for knowledge acquisition. Moreover, different knowledge bases can help firms to experiment with new and different ideas about product concepts, as well as the development process itself, which enhances new product innovativeness. However, the technological gap between developed and emerging economies can reduce firms of the latter type's ability to acquire knowledge from such contexts (Hitt et al., 2000; Wright et al., 2005; Asakawa et al., 2014). The path-dependent nature of learning makes it hard for a partner to absorb and integrate knowledge that is different from that which it

currently knows (Cohen & Levinthal, 1990). That is, the lack of a common knowledge base aggravates firms' abilities to recognize knowledge and then integrate it with their own.

2.6.3 Search and Emerging Economy Collaborations

To determine whether searching broadly or deeply is beneficial when emerging economy firms collaborate with partners from such economies, the nature of the knowledge accessed, absorptive capacity and cost perspectives need to be considered. As pointed out above, emerging economy firms collaborate with partners in other such economies to access knowledge about local markets and customers (Wright et al., 2005; Luo & Tung, 2007). These partners provide cost effective access to specialized resources and innovation inputs (Li & Zhong, 2003). The accessed knowledge from such partners enables firms to adapt their existing products effectively, thereby achieving greater local market acceptance. This shows that firms leverage their own resources to be innovative. This interaction with partners from other emerging economies is likely to provide resources that extend local firms' current capabilities. This supports the argument that collaboration with emerging economy partners is more likely to result in refinement rather than the discovery of a new product. These collaborations enable firms to develop products that concentrate on essential features. If collaboration with emerging economy partners primarily leads to refinement, it would appear safe to assume that a dominant design has been established already (Abernathy & Utterback, 1975; Utterback, 1994). The main challenge is to fine-tune the products and processes. Such adaptations are more likely to be inspired by many different sources of innovation than by the deep usage of a small number of key knowledge sources. With the successful development of new products the technology and the market mature. Moreover, the number of actors with specific and useful knowledge about particular aspects of a technology increases. Consequently, working with a number of different actors in the innovation system will be required in such a diverse knowledge environment (Pavitt, 1998), which will increase firms' chances of finding new combinations of existing knowledge and technologies. In line with this argument, Laursen and Salter (2006) provide empirical

evidence that search breadth has a higher impact on incremental innovation than radical innovation. Accordingly, the combination of a search breadth strategy and emerging economy collaborations enhances the strategic fit between these two strategies.

In addition, the unique features of emerging economy partners require firms to search across a wide range of knowledge sources to increase the variety and opportunities to create innovation. Emerging economy partners are likely to have problems such as high uncertainty and unpredictability in their activities (Luo, 2003b). For instance, there is a demand uncertainty which creates changes in customer preferences. Variations in customer preferences and fluctuations in supply of materials can lead to problems in terms of accessing partner knowledge and lead to current knowledge becoming obsolete (Jansen et al., 2006). For this reason, firms need to extend boundary spanning to identify novel recombinations (Peng & Heath, 1996). That is, they need to enhance the search scope to increase the chances of recognizing new opportunities when they face the problem of rapid obsolescence of knowledge, for a deep focus on a few knowledge sources will lead to rigidity problems (Terjesen & Patel, 2015).

Absorptive capacity considerations also support the perspective that searching broadly is most beneficial when firms collaborate with partners from other emerging economies. Since the differences between them in terms of economic and institutional development is lower, firms do not need as high a level of absorptive capacity as they would do when collaborating with developed economy partners (Jacob et al., 2013). The nature of engagement suggests that emerging economy firms do not collaborate with other emerging economy partners to gain access to advanced cutting-edge knowledge and technology (Luo & Tung, 2007; Tsang & Yip, 2007). This suggests that such collaborations decrease the novelty, but facilitate absorption (Cohen & Levinthal, 1990; Nooteboom et al., 2007). Consequently, this type of partnership does not need the same level of attention and effort as having developed economy partners does. Therefore, searching across a wide range of

knowledge sources becomes feasible for emerging economy firms collaborating with partners from other emerging economies.

Cost considerations provide further support to the claim that the interaction between search breadth and collaborations with emerging economy partners is most beneficial. For, interactions with many knowledge sources lead to mounting coordination and monitoring costs. Consequently, emerging economy firms can struggle to deal with too many novel ideas and collaborating with other emerging economy partners helps to keep down costs. Emerging economy firms continue to use their existing practices regarding management and resources when they collaborate with partners from the same context, which reduces the time and effort needed to experiment. In addition, institutional proximity reduces managers' uncertainty about the nature of a foreign environment. For example, Turkish firms may be better at dealing with political instability as they can access relevant experience from their home country (Cuervo-Cazurra & Genc, 2008), which reduces the cost of searching widely across a range of knowledge sources. Overall, the nature of knowledge accessed when emerging economy firms collaborate with partners from such economies (Gassman & Han, 2004; Luo & Tung, 2007; Tsang & Yip, 2007) suggest that the combination of search depth and emerging economy collaborations is not beneficial for emerging economy firms' innovation performance, therefore the hypothesis looking at this relationship is not formulated and put forward for testing in this thesis. However, searching widely is beneficial when emerging economy firms collaborate with other emerging economy partners. Hence I propose:

> *Hypothesis 3 (H3): Search breadth has a positive impact on innovation performance for emerging economy firms collaborating with other emerging economy partners.*

2.6.4 Search and Developed Economy Collaborations

To determine whether search breadth or search depth is most beneficial when emerging economy firms partner with developed economy partners, the nature of knowledge accessed, absorptive capacity and cost perspectives are considered. Emerging economy firms engage with such partnerships so as to be able to access advanced technological and market knowledge (Wright et al., 2005; Hitt et al., 2005; Tsang & Yip, 2007). Developed economies are technologically more advanced than emerging ones, providing 76 percent of the world's patent filing and being associated with most breakthrough innovations (WIPO Statistic Database, 2008). Hence, collaborating with developed economy partners can give emerging economy firms access to resources that are not easily replicated by local competitors (Hitt et al., 2000). It involves experimentation with new alternatives and acquiring major additions of knowledge to a firm's knowledge stock (Ahuja & Lampert, 2001). Consistent with this logic, emerging economy firms gain access to novel and sophisticated knowledge that increases their chance of producing innovative products. This supports the argument that innovation in developed economies is more likely to be of a more radical nature (Wright et al., 2005; Hitt et al., 2005) and such innovators are more likely to be inspired by drawing deep knowledge from a small number of key sources rather than having a shallow focus on a broad range. Novel knowledge is particularly valuable in the early stages of the product life cycle. Regarding which, empirical evidence suggests that during the early stage of the life cycle firms primarily rely on a narrow range of sources, such as a lead user, supplier, or university (Rothwell et al., 1974; Urban & von Hippel, 1988; von Hippel, 1988). In-depth engagement is required in order to exchange tacit knowledge about distant technology that cannot be achieved across a wide variety of knowledge sources. For instance, the development of biotechnology firms supports the idea of narrow, but deep engagement, as in many instances universities have been the main source of innovation (Zucker, Darby, & Brewer, 1998). A similar point is made by Riggs and von Hippel (1996) when they showed that close to 50 percent of the innovations in scientific instruments came from one particular source (Riggs & von Hippel, 1996). In sum, searching key sources with high intensity is important in order to develop understanding and enhance the ability to assimilate radical changes in products

(Hsieh & Tidd, 2012). Consequently, searching deeply is most appropriate in settings where novel technology is available (Laursen & Salter, 2006).

Taking an absorptive capacity perspective, this also suggests that searching deeply becomes most beneficial when emerging economy firms collaborate with partners from developed economies. However, the overlap between the former's knowledge base and that of the latter is likely to be insufficient (Hitt et al., 2005; Wright et al., 2005). In particular, having large knowledge gaps in terms of technological and managerial conditions aggravates an emerging economy firm's ability to integrate and utilise knowledge from developed economy partners (Zhang et al., 2010). Impediments to inter-organisational learning and collaboration become substantial as relative absorptive capacity diminishes with increases in technological and knowledge differences between the firm and its foreign partners (Lane et al., 2001). This is especially hindered because tacit knowledge is often imperfectly understood. Lack of shared knowledge and common understanding inhibit the exchange process of tacit knowledge (Cohen & Levinthal, 1990). Hence, emerging economy firms face difficulties in engaging in knowledge sharing and transmission of acquired knowledge. In which case, broad search is not efficient for increasing innovation performance due to absorptive capacity problems and high search costs. Scott and Brown (1999) and Brown and Duguid (2000) explain that each knowledge domain has different institutional norms, habits, and rules. Searching effectively in different domains therefore requires an adaptation of organisational practices. For example, working with a university or private laboratory usually involves different contractual arrangements and cultural norms (Dasgupta & David, 1994). It is not same as when partnering with suppliers where firms operate in the same value chain and market (Song & Thieme, 2009). This means that searching widely increases the complexity of search and hence, makes absorption of knowledge more difficult (Terjesen & Patel, 2015).

In addition, this diversity enables firms to obtain shallow rather than rich knowledge (Cruz-Ganzalez et al., 2015). Therefore, they need to keep their search focus on key knowledge sources in order to increase their understanding and ability to acquire

knowledge from such partners. In particular, deep focus expands a firm's knowledge base and ability to transfer what is tacit as well as what is important (Fabrizio, 2009). When firms draw knowledge from a small number of key sources, they build up an interaction over time and consequently, obtain rich knowledge. Longer interactions lead to cumulative learning, which results in a common understanding (Cohen & Levinthal, 1990). Emerging economy firms put effort into gaining expertise and increasing their abilities to acquire rich knowledge from developed economies. Consequently, they endeavour to mitigate the absorptive capacity problems they are likely to encounter when they collaborate with such partners.

Costs considerations provide further support for the suggestion that searching deeply is most beneficial when emerging economy firms collaborate with developed economy partners. When firms acquire knowledge from developed economies, it increases integration and management costs. At the same time, their search activities across a wide range of knowledge sources put up costs. In particular, in order to expand their understanding firms need to maintain their interactions with knowledge sources over time. Despite the benefits of longer interactions, they come at a cost: they are time consuming (Laursen & Salter, 2006; Garriga et al., 2013). Hence, firms have to focus on a small number of sources and searching deeply keeps down the costs of collaboration with developed economy partners. Otherwise, they will face excessive search costs in relation to integration, monitoring and coordination, which will limit their ability to reap the benefits. Overall, the nature of knowledge accessed when firms collaborate with developed economy partners, absorptive capacity, and cost considerations suggest that the combination of search breadth and developed economy collaborations is not beneficial for emerging economy firms' innovation performance, therefore the hypothesis looking at this relationship is not formulated. However, searching deeply is beneficial when emerging economy firms collaborate with partners from developed economies and hence, I propose:

> *Hypothesis 4 (H4): Search depth has a positive impact on innovation performance for emerging economy firms collaborating with developed economy partners.*

2.7 Types of International Collaboration Partners

In addition to the impact of environmental context, extant studies on search have recognized the importance of context specificity of search strategies by looking at different contextual factors (Laursen & Salter, 2006; Grimpe & Sofka, 2009; Almirall & Casadesus-Masanell, 2010; Laursen, 2012; Salge, Farchi, Barrett, & Dopson, 2013). Those such as product novelty, firm absorptive capacity (Laursen & Salter, 2006), industry membership (Grimpe & Sofka, 2009), product complexity (Almirall & Casadesus-Masanell, 2010) and project and managers types (Salge et al., 2013) have been examined. In addition, previous studies on search have underlined the link between search strategies and certain kinds of knowledge being accessed (Grimpe & Sofka, 2009; Sofka & Grimpe, 2010; Laursen, 2011; Chen, Chen, & Vanhaverbeke, 2011). These researchers have investigated the direct effects of different types of search strategies, such as market-driven and science-driven, on innovation performance. However, Kohler et al. note that "search breadth and search depth do not explain much as to what knowledge sources to combine in a broad search and what ones to emphasize for depth" (2012: 1351). That is, firms may engage in a broad and deep search for knowledge sources. But it is of importance for firms to interact with the right type of innovation partner in accordance with the knowledge and technology they are looking for (Todtling, Lehner, & Kaufmann, 2009; Chen et al., 2011).

Partner types are important in terms of providing different kinds of knowledge (Vanhaverbeke et al., 2014). In particular, interacting with different partner types becomes important for different types of innovation performance (Faems et al., 2005; Nieto & Santamaria, 2007; Todtling et al., 2009). Radical innovation performance requires deeper search and departure from existing knowledge, whereas incremental innovation performance requires broader search and extending current knowledge (Benner & Tushman, 2002, 2003; Grant & Baden-Fuller, 2004). The specific characteristics and objectives of each partner type provide different kinds of knowledge. These partners thus perform differently in product innovation (Ozer & Zhang, 2015). In other words, firms rely on specific knowledge types when they

introduce different novelty in their innovations (Lane et al., 2006; Todtling et al., 2009; Kohler et al., 2012). Previous studies have mostly investigated different partner types in the local context and consequently, little research has examined the differences between different international partner types (Colombo et al., 2009; Li & Vanhaverbeke, 2009).

Building on extant research (Chen et al., 2011; Kohler et al., 2012), this study considers the impact of international partner types on the link between search strategies and different types of innovation performance from the perspective of emerging economy firms. Firms engage with different types of collaboration partners, such as suppliers, customers, competitors and universities. Previous studies have distinguished different partners, such as vertical and horizontal (Belderbos, Gilsing, & Lokshin, 2012), upstream and downstream (Hess & Rothaermel, 2011; Un & Asakawa, 2015) and market-based and science-based collaborations (e.g. Du, Leten, & Vanhaverbeke, 2014; Gesing, Antons, Piening, Rese, & Salge, 2015). Following prior literature (Danneels, 2002; Faems, Van Looy, & Debackere, 2005; Du et al., 2014; Vanhaverbeke, Du, Leten, & Aalders, 2014; Gesing et al., 2015), this research distinguishes between two types of international collaboration partners: market-based and science-based partners. The former are associated with establishing collaborations with customers and suppliers, whereas the latter engage in collaborations with universities and research institutes. This differentiation can also be undertaken for such partner types when they come from different institutional settings namely, from developed economies and emerging economies. In other words, it can be that market-based and science-based partners are from developed economies and emerging economies. However, since this study does not focus on the effects of partner types from different institutional contexts, this research explores the effects of international market-based and science-based partners on the link between search strategies and different types of innovation performance. However, this issue opens up an important research area which can be further explored in future studies.

Different partners play different roles in complementing a firm's own resources and capabilities according to potentially different goals of collaborations (Ahuja, 2000; Baum et al., 2000; Faems et al., 2005; Belderbos, Carree, & Lokshin, 2006; Belderbos et al., 2012). Market-based collaborations enable firms to access knowledge related to customer preferences, needs, new market opportunities as well as new equipment and technology. In this case, customers are usually located downstream in the knowledge chain, dealing with the output side of the firm's operation (Un & Asakawa, 2015). On the other hand, science-based collaborations provide firms new, basic and research-oriented knowledge outcomes (Faems et al., 2005; Gesing et al., 2015). Thus, universities are positioned upstream in the knowledge chain, dealing with the input side of the firm's operation (Un & Asakawa, 2015). These differences show that each partner type differs significantly in the type of knowledge they can provide (Danneels, 2002; Rothaermel & Deeds, 2004; Faems et al., 2005; Du et al., 2014). Consequently, the unique differences across collaboration partner types indicate that market-based and science-based partners have different impacts on firms' innovation performance (Faems et al., 2005; Ozer & Zhang, 2015).

Since each type of partner provides specific kinds of knowledge, they influence the relationship between search strategies and different types of innovation performance differently. The knowledge at the heart of universities is generally new and with the partners having little or no experience of it (Knudsen, 2007; Colombo et al., 2009). Science-based partners therefore place greater demands on technological and management capabilities relative to market-based ones (Rothaermel & Deeds, 2006). In particular, emerging economy firms can have limitations in their absorptive capacities when they collaborate with science-based partners relative to those market-based. Absorptive capacity suggests that a firm's ability to understand, acquire and use outside knowledge depends on the type of knowledge (Cohen & Levinthal, 1990; Lane et al., 2006). Limited absorptive capacity can undermine the exchange of tacit and complex knowledge (Cohen & Levinthal, 1990). Partnering with universities increases the novelty, but on the other hand, decreases the absorption (Nooteboom et al., 2007; Gilsing et al., 2008). Accordingly, firms need to consider the pay-offs from search strategies depending on partner types. As Fabrizio

(2009) suggests, interaction with outside knowledge sources provides benefits in terms of accessing and exploiting external knowledge (Cockburn & Henderson, 1988). It enables firms to produce more efficient search that identifies and absorbs external knowledge more quickly (Fabrizio, 2009). Search breadth and depth strategies, hence, enable firms to have a different level of understanding and as a result, emerging economy firms need to follow refined search strategies aimed at increasing the benefits.

2.7.1 Market-Based Partners

Market-based partners, such as suppliers and customers, provide close links to markets and there are various reasons for collaborating with such partners (Danneels, 2002; Du et al., 2014; Gesing et al., 2015). First, when firms collaborate with customers they can gain access to knowledge that is fundamentally different from that developed by researchers within firms. Firms' interaction with those partners enables them to access first-hand knowledge on market needs (Luca & Authane-Gima, 2007; Du et al., 2014). Moreover, firms gain access to market insights, opportunities and knowledge in the marketplace (Vanhaverbeke et al., 2014). Listening to customers helps firms better understand their needs and unfulfilled preferences, more so than a firm's own manufacturing operations (Tether, 2002). Accessing reliable knowledge about market preferences and requirements is important for product development. Customers uncover problems related to products and suggest solutions for their improvement. Consequently, their feedback and support is complementary for the development of products (Kang & Kang, 2010). In addition, interaction with customers helps firms to determine the market value of new products (Shane, 2000; Wiklund & Shepherd, 2003). In particular in this regard, new products require adaptations in use by customers and, hence this type of collaboration may be essential to ensure market expansion. Moreover, customers can play an important role in recommending products to others, which leads to more sales of existing products.

Second, when firms collaborate with suppliers they can gain access to expertise and knowledge on technologies, components and parts (Tsai, 2009; Song & Thieme, 2009; Du et al., 2014). Moreover, this enables firms to have access to new materials, equipment and machinery. Manufacturing firms combine their resources with those and the capabilities of suppliers to develop and improve their innovations (Zhao et al., 2014). Suppliers help firms improve solutions for problems or create new methods for developing new products with better quality. They enable firms to improve the efficiency of product by delivering insights into the integration of product development and production process (Knudsen, 2007). They thereby reduce unnecessary work and hence, costs, as well as enhancing product quality (Dyer & Nobeoka, 2000; Johnsen, 2009). This collaboration type also enables firms to learn faster and to shorten the new product development time (Chang et al., 2006; Li & Vanhaverbeke, 2009; Kohler et al., 2012).

Market-based partners' knowledge is further explained in terms of its aim, the relativeness to the focal firm's knowledge and the level of uncertainty. These partners are considered to be useful throughout the entire innovation process (Ganotakis & Love, 2012), for this type of partnership provides knowledge that is deep and specialized. Such partners are more likely to provide complementary knowledge for development and commercialization purposes than scientific discoveries (Rothaermel & Deeds, 2006; Colombo et al., 2009; Lavie & Drori, 2012). In line with this, they are often focused on generating knowledge that is less basic and more applied in nature (Trajtenberg et al., 2002; Alcacer & Chung, 2007; Gesing et al., 2015). These collaboration partners are thus linked to exploitative collaborations, thereby suggesting that the focus on complementarities between technologies and products is already present (Faems et al., 2005). Vanhaverbeke et al. (2014) also link market-based collaborations to downstream activities of firms, such as production and marketing, for these activities enable firms to exploit existing capability by leveraging complementary knowledge (Rothaermel, 2001; Rothaermel & Deeds, 2004). This type of activity facilitates firms in commercializing the knowledge gained through exploration and accordingly, this type of partnership is used for firms' profit motives (Alcacer & Chung, 2007).

Market-based partners provide knowledge similar to the firm's existing knowledge and capabilities. In addition, suppliers often have similar objectives and working procedures as industrial firms. Both share the goal to serve the end market and make profits in the marketplace (Du et al., 2014). Suppliers operate in industry contexts that are relatively similar or close to the industry context of operations of the focal firm (Un et al., 2010; Un & Asakawa, 2015). They are hence likely to share a common understanding. Consequently, the common goals and closeness between partners and focal firms provide similar knowledge to that already in existence. In particular, the close relationship between suppliers and the firm enables the integration of firm-specific tacit knowledge and external knowledge of best practices. However, unwanted knowledge spillovers during this type of partnership indicate that firms' chances of gaining access to unique knowledge decreases. That is, critical knowledge about the firm's innovation efforts can leak to its competitors when they collaborate with market-based partners (Cassiman & Veugelers, 2002; Laursen & Salter, 2014). Specifically, commercially sensitive and confidential information, which is the result of these vertical, applied partnerships, often leaks out to competitors through common suppliers and customers (Belderbos et al., 2004b; Du et al., 2014). This potential leakage reduces the chance of having unique and novel knowledge from supplier and customer partners. However, in this scenario, the risk of spillovers may be outweighed by gaining access to scarce information on specific customer needs and the higher likelihood of initial market acceptance leading to future commercial success (Belderbos et al., 2012).

Market-based partners are associated with a low level of uncertainty and lower risk (Gesing et al., 2015). Firms mainly use these partners to improve and complement existing products incrementally (Faems et al., 2005). Since the product is ready to enter the development and commercialization stage uncertainty is reduced (Rothaermel & Deeds, 2004). Firms aim to generate short and mid-term revenues and certain profitability with their market-based collaborations (Knudsen, 2007). The low level of uncertainty and lower risk is further supported when governance mechanisms are considered (Dyer & Singh, 1998). The literature distinguishes between formal governance mechanisms, such as contracts that specify the rights as well as obligations of collaboration partners and informal, self-enforcing

mechanisms, such as trust (Poppo & Zenger, 2002). Formal governance mechanisms are more effective for market-based partners than informal ones (Du et al., 2014; Gesing et al., 2015). Firms focusing on complementary activities and commercialization are likely to benefit from formalized roles and coordinating mechanisms (Bierly et al., 2009). In particular, market-based partners perform better under regular monitoring and strict control. Moreover, following a structured plan can mitigate the challenges firms have while integrating such market-based knowledge into their innovation activities.

2.7.2 Science-Based Partners

Science-based partnerships are usually undertaken with universities and research institutes (Baum et al., 2000; Du et al., 2014; Vanhaverbeke et al., 2014; Gesing et al., 2015). Firms collaborate with science-based partners because they can gain access not only to tacit scientific knowledge, but also to unpublished codified knowledge, thus enabling them to build on the latest research findings quickly (Cockburn & Henderson, 1998; Fabrizio, 2009). Universities and research institutes are important contributors to the supply of new scientific and technological knowledge (Lundvall, 1992; Nelson, 1993; Tether, 2002; Audretsch et al., 2005; Tsai, 2009). Firms rely on science-based collaborations to tap into the early stage research (Hess & Rothaermel, 2011). University scientists have relatively more freedom to choose their own research agenda therefore they are more likely to develop foresights on the emerging fields (Jiang et al., 2010). This type of partnership is often focused on generating knowledge that is more basic and less applied in nature (Rothaermel & Deeds, 2006; Alcacer & Chung, 2007; Un & Asakawa, 2015). That is, the knowledge they produce is likely to be far from application and typically, requires substantial investment before it can be utilized for developing the final products. In addition, the research on search, absorptive capacity and organizational learning suggests that pursuing university partnership is likely to be more highly valued by firms with innovation strategies that emphasize exploration (Cyert & March, 1963; March, 1991; Cohen & Levinthal, 1989). For example, firms and universities can try to create a new method of production which can lead to a

new market or organization of industry (Bercovitz & Feldman, 2007; Audretsch et al., 2012). These partners are exploratory in nature, because they enable firms to tap academic experts and to enhance the technological vitality of the firm's projects (Lavie & Drori, 2012). Consistent with this logic, these collaboration partners are linked to firms' upstream activities (Vanhaverbeke et al., 2014). They are seen as instrumental in creating and discovering new competencies as well as producing novelty in firms' innovative outcomes (Rothaermel, 2001; Rothaermel & Deeds, 2004; Faems et al., 2005).

Firms collaborating with science-based partners are likely to keep unique and novel knowledge inside the boundaries. University partners are not likely to be competitors of firms in the industry. Moreover, they are not directly competing with industrial firms in the market place for revenues from jointly created products. Thus, not being able to appropriate exclusively the benefits from the new know-how generated is not an issue for firm-university cooperation. In addition, innovation activities between university-industry take place in the early stages of the innovation process. This process is characterized by high technological uncertainty and still low demand for the outcomes of innovation activities. Consequently, this low demand reduces the risk of knowledge spillovers to competitors. This is further supported by the argument that the leakage of knowledge is unlikely to happen, because these institutions have high levels of protection for their intellectual property. In sum, there is less concern about unwanted knowledge spillovers to competitors in the market (Veugelers & Cassiman, 2005; Cassiman & Veugelers, 2002; Alcacer & Chung, 2007).

Since science-based partners are involved in basic research, the production process of knowledge has quite a long time frame. That is, these partnerships are likely to result in performance improvements only in the long term (Rothaermel & Deeds, 2004; Knudsen, 2007; Colombo et al., 2009; Nieto & Santamaria, 2010). Assessing the full value of the often tacit and causally ambiguous knowledge might only be possible through joint research activities in which university and firm scientists develop a mutual understanding and language in practice over time (Kohler et al.,

2012). This requires long-term interactions with those types of partners (Knudsen, 2007). A close collaboration with a research organization cannot be guaranteed to produce radical innovations, at least within a short time period. In fact, the results are not certain and perhaps not even possible to produce regardless of how much effort or resources are devoted to the chosen purpose. These collaborations are hence, generally characterized by high uncertainty and frequent failure (Colombo et al., 2009; Gesing et al., 2015). Making specialized investments in the face of uncertainty also increase the risks and costs. This uncertainty can also be caused by operating in industry contexts that are different from that of the focal firm (Un & Asakawa, 2015). In addition, these partners would require an extensive amount of time and resources since owing to the different motivations of firms (profit) and universities (non-profit) being a fundamental factor (Rothaermel & Deeds, 2006). Further, most universities and research institutes are large public institutions following bureaucratic structures, which militate against the flexibility of knowledge access. Friction can also arise from appropriability problems when intellectual property rights are not fully specified and sufficiently protected (Teece, 1986). Consequently, firms tend to manage the property rights on the innovations exclusively (Fabrizio, 2007). However, legal disputes over who owns the rights to certain patents create additional uncertainty.

To summarize, firms gain access to complex knowledge by partnering with universities and research institutions. This high level of knowledge complexity requires a high level of firms' technological and management capabilities (Rothaermel & Deeds, 2006). Firms lagging in terms of their abilities in absorption will face difficulty accessing basic research as provided by less commercial sources, such as universities (Alcacer & Chung, 2007). Firms need to have an intensive understanding to utilize such specified knowledge from science-based partners, which leads to greater knowledge acquisition, assimilation, and application (Cohen & Levinthal, 1990). There are mechanisms that these institutions establish to facilitate access to and transmission of deep, complex knowledge to a wide audience (Kaufmann & Totdling, 2001; Un et al., 2010). Policymakers have called on universities and government R&D labs to make their science and engineering more relevant to industry's needs, which can ease the transfer of knowledge (Cohen et al.,

2002). However, this is likely to happen through explicit knowledge, such as that by the established media in the form of publications in journals and presentations at conferences, rather tacit knowledge which harder to access (Santoro & Bierly, 2006). Another way in which explicit knowledge is conveyed is through with students in the classroom when university researchers are prepared to share their specialized knowledge (Un et al., 2010).

2.7.3 Types of Innovation Performance

Innovations are associated with different degrees of novelty. According to the extent and magnitude of the novelty of innovation, radical innovation and incremental innovation are two important types of innovation performance (e.g. Ettlie, Bridges, & O'Keefe, 1984; Abernathy & Clark, 1985; Dewar & Dutton, 1986; Tushman & Anderson, 1986; Damanpour, 1996; Gatignon, Tushman, Smith, & Anderson, 2002). In addition to this classification, Tushman and Anderson (1986) distinguished between types of innovations that build on existing competencies versus those that destroy them. Later, Henderson and Clark (1990) added architectural innovation into innovation classification, which refers to adding or subtracting product subsystems or change the linkages between subsystems. Additionally, scholars have made a distinction between types of innovation, such as technical and administrative (Daft, 1978; Kimberly & Evanisko, 1981; Damanpour, 1987), product and process (Damanpour & Gopalakrishnan, 2001). However, among the different types of innovations, the most established classification in existing studies is radical and incremental innovation (Dewar & Dutton, 1986; Subramaniam & Youdth, 2005). The obvious differences between these two types of innovation performance are evident in how differently they draw upon organizational knowledge (Cardinal, 2001). As Gatignon et al. (2004: 1107) observe, radical innovations "disrupt an existing technological trajectory", whereas incremental innovations involve "improving and exploiting an existing technological trajectory". Similarly, Abernathy and Clark note that radical innovations "destroy the value of an existing knowledge base", while incremental innovations "build on and reinforce the

applicability of existing knowledge" (1985: 5). Below, the differences between radical and incremental innovations are explained in detail.

2.7.3.1 Radical Innovation

Radical innovation is a shift to a different knowledge domain with the aim being to adopt or create new processes and products (Benner & Tushman, 2002). This type of innovation is likely to depart from existing knowledge and make prior competences obsolete (March 1991; Levinthal & March 1993; Benner & Tushman, 2002, 2003). It changes the technology of process or product in a way that imposes requirements that the existing resources, skills and knowledge satisfy poorly or not at all. The effect is thus to reduce the value of existing competence and to produce new and novel products to market segments (Atuahene-Gima, 2005). In terms of market/customer segment, this type of innovation is designed to meet the needs of emerging customers and markets (Benner & Tushman, 2003). It offers new designs, creates new markets, and develops new channels of distribution (Abernathy & Clark, 1985). Entering a new product-market position, compared to improving existing ones, requires a radical departure from the established norms and routines (Bierly et al., 2009).

This type of innovation is associated with distant search, increased variance, experimentation, divergent thinking and flexibility (Tushman & Smith, 2002; Smith & Tushman, 2005). Tushman and Smith (2002) describe radical innovations as explorative, since such activities include "things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (March, 1991: 71). Radical innovations are riskier, slower and more costly to produce (Damanpour, 1996). They are hence uncertain in their pay-offs and any positive performance effects usually occur in the long run (March, 1991; Levinthal & March, 1993). They require commitment of more resources including financial ones (Bierly et al., 2009). In general, pursuing radical innovation typically requires much more development time, capital investment, risk taking, and failure tolerance. In addition, radical innovations are uncontrollable by their nature and therefore require

non-routine problem solving activities. Hence, greater control and managerial efficiency might not be useful for this innovation type (Bierly et al., 2009).

For this type of innovation, firms tend to search for novel knowledge and skills. Radical innovations require a variety of knowledge resources and opportunities that are new and novel to firms' existing knowledge base (Benner & Tushman, 2003; Tushman et al., 2010). Access and exposure to diverse knowledge domains enlighten organizations about new ways by which existing problems can be solved (Rosenkopf & Nerkar, 2001). Diversity increases the number of possible combinations and the potential for highly novel solutions (Fleming, 2001). Moreover, radical innovations require access to and absorption of new insights and knowledge at a larger cognitive distance (Nooteboom et al., 2007). However, whilst broadness and distance increases the novelty, at the same time it decreases the absorption of knowledge (Lane & Lubatkin, 1998).

Nevertheless, firms producing radical innovation performance are more likely to benefit from access to specialized and sophisticated knowledge than broad knowledge (Grant & Baden-Fuller, 2004; Laursen & Salter, 2006; Hsieh & Tidd, 2012). This type of knowledge is likely to be unique, rare and difficult for competitors to replicate (Nonaka, 1994). This enables firms to have rich rather than shallow knowledge. Accordingly, the transfer of sophisticated and tacit knowledge becomes important for producing radical changes in products. Since it is difficult to assimilate this type of knowledge, firms need to increase their understanding and develop confidence in transferring it (Szulanski, 1996; Luca & Atuahene-Gima, 2007). As Taylor and Greve (2006) note, it is not only accessing diverse knowledge, but also having a deep understanding that increases the chances of innovation. Consequently, firms can benefit from deep focus on important knowledge sources so as to be able to transfer tacit and complex aspects (Laursen & Salter, 2006; Terjesen & Patel, 2015). Investing greater effort and resources into knowledge sources enables firms to transfer knowledge and information efficiently (Cohen & Levinthal, 1990). As Bierly et al. (2009) argue, knowledge connections facilitate communicating new knowledge from the university-research centres to the firm and transforming specific

knowledge into organizational knowledge. This close interaction will provide ways to access specialized and sophisticated knowledge which is important for the discovery of new products (Grant & Baden-Fuller, 2004; Laursen & Salter, 2006; Cruz-Ganzalez et al., 2015).

2.7.3.2 Incremental Innovation

Incremental innovation pertains to focusing on the firm's existing knowledge base to improve its existing processes and products (Benner & Tushman, 2002). That is, this type of innovation is not about producing new products or technologies, but rather, about refining a firm's existing products and improving its processes (Jansen et al., 2006; Greve, 2007). It thus refers to minor changes in existing products or services (Ettlie et al., 1984; Dewar & Dutton, 1986; Tushman & Anderson, 1986; Henderson & Clark, 1990). As such, it does not require a radical departure from the established norms and routines since it does not disrupt an existing technological trajectory (Henderson & Clark, 1990). In terms of market/customer segment, this type of innovation is designed to meet the needs of existing customers or markets (Benner & Tushman, 2003). Firms broaden existing knowledge and skills, improve established designs, expand existing products and services, and increase the efficiency of existing distribution channels (Abernathy & Clark, 1985: 5). Moreover, this type of innovation provides customers with similar products or services that are marginally improved or provided at a lower cost and/or with easier accessibility. That is, incremental innovations are associated with extending the existing technological trajectories to existing customers (Jansen et al., 2006; Tushman et al., 2010).

This type of innovation is associated with local search, decreased variance, efficiency, convergent thinking and focus (Tushman & Smith, 2002; Smith & Tushman, 2005). In addition, Tushman and Smith (2002) describe incremental innovations as exploitative since exploitation activities include "such things as refinement, choice, production, efficiency, selection, implementation, execution" (March, 1991: 71). As firms are engaged in refinement, efficiency and implementation (March, 1991; Levinthal & March, 1993), incremental innovations

are quicker and less costly to produce (Damanpour, 1996). They are limited in scope and newness and therefore generate less uncertainty. In addition, their results can be obtained in the short term and are often positive (March, 1991). Moreover, they are controllable, for by their nature they are like a problem-solving process, which will lead a solution. In other words, they can be monitored by formalized coordinating and control mechanisms throughout the process (Bierly et al., 2009).

Firms that aim to produce products or services new to the firm are likely to search more local and neighbourhood information (Benner & Tushman, 2002, 2003; Sidhu et al., 2007). Incremental innovations require a deeper understanding of specific information (Rowley et al., 2000), i.e. firms need to obtain specific knowledge in one particular area, for a deep understanding of a core area increases the possibility of improving existing products and efficiency. This deep focus enables firms to establish a structured mechanism, usually provides successful outcomes to current problems (Chiang & Hung, 2010; Zang et al., 2014). On the other hand, extant studies have suggested that firms producing incremental innovation performance are more likely to benefit from general and broad knowledge rather than specialized knowledge (Grant & Baden-Fuller, 2004; Laursen & Salter, 2006; Cruz-Ganzalez et al., 2015). This form of innovation entails fine tuning an existing product, process, or service for which a dominant design has already emerged and the market for the innovation has expanded. Since the product is already established in the market firms can find relevant knowledge by scanning across a wide range of knowledge sources, which increases the chances of finding knowledge that aligns with that currently held (Laursen & Salter, 2006). In addition, since incremental innovations are related to knowledge application rather than its creation, firms need to have access to a diversity of it so as to be able to apply many types of sources (Grant & Baden-Fuller, 2004). Broad knowledge thus facilitates application, modification and improvement of products and processes (Bierly et al., 2009).

2.7.4 Partner Types and Innovation Performance

The characteristics of market-based and science-based partners indicate that each type can result in different forms of innovation performance and existing studies have investigated these differences (Faems et al., 2005; Nieto & Santamaria, 2007; Todtling et al., 2009; Ozer & Zhang, 2015), but without delivering consistent results. Regarding the effects of customers on innovation performance, researchers have shown that firms that listen carefully to their customers are less likely to launch radical products (Lukas & Ferrell, 2000). That is, firms are likely to be constrained by the tyranny of the served market (Hamel & Prahalad, 1991, 1994). In addition, customers cannot see the world through the world of technologists (Lukas & Ferrell, 2000). Therefore, if firms rely on existing customers they are more likely to develop sustaining innovations than disruptive ones (Christensen, 1997). Regarding the effects of suppliers on innovation performance, previous studies have suggested that suppliers enable firms to produce incremental innovations, for they provide access to existing and relatively standardized resources to ascertain potential areas for improvement in existing products (Faems et al., 2005; Song & Thieme, 2009).

On the other hand, it is contended that users and suppliers provide the kind of insights that provide a substantial increase to corporate innovative performance (Li & Vanhaverbeke, 2009; Belderbos et al., 2012; Chatterji & Fabrizio, 2014; Ozer & Zhang, 2015). In particular, customers are most likely to be engage with when the innovation under development is more novel or complex (Tether, 2002; Chatterji & Fabrizio, 2014). That is, the knowledge they can provide is heterogeneous and conducive for radical innovations. Additionally, it is argued suppliers are linked to the production of radical products, whereby they enable firms to get access to new or complementary knowledge and recombine it into radical innovations (Li & Vanhaverbeke, 2009; Un & Asakawa, 2015). Inputs of suppliers' technology and know-how are probably the most valuable elements in new product development processes. They have deep firm specific knowledge and therefore gaining insights from them can enable firms to produce radical innovations. In addition, these

partners can work closely with the firm, helping it design and manufacture new products (Takeishi, 2001, 2002).

There is considerable evidence that breakthrough innovations are related to both knowledge in the public domain and participation in scientific research (Henderson & Cockburn, 1994; Zucker, Darby, & Armstrong, 2002; Thursby & Thursby, 2006). Science-based partners provide scientific, basic research knowledge that poses challenges for firms while trying to integrate this type of knowledge. Thus, this type of partnership generates a radical departure from existing products and requires longer-term interactions to yield the outcomes (Knudsen, 2007). However, extant studies have found conflicting results regarding the impact of scientific collaborations on innovation performance. Some have argued that those with universities and research institutes result in improvements (Cohen et al., 2002). By contrast, others have suggested that they can provide radical changes in products (Faems et al., 2005; Todtling et al., 2009). Counter to their positive effects, there are scholars who have found negative impacts of science related collaborations on innovation performance (Miotti & Sachwald, 2003; Colombo et al., 2009).

2.7.5 Search Breadth and Partner Types

It is posited here that an emerging economy firm with a broad search strategy benefits from collaborating with international market-based partners, rather than science-based ones, with the aim being to increase radical innovation performance. The nature of partners, absorptive capacity and cost perspectives support this relationship. Emerging economy firms collaborating with international science-based partners aim to gain access to basic forms of scientific knowledge and technology (Faems et al., 2005; Fabrizio, 2009). These partners proceed upstream and independently of technological development (Cohen et al., 2002; Vanhaverbeke et al., 2014). They are associated with suggestion and the creation of new ideas and R&D projects. Science-based partners thus create more discovery knowledge by providing an understanding of the underlying fundamental properties (Alcacer & Chung, 2007; Hess & Rothaermel, 2011). Even though this type of knowledge is

important for increasing radical innovation performance, science-based partners can pose challenges for emerging economy firms with a broad search strategy.

The absorptive capacity concept suggests that a firm's ability to recognize the value of external knowledge, assimilate it and apply it is critical its innovation performance (Cohen & Levinthal, 1990). Emerging economy firms lag in terms of their technical and managerial capabilities (Hitt et al., 2000; Asakawa et al., 2014). Moreover, the complex nature of scientific knowledge creates difficulties for emerging economy firms to acquire and absorb such knowledge. As Alcacer and Chung suggest, "due to lower absorptive capacity, technically lagging firms will have troubles benefiting from less commercial sources (academic or government)" (2007: 765). These difficulties are aggravated when emerging economy firms follow a broad search strategy because of increased absorption problems. That is, a firm that searches broadly across many sources may not absorb the new knowledge due to limited prior knowledge. This search strategy leads firms to have a large volume of diverse and complex information, which causes difficulties when trying to transfer it (Terjesen & Patel, 2015) and consequently, firms tend to obtain shallow knowledge rather than a deep form with a search breadth strategy (Cruz-Ganzalez et al., 2015). As Fontana et al. (2006) note, searching for external knowledge comes with a general attitude of looking at potential knowledge sources without getting in-depth knowledge and hence, firms pursuing this strategy do not benefit from science-based partners. In general, too much novelty and complexity can cause dire consequences for innovation (Nooteboom et al., 2007; Gilsing et al., 2008). It is thus essential to have a certain level of understanding while producing novelty products (Taylor & Greve, 2006; Vanhaverbeke et al., 2009). Otherwise, the lack of absorption undermines the exchange of tacit knowledge, the ability to resolve complex problems jointly and the interaction needed for generating new insights.

In addition, cost perspective suggests that science-based partners add additional costs into the management of a larger variety of knowledge sources. Science-based partners require extensive investment and a high level of commitment in terms of time and effort (Knudsen, 2007; Colombo et al., 2009). These investments are

important to maintain relationships and coordinate joint activities (Ocasio, 1997). In addition, science-based partners augment management costs due to their certain characteristics. For instance, firms need to spend great amount of time and resources in order to understand differences between profit (industry) and non-profit (universities) institutions (Rothaermel & Deeds, 2006). Management problems can also arise in terms of ownership of the intellectual property. There might be conflicts over who has the ownership rights (Bruneel et al., 2010). These problems can be aggravated by the bureaucratic nature of university administration and excessive bureaucratic red tape can increase the coordination and monitoring costs (Siegel et al., 2003). As a consequence, firms with a search breadth strategy do not benefit from science-based partners in terms of producing radical innovative products. Regarding which I propose:

> *Hypothesis 5a (H5a): Search breadth is not expected to have a significant impact on radical innovation for emerging economy firms collaborating with international science-based partners.*

By contrast, the nature of market-based partners suggests that emerging economy firms with a search breadth strategy benefit from collaborating with such partners in terms of increasing their radical innovation performance. Firms with a search breadth strategy scan the external environment, which enables them to access shallow knowledge about potential sources inside the innovation system (Laursen & Salter, 2006; Hsieh & Tidd, 2012; Garriga et al., 2013). Firms with those knowledge sources do not show any higher intensity of interaction and are less likely to obtain sophisticated knowledge about key sources. In order to increase radical innovation performance, they not only need a wide range of variety but also, specialized knowledge about technology and the market (Grant & Baden-Fuller, 2004; Laursen & Salter, 2006). Thus, firms close interaction with market-based partners can expand their ability to produce radical products (Zhou & Li, 2012; Gesing et al., 2015). Users provide knowledge about alternative product ideas, emerging market trends, current and future customer needs and potential new product applications (von Hippel, 1986). This interaction expands opportunities for firms to acquire market and

technological knowledge for new product ideas (Nieto & Santamaria, 2010; Ozer & Zhang, 2015). In particular, the early stage of the product development leads firms to draw knowledge from customers. At this stage of the product life cycle existing knowledge becomes obsolete and the state of technology is uncertain. So, firms primarily work with concepts and ideas rather then prototypes or features. Consequently, much of the data collected come from close interaction with a smaller set of users (Bosch-Sijtsema & Bosch, 2015). In a similar vein, survey evidence confirms that customers often supply key ideas for new R&D projects (Cohen et al., 2002). They experience a product's functions and limitations firsthand, also providing user experience in terms of domain and technical knowledge. This allows firms access to knowledge that is different from in-house knowledge and is critical to innovation success (Un et al., 2010; Foss et al., 2011).

Moreover, having market-based partners eases the integration process. That is, firms are likely to have a common knowledge base with their market-based partners as they already have information about heterogeneous market segments. In addition, these firms belong to the same industry segment as their suppliers (Un & Asakawa, 2015). The overlapping market knowledge mitigates the difficulties firms face while integrating knowledge from such partners, which improves understanding as well as easing the utilization and integration process of the gained knowledge. Consequently, emerging economy firms do not face the same challenges when transferring knowledge from market-based partners that they would doing so from science-based partners. In sum, firms' collaboration with market-based partners enables them to obtain specialized knowledge about the market and technology, thereby increasing radical innovation performance. Hence, I propose that:

> *Hypothesis 5b (H5b): Search breadth has a positive impact on radical innovation for emerging economy firms collaborating with international market-based partners.*

It is also contended that an emerging economy firm with a search breadth strategy benefits from international market-based rather than science-based partners in

relation to augmenting incremental innovation performance. Firms refine their existing trajectories and knowledge for minor adaptations in their existing products in order to produce incremental innovations (March, 1991). Since the product already exists, accessing a wide range of knowledge sources becomes important (Laursen & Salter, 2006). In doing so, the chances of acquiring relevant knowledge about products increase and firms begin to have a more refined understanding of their existing knowledge (Cruz-Ganzalez et al., 2015). This increases their innovation performance through making incremental changes in the products. In line with this, firms' collaboration with market-based partners also strengthens the relationship between a search breadth strategy and incremental innovation. That is, market-based partners help the firm to understand the nature of consumer demand and potential customer preferences as well as estimating the market size. These partners have expertise and knowledge on market needs and the latest technologies, parts and components that are available to satisfy these needs. As a result, firms can fine tune, upscale and/or adjust existing products to meet current or future customer needs. These changes enable firms to respond faster to the market by speeding up the development of products. In other words, they facilitate the modification of existing products (Faems et al., 2005; Bierly et al., 2009).

Firms must secure access to complementary technologies and assets in order to commercialize the products successfully (Teece, 1992). Market-based partners can help them to apply and commercialize the product in the market (Alcacer & Chung, 2007; Un & Asakawa, 2015). They help a new product to establish a foothold in the marketplace by eliminating the likelihood of product failures and meeting customer satisfaction (Vanhaverbeke, Du, Leten, & Aalders, 2014). Moreover, they stimulate the wider adoption of a new product by establishing manufacturing facilities, building up distribution channels and by preparing for market entry. Customers can play a special role in recommending products to others, potentially leading to more sales of existing products, but not necessarily to the development of innovations (Chatterji & Fabrizio, 2014). Overall, since the characteristics of science-based partners are associated with creation of new ideas and providing more scientific and discovery knowledge, such partners are not likely to influence incremental innovation performance. Therefore, the hypothesis looking at the effects of science-

based partners on the relationship between search breadth and incremental innovation is not formulated. However, market-based partners increase the chance that developed technologies become a market success and therefore, I propose:

Hypothesis 5c (H5c): Search breadth has a positive impact on incremental innovation for emerging economy firms collaborating with international market-based partners.

2.7.6 Search Depth and Partner Types

In order to increase radical innovation performance, firms need to gain access to novel knowledge that will help them to generate breakthrough ideas. In line with this logic, it is posited that an emerging economy firm with a search depth strategy collaborating with international science-based partners increases radical innovation performance. Having science-based partners increases the potential of producing radical innovative products for firms with a search depth strategy. Firms collaborate with universities and research institutes to produce novel knowledge and technologies (Cohen et al., 2002; Hess & Rothaermel, 2011; Lavie & Drori, 2012). These partners search and discover and consequently are experts in scientific research, generating technologies that rely on the latest scientific insights (Vanhaverbeke et al., 2014). Collaborating with universities or research institutes offers firms the opportunity to drill down to the essence of an emerging breakthrough idea (Fabrizio, 2009). In particular, foreign science-based partners enable emerging economy firms to gain access to novel knowledge that is less likely to be obtained in their local geographies (Colombo et al., 2009). This novelty expands and updates firms' knowledge scope, thus increasing the likelihood radical changes in products and technologies being observed (Cohen et al., 2002; Todtling et al., 2009).

However, science-based partners are exposed to coordination difficulties and the challenge of transferring complex knowledge across firm boundaries (Lane & Lubatkin, 1998). Moreover, the tacit and experimental nature of partners' knowledge

increases the challenge for firms to be able to recognize and value such knowledge. This can be more of a test for emerging economy firms due to limitations in their absorptive capacities (Hitt et al., 2000; Asakawa et al., 2014). This is even more problematic for such firms as these partners are invariably from international contexts and consequently, knowledge dissimilarity poses extra challenges for these firms when trying to utilize and absorb new knowledge effectively (Phene et al., 2006; Tallman & Phene, 2007; Lavie & Miller, 2008). There will be limits to the cognitive ability of R&D staff to combine scientific knowledge with existing knowledge (Fleming & Sorenson, 2001; Jiang et al., 2010). Additionally, firms can face increasing management and coordination costs due to friction between partnering firms. For instance, appropriability problems can arise when intellectual property rights are unspecified for emerging economies and as a result, partners are hesitant to share their knowledge with firms operating in them (Li et al., 2008).

Search depth strategy mitigates the issues that are likely to occur through firms' collaborations with science-based partners, for it enables firms to build an interaction with key sources over time (Laursen & Salter, 2006). The focus on and experience in one domain facilitate comprehensive information flow, leading to intensive understanding of a specified knowledge source (Patel & Van der Have, 2010). Deeper search thus allows emerging economy firms to draw on rich knowledge (Cruz-Ganzalez et al., 2015). This specialized knowledge helps the firm to exploit and hone the opportunities obtained from engaging with science-based partners (Fabrizio, 2009; Foss et al., 2013). As Fontana et al. (2006) suggest, firms with in-depth screening activity of a knowledge source are more likely to leverage universities and research institutes. In particular, firms with a deep search strategy can transfer tacit and important knowledge to inside their boundaries, thereby expanding their ability to benefit from science-based partners. In addition, narrowing down the search strategy can help firms to reduce the costs relating to integration and management of science-based partners. That is, when managers focus on one or two knowledge sources, they will be able to manage their time and effort between these sources and the partners (Ocasio, 1997). Through repeated interactions over time, managers develop a better understanding of what source offers the right way to proceed and then allocate attention to it. Hence, I propose:

Hypothesis 6a (H6a): Search depth has a positive impact on radical innovation for emerging economy firms collaborating with international science-based partners.

By contrast, the nature of market-based partners suggests that emerging economy firms with a search depth strategy do not benefit from collaborating with such partners in terms of increasing their radical innovation performance. Moreover, firms searching the external environment by focusing on one or two key knowledge sources are more likely to transfer tacit and important knowledge inside their firm boundaries (Laursen & Salter, 2006). Knowledge transfer requires cumulative learning and path dependency (Kogut & Zander, 1992). In this vein, firms searching deeply are likely to establish some prior experience or related knowledge enabling them to leverage these sources with high intensity (Terjesen & Patel, 2015). The key sources that firms deeply leverage are often customers and suppliers (von Hippel, 1988). Because the firm already has detailed information about market segments, the marginal effects of market-based partners in increasing radical innovation performance decline (Zhou & Li, 2012). Specifically, the inflow of information about customer needs, market trends and foresight will most likely bring in ideas for minor refinement or extension of existing knowledge (Faems et al., 2005; Vanhaverbeke et al., 2014). This has a detrimental effect on novelty as it blocks any new knowledge required for radical innovations. Therefore, I propose:

Hypothesis 6b (H6b): Search depth is not expected to have a significant impact on radical innovation for emerging economy firms collaborating with international market-based partners.

For this research, it is also anticipated that an emerging economy firm with a search depth strategy collaborating with international market-based partners leads to improved incremental innovation performance. As explained earlier, firms drawing deep knowledge from key sources, such as customers, suppliers and universities, develop a certain level of knowledge base and understanding (Laursen & Salter, 2006; Terjesen & Patel, 2015). In particular, when firms collaborate with

international science-based partners, they bring scientific knowledge into their activities (Alcacer & Chung, 2007). This type of partnership engages in the creation of new knowledge, thereby reducing the chance of benefiting from minor improvements in firms' products and services.

In order to increase incremental innovation performance, firms need to pursue expansion of their existing knowledge base and trajectories (Benner & Tushman, 2002, 2003; Jansen et al., 2006). Regarding which, firms with a search depth strategy have the chances of improving and exploiting an existing technological trajectory by collaborating with customers and suppliers from international economies (Faems et al., 2005; Alcacer & Chung, 2007). Market-based partners provide up-to-date market information, which enables firms to recognize potential applications of their technologies and learn how to serve the market (Vanhaverbeke et al., 2014). This information allows for their being able to respond to market needs fast by speeding up the development process. In addition, market-based partners can facilitate firms gaining access to a similar knowledge base and skills (Un et al., 2010; Un & Asakawa, 2015). That is, as these entities operate in the shadow of the same dominant industry technology paradigm, it is likely that there will be substantial overlap in the knowledge base of the firm and the knowledge base of others in its value chain (suppliers, buyer and competitors) (Bercovitz & Feldman, 2007). As a result, since firms have detailed information about market due to their deep focus on key knowledge sources, such as customers and suppliers, the significant level of overlap leads to firms deciding to build on existing knowledge and extending already present products and services for current customers (Benner & Tushman, 2003; Atuahene-Gima, 2005).

In addition, because a dominant design has emerged for incremental innovation products, the availability of specific knowledge which enables to improve existing products increases (Abernathy & Clark, 1985). In this vein, firms are more focused on commercialization of their products rather than discovery of new knowledge or technology (Lavie & Drori, 2012). Market-based partners provide firms complementary knowledge to increase market acceptance of improved products

(Belderbos et al., 2012). In particular, they can provide knowledge about effective distribution channels and marketing strategies (Rothaermel & Deeds, 2004). They can also potentially deliver more sales of existing products by recommending them to others. The similarity and deep understanding as increasing factors and the novelty as a decreasing one, lead to improved efficiency, thus resulting reliable outcomes in terms of innovation performance (Lavie & Rosenkopf, 2006). As aforementioned, due to the characteristics of science-based partners, the hypothesis looking at the effects of science-based partners on the link between search depth and incremental innovation is not formulated. However, regarding market-based partners, I propose:

> *Hypothesis 6c (H6c): Search depth has a positive impact on incremental innovation for emerging economy firms collaborating with international market-based partners.*

2.8 Summary

In this chapter, drawing on innovation search literature, the effects of external search strategies on innovation performance have been discussed and related hypotheses developed. The extant literature on innovation search has not taken into account the importance of emerging economy firms. Moreover, there is little knowledge explaining firms' search strategies when they operate in a context where the institutional and economic situation is different, such as in emerging economies (Li et al., 2013; Asakawa et al., 2014). However, existing studies have argued that different environmental characteristics influence firms' search choices and their innovation performance (Chen & Miller, 2007; Vissa et al., 2010; O'Brien & David, 2014). For this research, it is therefore proposed that the unique characteristics of emerging economy firms can lead to them following different search patterns to generate innovative outcomes. Most extant research has focused on developed economy contexts, such as the UK, Finland, Germany and Ireland (Laursen & Salter, 2006; Grimpe & Kaiser, 2010; Leiponen & Helfat, 2010; Love et al., 2014). These authors have argued that searching broadly and deeply the external environment positively influences firms' abilities to generate innovation outputs. It is also argued

that there are limits to the beneficial effects of firms' external search strategies due to the extensive search cost (Love & Roper, 2001; Katila & Ahuja, 2002; Laursen & Salter, 2006; Leiponen & Helfat, 2010; Garriga et al., 2013). Accordingly, in this chapter the effects of firms' external search strategies involving search breadth and search depth on innovation performance have been discussed extensively from the perspective of emerging economy firms (H1, H2, Figure 2-3).

Emerging economy firms typically draw knowledge from their foreign partners to upgrade their knowledge base and to catch up with the global world (Hitt et al., 2000; Wright et al., 2005; Li et al., 2013). The extant literature on innovation search has also highlighted the important role of international knowledge sources for firms in accessing novel knowledge sources (Ahuja & Katila, 2004; Phene et al., 2006; Sidhu et al., 2007). Regarding which, the unique characteristics of emerging economy firms suggest that such firms need to build up strong and formal interaction with their partners so as to increase their ability to acquire knowledge from outside. Such collaboration is essential for facilitating the flow of knowledge (Ahuja, 2000; Hagedoorn, 2002; Singh et al., 2015) and the importance of close interaction is emphasized for transferring it between international partners (Levin & Barnard, 2013). Accordingly, for this study the focus is on emerging economy firms' international collaboration as a contingency factor of search strategies. In order to investigate the effects of international collaboration, a first conceptual framework has been proposed to explain the impact of different international collaboration contexts on the relationship between search strategies and innovation performance. In the extant literature on search it has been argued that its success is influenced by the context where firms obtain the knowledge (Katila, 2002; Phene et al., 2006; Chen & Miller, 2007; Zhang & Li, 2010). In respect of this, researchers have examined the effects of search on innovation by looking at the differences between search spaces, such as national and international contexts (Ahuja & Katila, 2004; Phene et al., 2006). This research builds on this by examining the contingency effects of international collaboration contexts on the link between search strategies and innovation performance by distinguishing between collaboration with partners from developed economies and that with partners from other emerging economies. The nature of engagement with developed economy partners is fundamentally different

from that with other emerging economy partners. Emerging economy firms thus access different level of technological development when they collaborate with developed and emerging economy partners, thereby requiring different levels of absorption if they are to be able to utilize the knowledge. In addition, each context presents different threats and opportunities. Drawing on the characteristics of the contexts, for this research it is proposed that search breadth is beneficial for firms collaborating with emerging economy partners, for such collaborations can help forge a positive relationship between search breadth and innovation performance (H3, Figure 2-3). In addition, search depth is advantageous for firms collaborating with developed economy partners as such collaborations foster the positive relationship between search depth and innovation performance (H4, Figure 2-3).

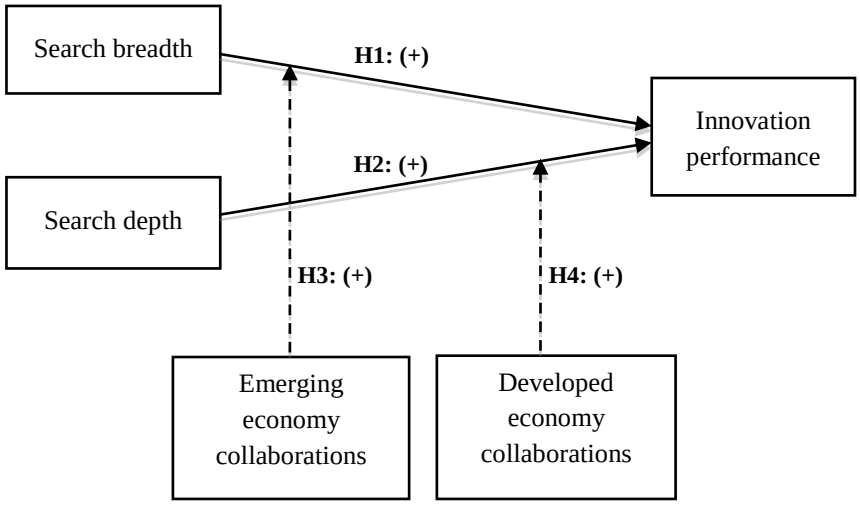

Figure 2-3 The Associations of the Hypotheses for the Impact of the Context of Collaboration

A second conceptual framework put forward to explain the extent to which the impact of firms' search strategies on different types of innovation performance varies depending on the types of collaboration partners, in this case, international market-based and science-based partners. Previous studies have drawn attention to different kinds of knowledge when investigating the effects of search breadth and search depth on different types of innovation performance (Laursen & Salter, 2004; Laursen, 2011; Chen et al., 2011; Kohler et al., 2012). In particular, partner types become

important in terms of accessing certain kinds of knowledge and producing different types of innovation performance (Faems et al., 2005; Todtling et al., 2009; Vanhaverbeke et al., 2014). Accordingly, market-based partners and science-based partners enable firms to access to diverse types of knowledge (Baum et al., 2000; Faems et al., 2005; Du et al., 2014; Gesing et al., 2015). These partners differ in the kind of knowledge they provide as well as the way it can be accessed by the firm (Vanhaverbeke et al., 2014), which turn influences the benefits and costs of search strategies (Salge et al., 2013). This research thus involves investigating different effects of collaboration partners on the link between search strategies and different types of innovation performance. Drawing on the characteristics of partners, it is contended that international science-based partners do not affect the link between search breadth and radical innovation performance (H5a, Figure 2-4a), whereas having such partners increases the effects of search depth on radical innovation performance (H6a, Figure 2-4a). In addition, international market-based partners help forge a positive relationship between search breadth and radical and incremental innovation performance (H5b, H5c, Figure 2-4a and 2-4b). Such partners also positively influence the link between search depth and incremental innovation performance but they do not moderate the link between search depth and radical innovation performance (H6b, H6c, Figure 2-4a and 2-4b). The next chapter will present and justify the research methodology.

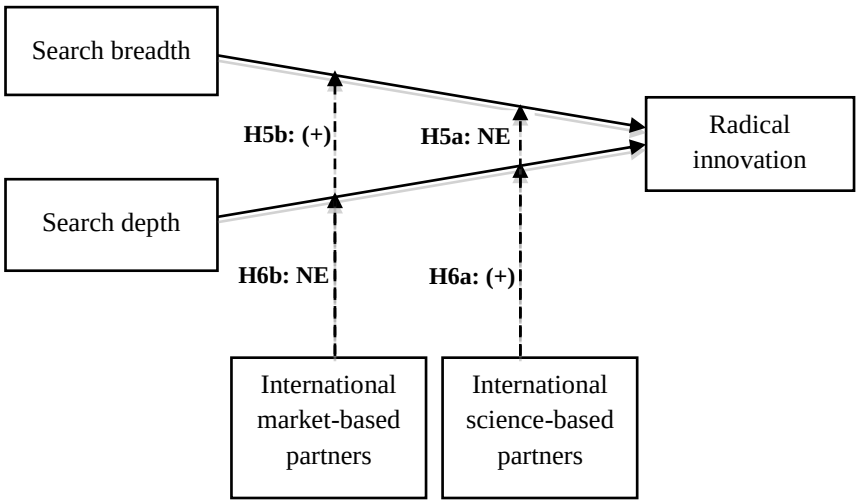

Figure 2-4a The Associations of the Hypotheses for the Impact of Collaboration Partner Types (Radical Innovation)

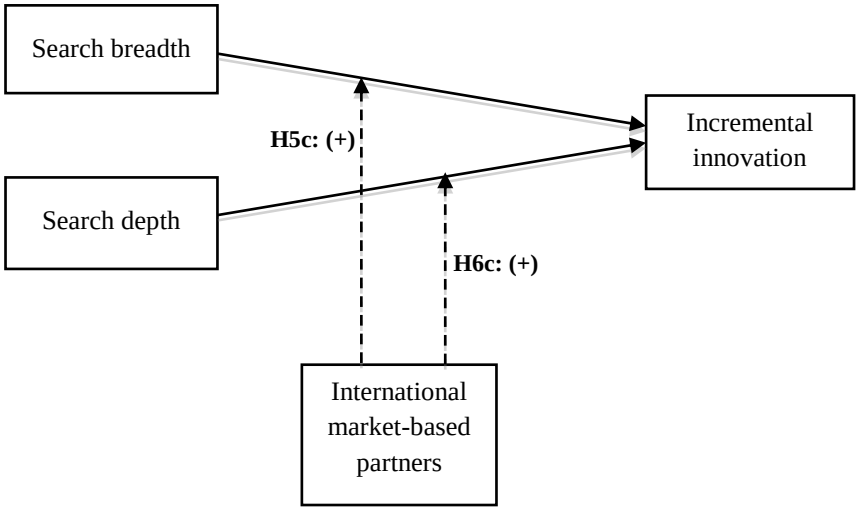

Figure 2-4b The Associations of the Hypotheses for the Impact of Collaboration Partner Types (Incremental Innovation)

Chapter 3

Methodology

This chapter describes the way in which this study was operationalised so as to address the research inquiries set out in Chapter 1 and 2. It describes the methodological choices that have been made in terms of the context, data and operationalisation of the constructs. For this research, a positivist paradigm was adopted, under which a deductive approach and quantitative research strategy were employed to guide the design of the research.

3.1 Research Paradigm

The term paradigm rose to prominence among social scientists after the work of Kuhn (1962, 1970) who analysed revolutions in science. A paradigm is a set of beliefs and dictates which for scientists in a particular discipline influence what should be studied, how research should be done and how results should be interpreted (Bryman, 1988; Bryman & Bell, 2007). Three principles of a paradigm can be explained as: ontology, regarding the nature of reality; epistemology, referring to what is valid knowledge as well as the relationship between the researcher and the research; and finally, the methodology, regarding how the research should be conducted to gather the knowledge.

3.1.1 Positivism and Social Constructionism

Discussions related to the research paradigm begin with two contrasting views of how social science research should be conducted. These two philosophical positions are positivism and social constructionism (Easterby-Smith, Thorpe, & Lowe, 2002; Lincoln & Guba, 2003; Bryman, 2004). Under the positivist view, it is assumed that

the social world exists externally and it needs to be measured through objective methods rather than through subjective sensation and reflection. That is, under this paradigm, ontologically, reality is external and objective. The epistemological assumption is that knowledge is only of significance if it is based on observations of this external reality (Easterby-Smith et al., 2002). Consequently, the researcher, on the basis of what is known about a particular domain and the theoretical considerations in relation to that domain, deduces a hypothesis (or hypotheses) that must then be subjected to empirical scrutiny to prove or disprove the proposition under carefully controlled conditions (known as a deductive approach) (Lincoln & Guba, 2003; Bryman, 2004). This deductive approach is usually associated with quantitative research.

In contrast, the ontological assumption of social constructionism is that reality is not objective and exterior, but rather, is socially constructed and given meaning by people (Easterby-Smith et al., 2008). Epistemologically under this lens, reality is determined by people rather than by objective and external factors. In other words, exponents of the constructivist paradigm assume that there are multiple realities, which are dependent for their form and content on the persons who hold them. Unlike positivism, the focus is on understanding subjective meanings of social actions, such as what people are thinking and feeling and why they have different experiences. In which case, the researcher reports the implications of his or her findings for the theory that prompted the whole exercise (Lincoln & Guba, 2003). The findings are then fed back into the stock of theory and hence, contribute new knowledge to the domain of enquiry (known as an inductive approach) (Bryman, 2004). This inductive stance is usually associated with qualitative research.

3.1.2 Positivistic Paradigm Research and Research Strategy

Guba (1990) advised that the positivism and social constructionism paradigms are not in competition with each other, but rather, offer their specific characteristics to research and that the choice of research paradigm should pertain to the questions that are to be studied. Thus, regarding ontological considerations, this research adopts an

objectivist perspective that asserts that social phenomena and their meanings have an existence that is independent of social actors (Bryman & Bell, 2007). In relation to epistemological considerations, a positivist view that advocates the application of the methods of the natural sciences to the study of social reality and beyond is taken up (Bryman & Bell, 2007). Thus, the epistemological assumption of this study is that the discovery and verification of the hypotheses that measure cause-effect relationships by empirical tests can be pursued (Easterby-Smith et al., 2008). In other words, to address the research question in this study, positivistic paradigm was assumed so as to undertake a deductive approach to test the hypothesised relationships underlying the linkages between search strategies, context of collaboration, partner types and innovation performance. Accordingly, a quantitative research strategy was adopted, thus providing a way of linking theoretical categories or concepts with empirical research, thereby testing theory (Bryman & Bell, 2007). More specifically, the findings with regards to the research question in this study address the impact of search strategies on innovation performance as well as the effects of location of the collaboration and the nature of international partners on this relationship. The research design adopted for this study is explained next.

3.2 Research Design: The Survey Research

In accordance with the ontological and epistemological considerations of this research, a research design that provides a framework for the collection and analysis of data was devised as explained in this section. Several research designs have been identified as being appropriate for use in quantitative research, including: experimental design, cross-sectional or survey design, longitudinal design and case study design (Bryman, 2004; Bryman & Bell, 2007).

Experimental research is the strongest technique for testing causal relationships (Bryman & Bell, 2007). The logic of an experiment involves an experimenter inducing a change in some focused part of social life, which is then examined to ascertain the consequences that have resulted from the change or intervention (Neuman, 2006). This research design usually entails comparing two samples, one

receiving the treatment (the experimental group) and the other not (the control). Hence, this research design is usually best for issues that have a narrow scope or scale. However, the experiment is rarely appropriate for research questions that require a researcher to examine the impact of dozens of diverse variables simultaneously. In relation to this current study, the research framework is based on the relationship between firms' search strategies and innovation performance depending on the context of collaboration as well as the types of international partners. Accordingly, the experimental was considered not to offer an effective choice of research design for application in this investigation.

Survey research comprises a cross-sectional design for which data are collected predominantly by questionnaire or by structured interview, often called a survey design (Bryman, 2008). While the research methods associated with surveys are certainly frequently employed within the context of cross-sectional research, so too are many other research methods, including structured observation, content analysis, official statistics and diaries (Bryman, 2004). A cross-sectional design entails the collection of data on more than one case (often significantly more than one) and at a single point in time in order to collect a body of quantitative or qualitative data in connection with two or more variables (usually many more than two) (Bryman, 2004). The purpose is to detect patterns of association, but with a cross-sectional design, it is only possible to examine the relationships between variables. Further, it works best if the researcher knows what kind of information is needed in order to provide explanations regarding the phenomena of interest and if the provisional questions can be standardized so as to assure that the questions convey the same meaning for the different respondents (Bryman, 2004). Thus, consistency in terms of the reliability of the measure, and measurement validity, i.e. whether or not the measure that has been devised for a concept really does reflect the concept that it is supposed to be denoting, are key challenges for the researcher when drawing any conclusions from the study (Bryman, 2004; Bryman & Bell, 2007). In other words, the issues of reliability and measurement validity are primarily matters relating to the quality of the measures that are employed to tap the concepts in which the researcher is interested. With regard to this, researchers need to have a clear understanding of

the measurements associated with the issues of interest and are advised to choose well-tested ones to improve the measure validity.

Another research design is longitudinal, which involves a process whereby the sample is surveyed and then this is repeated on at least one further occasion (Bryman, 2004). Because of the time and cost involved, it is a relatively little-used design method in social research (Bryman, 2008). In terms of reliability, replication and validity, longitudinal design is somewhat different from cross-sectional design. For, it allows for observations of changes and casual influences regarding the variables over time. Further, case study design is similar to survey research but differs in its focus (Bryman & Bell, 2007). That is, researchers following this approach focus on the case, either in the form of an organisation, event, people or location, with the aim being to illustrate the unique features of the case in order to address the research questions. By contrast, the main focus of the survey research approach is to examine the pattern or causal relationships of the study variables.

To this end, it was not the aim with this study to explain the unique features of Turkish manufacturing and service firms that provided the setting for the search strategy, international collaboration and innovation performance investigation. Rather, the aim was to investigate external search strategies and innovation linkages using a sample taken from the Turkish manufacturing and service sectors. Hence, for this research it was deemed most appropriate to use a cross-sectional research design instead of a case study approach for the investigation. Accordingly, data were drawn from innovation surveys carried out through questionnaires. This decision was made whilst remaining aware of the potential drawbacks of taking of this approach, particularly regarding the reliability and validity of the measures adopted. The reliability and validity of the survey that has been used in this research were established by extensive piloting and pre-testing before implementation. Additionally, most of the concepts referred to in this study have well established measures that have been used in previous research.

3.3 Research Context: Turkey

In Chapter 2, the specific characteristics of the emerging economy contexts were described and the significance of accessing external knowledge sources was demonstrated. Further to this, it should be noted that additional specific features of the Turkish manufacturing and service sectors made it suitable as the context for this investigation. Below is a review of the Turkish context, which provides useful background about the process of economic liberalisation that has been taking place in this emerging economy. Additionally, the nature of the investment aimed at enhancing the national innovation system of Turkey is explained. Moreover, Turkey's developments in R&D capabilities and skilled human capital are compared across different countries, thereby eliciting the current position of that country's innovation capability at the global level. This review helps to show that Turkey is a representative case of an emerging economy despite its unique characteristics.

Turkey's business landscape has changed dramatically in the last four decades. In order to catch up with Western technology developments, in the 1960s and 1970s, Turkey followed the import substitution industrialisation strategy with a state-planned and inward-looking approach to support private industrial development. Even though this strategy was not successful as it generated unsustainable economic growth, this led the government to be a major actor and source for technological development, knowledge and skilled people. After the severe balance of payments crisis in the late 1970s, the Turkish government implemented a stabilisation and structural adjustment programme in 1980.

In the 1980s, Turkey embarked on a process of macro-level institutional transformation involving a shift from an import substituting industrialisation model towards an export oriented growth strategy that included greater liberalisation and internationalisation (Onis, 1992, 1996). The objectives behind this shift were: to reduce state intervention and involvement in production activities, to focus on export-led growth, and to encourage greater inflow of foreign direct investment (FDI). Since then, the country has made substantial progress in liberalisation as well

as increasing its exports and incoming FDI. Some sectors, such as textiles, garments, food and leather, used these incentives and the availability of low-cost labour to increase their exports (Karabag & Berggren, 2014). The changes implemented in the 1980s contributed to a significant increase in FDI. As a result, the number of firms with foreign participation increased from 78 in 1980 to 1,856 in 1990 and reached 5,328 in 2000, whilst the total value of inflow of FDI reached 2.6 billion USD in the 1980-89 period, rising to 11.8 billion USD between 1990 and 2000. This shows that FDI has played a substantial role in Turkish manufacturing industry. With this increase in the flow of FDI, R&D activities of foreign firms have served as a crucial channel for not only the transfer of technology, but also for increasing the focal firms' ability to absorb and even create technology.

Despite these very significant changes, there is still considerable state presence in the economy, for the government continues to decide which sectors to protect and which to liberalise. Moreover, the state remains an important resource allocator, controlling the entry in industries such as energy, telecommunications, banking, and construction materials as well as actively supporting internationally competing manufacturing industries, such as autos (Karabag & Berggren, 2011). A recent study highlights the weak impact of current strategy on performance, arguing that political factors such as accessing government contracts and regulatory opportunities remain important in determining business outcomes (Karabag & Berggren, 2014). Hoskisson et al. (2013) also contend that countries like Turkey with strong development of infrastructure and factor markets, but weak institutional development, focus more on the management of the institutional environment (government policies and structures), than on that of their product market.

This process shows that Turkey has had a rapid pace of economic development and government policies favouring economic liberalisation and the adoption of a free-market system. These criteria are used to define a country as an emerging economy. Other emerging economies have also experienced this process of economic development (Peng & Heath, 1996; Hoskisson et al., 2000). A strong state that actively coordinates and controls economic activities is another characteristic

observed across emerging economies. In addition, one common organizational form, business groups, has influenced the development of many emerging economies (Kahanna & Palepu, 1997). They have been called as family holdings in Turkey, business houses in India and chaebols in South Korea. These business groups created value by substituting for institutions that are taken for granted in developed countries. The Turkish holding structure with its diversified nature and the role of state in its establishment and development, is comparable to similar structures in lately industrialized countries for example, the Korean chaebol (Bugra & Usdiken, 1995). Having these common characteristics and experiencing the process of economic development make this research context representative for the features of an emerging economy. In addition, previous studies mostly focused on either large-sized emerging countries such as China or small-sized emerging countries such as Taiwan. It is important to focus on mid-sized emerging countries since they are less likely to face large or small country problems in terms of resource access and huge diversity. Therefore, Turkey is a mid-sized emerging economy which makes this research context important.

In addition to the country's business system changes, investments and developments for national innovation system has happened. To increase technological learning capability and production of its own products and patents, the government began to encourage R&D efforts in the early 1990s with the initiation of R&D support programmes. It established science and technology centres along with providing considerable support to foreign entities, prominent universities, research organisations and university-industry joint research centres so as to foster a culture of innovation. For example, The Technology Development Foundation of Turkey, founded in 1991 and funded by the World Bank, is a member of the Association for Technology Implementation in Europe, which has provided R&D support to Turkish industry through soft loans. Many initiatives have also been undertaken by the government, such as interest-free R&D loans and R&D grants with the coordination of the Scientific and Technical Research Council of Turkey, since 1995. In addition to these improvements, in order to build up innovation capabilities and develop university-industry linkages, science and technology parks have been introduced. These science parks have offered significant tax advantages to high-tech firms.

However, Turkey needs to invest more on science and technology policies as well as strengthening its national innovation system since it still clearly lags behind the developed countries. According to the European Innovation Scoreboard 2009, which includes innovation indicators and trends, the catching-up countries are below the European Union (EU) average in all dimensions and Turkey's innovation performance is currently well below that of other countries included in the European Innovation Scoreboard. In particular, Turkey lags behind developed countries in its R&D intensity. Gross domestic expenditure on research and development (GERD) is used as an indicator of an economy's relative degree of investment in generating new knowledge and it is one of the most widely used measures of innovation input. In Turkey, GERD was 0.47% of GDP in 1999 and 0.85% in 2009. As shown in Figure 3-1, Turkey's ratios regarding R&D stand well behind OECD and EU countries in 2009.

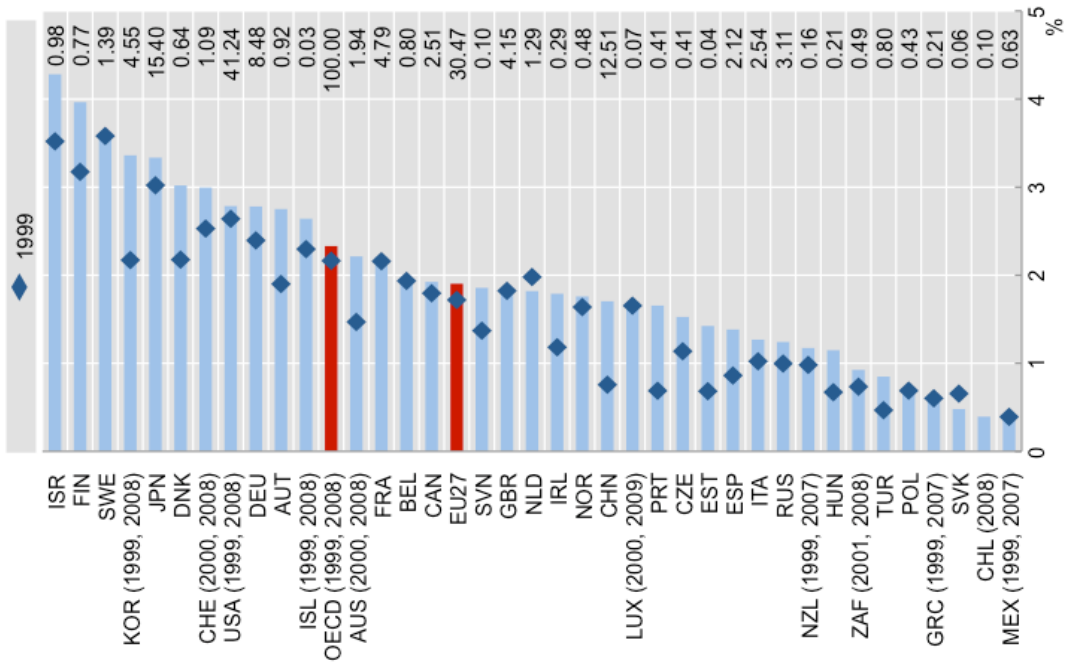

Figure 3-1 Gross Domestic Expenditure on R&D, 1999 and 2009

Source: OECD, Main Science and Technology Indicators Database, June 2011

Business enterprise expenditure on research and development (BERD) is also considered important for innovation and economic growth. Business R&D reached 1.6% of OECD GDP in 2008, up slightly from 1.5% in 1999. In Turkey, BERD was

0.18% of GDP in 1999, 0.34% in 2009 and 0.36% in 2010, being concentrated in a few medium-high-technology manufacturing industries and knowledge services, which as can be seen in Figure 3-2, are well below the OECD and EU values. In terms of the sectoral structure of the R&D, in Turkey, government and total higher education spending on R&D accounts for 0.60% of GDP in 2009, whereas business enterprise represents 0.40% of GDP in the same year. These figures show that Turkey's national innovation system is primarily based on the public sector. Private sector actors are slowly recognising the need for R&D.

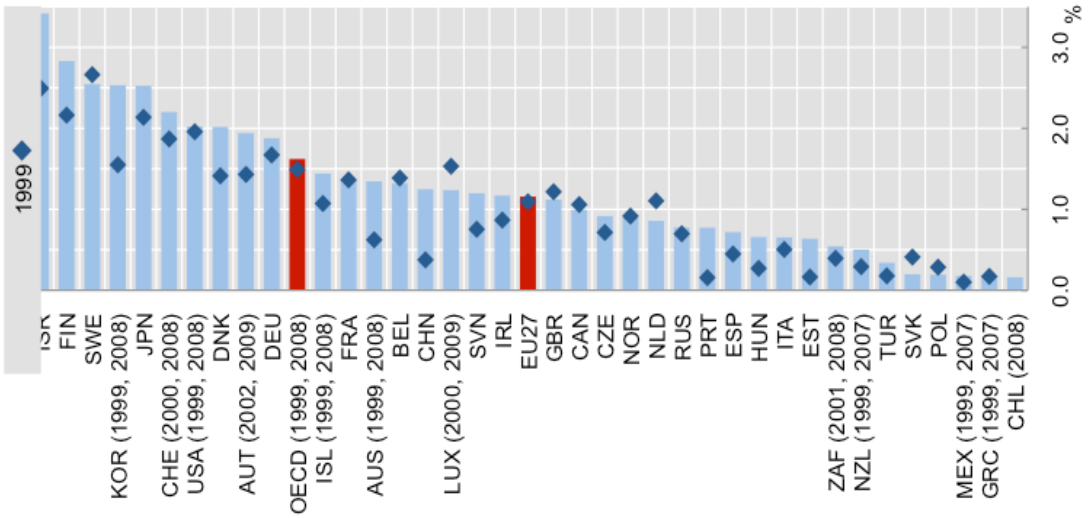

Figure 3-2 Business Enterprise Expenditure on R&D, 1999 and 2009

Source: OECD, Main Science and Technology Indicators Database, June 2011

Despite recent improvements, educational attainment and access to education at every level remain still significantly behind most OECD and EU countries. The quality of education continues to be very low, primarily as a result of significant disparities among schools, a shortage of teachers and the low socioeconomic status of students. The level of knowledge and skills available is low in Turkey, with only 50% of the total population having completed secondary level education and only 12% of the adult population has undertaken tertiary education (OECD, 2007). Moreover, the country's public research system is small. It has few articles in top scholarly journals and only one world-class university. Skills levels are weak and just

13% of employees are in science and technology occupations. In 2006, when compared with EU countries, Turkey had the lowest share of scientists and engineers in the total workforce, with 1.4%. The graduation rates at doctoral level, as a percentage of total population, was 0.2% in 2000 and still only 0.4% in 2009. As can be seen in Figure 3-3, Turkey has a quite low number of such graduates compared to other countries.

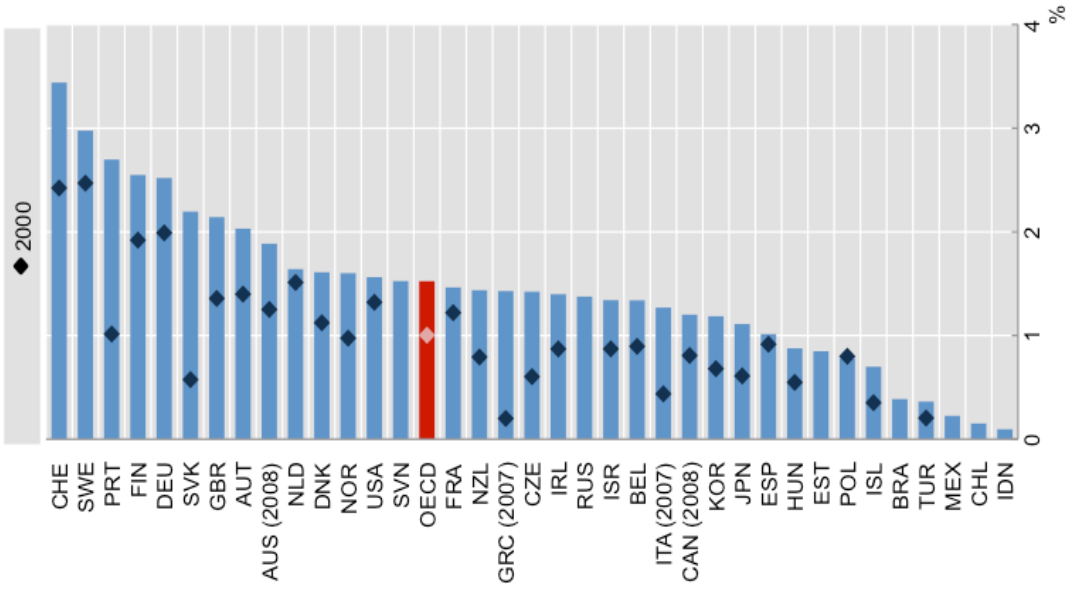

Figure 3-3 Graduation Rates at Doctorate Level, 2000 and 2009

Source: OECD, Main Science and Technology Indicators Database, June 2011

In sum, the country's economic globalisation has never been a smooth process and its entry onto a more sustainable path requires it to become more innovative in order to be competitive in the global markets. The figures show that Turkey lags behind the European and OECD countries in terms of R&D expenditure and skilled human capital. Turkey is a less-advanced receiver country with the weak national system of innovation and a negligibly small share of R&D expenditure in relation to GDP. The lag between developed countries and Turkey in terms of technological development and knowledge level leads Turkish firms to search international contexts in order to transfer foreign knowledge. Consequently, there is an extensive focus on foreign knowledge transfer from Western partners to the country through licensing and joint collaboration activities. In particular, changes in its trade and investment regimes

indicate the importance of foreign knowledge and capital for the country in order to gain a presence in new markets so as to be able to access complementary and technological resources. Overall, the Turkish case is an important research context, which shares similarities with emerging economies and dissimilarities with developed economies in terms of institutional and technological development.

3.4 Sample

The data for this study are drawn from the Turkish Innovation Survey conducted by the Turkish Statistical Institute (Turkstat) following the methodology set by Organization for Economic Co-operation and Development's (OECD) Oslo Manual and the European Community Innovation Survey (CIS). Basic definitions and the survey methodology rely on the so-called Oslo Manual: "Guidelines for Collecting and Interpreting Technological Innovation Data" (OECD & Eurostat, 2005). It contains guidelines for collecting and interpreting innovation data, provides definitions and explains sampling techniques and pretesting so as to ensure reliability and validity. Being compatible with the European CIS and following the Oslo Manual allows for comparison of the findings across industries, countries and other CIS studies. As with the European CIS, each of the Turkish innovation surveys covers the innovation activities of manufacturing and service-based firms over a three-year reference period. This survey includes questions about innovation output, innovation activities and expenditures, knowledge sources related to innovation, innovation related collaboration with others, and non-technological innovation activities.

CIS surveys of innovation are often described as subject-oriented and self-reported, thus raising issues with regard to administration and non-response. However, these surveys are subject to extensive pre-testing and piloting in various countries, industries, and firms with regard to interpretability, reliability, and validity (Laursen & Salter, 2006; Tether & Tajar, 2008; Grimpe & Kaiser, 2010). Moreover, CIS data have been widely used in recent years by scholars interested in innovation (e.g. Grimpe & Kaiser, 2010; Leiponen & Helfat, 2010, 2011; Leiponen, 2012; Garriga et

al., 2013; Klingebiel & Rammer, 2014). Accordingly, CIS data have been also used in studies investigating different characteristics of firms' collaboration activities, such as national and international collaboration (Miotti & Sachwald, 2003; Faems et al., 2005; Frenz & Ietto-Gillies, 2009; Lhuillery & Pfister, 2009; Duysters & Lokshin, 2011; Schmiele, 2012; Beers & Zand, 2014; Hottenrott & Lopes-Bento, 2014; Gesing et al., 2015). Compared to patent data, those from the CIS survey have the advantage of measuring whether firms introduce new products and the sales generated from these (Cohen et al., 2000; Mairesse & Mohnen, 2002; Tether & Tajar, 2008). In addition, it provides direct measures of firm success in commercialising innovations across a representative range of industries and the questionnaire asks firms to indicate whether they have been able to achieve product innovation. Product innovation is defined as "the market introduction of a new or significantly improved good or service with respect to its capabilities, user friendliness, components or sub-systems" (OECD & Eurostat, 2005). Firms are then asked to state what share of their sales can be ascribed to different types of innovations, including those new to the market and those new to the firm.

This research uses innovation surveys conducted in the years 2009, which covers the years 2006-2008 and 2011, pertaining to the years 2008-2010. The gross target sample of the 2009 survey consists of 7,351 enterprises, including manufacturing and service-based firms with at least 10 employees. Stratification is by sector (41 sectors at the two-digit level of NACE Rev.1.1) and firm size (three classes according to the number of employees). The gross target sample of the 2011 survey consists of 6,877 enterprises, including manufacturing and service-based firms. Stratification is by sector (49 sectors at the two-digit level of NACE Rev.2) and firm size (three classes according to the number of employees). The surveys were administered via face-to-face interviews with firms' official representatives. The person who is responsible for administrating the survey guides respondents in terms of how to fill the questionnaire. This method increases the response rates and prevents shortcomings and biases arising from telephone interviews or mail surveys (Bertrand & Mullainathan, 2001). Firms also had the option to respond online. The survey was completed by those managers responsible for innovation activities such as R&D managers or executive officers in charge of innovation or R&D. From the 2009

survey, 5,863 usable responses were obtained and from the 2011 survey, this figure was 5,767. Hence, the response rate for the 2009 survey is 79.7%, whilst that for 2011 survey is 83.8%, which in both cases is high. However, this is not surprising given that Turkish firms have a legal obligation to complete the questionnaires administered by Turkish Statistical Institute. This response rate is also of similar magnitude to those of other countries, such as Spain and Finland (Fosfuri & Tribo, 2008; Escribano et al., 2009).

This research combines innovation survey for the period 2008-2010, which contains the dependent variables in this study, with that for the period 2006-2008, covering the exploratory and control variables. That is, a partial panel dataset is created in order to have a full lag between knowledge sources, collaboration and innovation performance. Because firms need considerable time, effort and resources to undertake an innovation project and launch it as a new product and earn sales from such product, it is important to have a time lag between innovation inputs and outputs (e.g. Belderbos et al., 2004; Un et al., 2010; Hess & Rothaermel, 2011). In addition, introducing such a time lag in the regression addresses the issues of endogeneity (Frenz & Ietto-Gillies, 2009). In particular, drawing the dependent variable from a different survey alleviates simultaneity issues and common method bias. That is, the time periods over which the dependent and right-hand side variables are measured have minimal overlap, thus minimising simultaneity issues. Combining the two datasets resulted in 1,291 observations, but a further 632 firms were dropped from the sample as they conducted no product innovation activities. So, the final sample consists of 659 firms that had data in both the innovation surveys, and which had some activity directed toward innovation, regardless of whether they succeeded in innovating (Laursen & Salter, 2006; Leiponen & Helfat, 2010). Thus, the sample includes successful innovators as well as firms that attempted, but failed, to innovate. Of these, 224 are service firms in six different two-digit service industries and 435 are manufacturing firms in thirteen different two-digit industries. The sample consists of 19 industries at the two-digit classification code level. Some Turkish firms are so-called business groups. For example, Koc Holding is a business group that includes several sectors under its umbrella, such as the energy, automotive, consumer durables and finance industries. Survey respondents were independent (not

part of a business group), a subsidiary of a business group, or, in a few instances, the parent company itself (the business group) and as a result, the firms in the sample were not widely diversified. The firms are not identified by name since the data are confidential.

3.4.1 Respondent Overview

In this section, an overview of the respondents is presented. Table 3-1 shows the percentage of firm size according to their number of employees. The majority of firms in the sample are larger (441 firms over 250 employees), whilst 71 firms have less than 50 employees, with minimum number being 10 and hence, as illustrated in Table 3-1, the sample is biased toward larger firms. In addition, firms in the sample used here are slightly more R&D intensive (59% are active in internal R&D activities and 40% of them have continuous R&D in the sample compared with 16% being active in internal R&D activities and 10% of them having continuous R&D in the original sample of the 2009 survey). In addition, the firms in the sample are more innovative than the firms in the original sample of 2009 as a whole (74% are product innovators in the sample versus an average of 26% in the gross sample).

Table 3-1 Size Overview

Firm size	Number of firms	Percentage in the sample	Percentage in the gross sample
<50	71	10.8	10.7
≥ 50 - 100	44	6.7	22.0
≥ 100 - 250	103	15.6	22.9
≥ 250 - 500	130	19.7	14.0
≥ 500 - 1000	164	24.9	10.9
≥ 1000 - 5000	122	18.5	16.4
≥ 5000	25	3.8	3.1
Total	659	100.0	100.0

Table 3-2 below, compares the industry distribution of firms in the sample with that of the Turkish manufacturing and service sectors in the original sample of 2009 survey. The industry distribution of manufacturing and service firms here largely conforms to the original composition of the CIS respondents. Nevertheless, the current sample contains fewer wholesale trade firms (NACE 51: 6.7% of the sample) than the original representative CIS sample (10.3%) and relatively fewer communication and transportation service firms (NACE 60-63, 64: 7.4% of the sample) compared to the original (12.8%). On the other hand, motor vehicles producers are overrepresented (NACE 34-35: 7% of the sample) when compared with the original sample (3.5%). This may be because the sample only includes firms with some activity directed toward technological innovation and innovation activities are relatively less frequent in the wholesale trade sector, whilst be more so with manufacturers of motor vehicles (Leiponen & Helfat, 2011; Leiponen, 2012). Otherwise, the sample used in this study is similar to the actual distribution of Turkish manufacturing and service firms in terms of industry.

3.4.2 Non-Response Bias

Surveys can pose issues related to non-response bias, which refers to the difference between the true value and the estimated value obtained from the respondents. Following the Oslo Manual guidelines, a number of methods were used to minimise the problems of non-response, such as contacting the respondent to collect the missing information or estimating data from other statistical surveys (OECD & Eurostat, 2005). Additionally, the choice of treatment depends on the level of non-response, whereby if the non-response rate is fairly low, the weighting should be calculated on the basis of the units that replied. If the non-response rate is very high, no method can be recommended to solve the problem. In this case, non-response analysis can be undertaken, but the results should only be used if the response rate of non-respondents is very high. Non-response analysis was not conducted in this survey as the response rate is quite high for the Turkish innovation survey. Hence, it was concluded that this type of bias was not a problem.

Table 3-2 Industry Representation

NACE code	Industry	Number of firms	Percentage in the sample	Percentage in the gross sample
10-14	Mining and quarrying	28	4.2	6.2
15-16	Food and tobacco	41	6.2	3.5
17-19	Textiles and leather	64	9.7	10.7
20-22	Wood/paper/publishing	21	3.2	6.5
24	Chemicals/petroleum	34	5.2	3.9
25	Plastics/rubber	26	4.0	5.2
26	Glass/ceramics	44	6.7	4.6
27-28	Metal	45	6.8	6.7
29	Mnf. of machinery and equipment	33	5.0	3.8
31-32	Mnf. of electrical equipment and electronics	29	4.4	1.8
33	Medical, precision and optical instruments	4	0.6	0.4
34-35	Mnf. of motor vehicles	46	7.0	3.5
36	Mnf. of furniture, jewellery, sports and toys	20	3.0	2.7
40	Electricity, gas and water supply	11	1.7	3.9
51	Wholesale trade	44	6.7	10.3
60-63, 64	Transportation and communication	49	7.4	12.8
65-67	Financial intermediation	55	8.3	4.8
72	ICT services	55	8.3	3.9
74.2, 74.3	Other business-oriented services	10	1.5	4.8
	Total	659	100.0	100.0

Source: NACE Rev.1.1 (Statistical Classification of Economic Activities in the European Community, 2002). Mnf. indicates manufacture.

3.4.3 Common Method Bias

The downside of such survey data is the potential for common method variance or bias, which results from the fact that the predictor and criterion variables are obtained from the same source. It is one of the main sources of measurement error that threatens the validity of the conclusions about the relationships between measures (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). It can cause serious problems with empirical results and yield misleading conclusions. Therefore, it is essential to develop procedures to minimise its impacts.

Several procedural methods, as recommended by Podsakoff et al. (2003), were applied during the design of the survey instrument to mitigate the effect of common method bias. First, it has been emphasised that one way of minimising its effects is to obtain the measures of both predictor and criterion variables from different sources. For example, those researchers interested in research on the relationship between organisational culture and organisational performance can obtain the measures of the former from key informants and those of the latter from archival sources. When it is not possible to obtain data from different sources, another potential remedy is to separate the measurement of the predictor and criterion variables. One way to do this is to create a temporal separation by introducing a time lag between the measurement of these two types of variables. In line with this reasoning, this research uses the same survey, but the independent and dependent variables come from different time periods. That is, the dependent variables are measured at the end of the period of the later innovation survey (2008-2010) and the key explanatory variables are measured for the earlier innovation survey period (2006-2008). Consequently, because the variables come from two different surveys, the same person would probably not have filled out both surveys for the different time periods, which reduces the potential for common method bias.

Second, the CIS questionnaire has been designed to deal with this potential bias and to make it difficult for respondents to maintain logical associations between different input fields (Klingebiel & Rammer, 2014). The design of survey includes a psychological separation and use of different response formats (Likert scales). For instance, the answer scales for the questions about the dependent variables and the key explanatory variables are very different in this research. Key exploratory variables are mostly measured on Likert scale, whereas dependent variables are measured by the relative percentage of firms' turnover. This should reduce the respondents' ability and/or motivation to use previous answers to fill in gaps in what is recalled and/or to infer missing details (Podsakoff et al., 2003). Another procedure they use is that of allowing the respondents' answers to be anonymous. This ensures a high level of confidentiality, with the respondents/organization's being protected and hence, the responses are more likely to be accurate. These procedural measures

were incorporated in the survey design by developers of the questionnaire to dampen the effect of common method bias.

To date, CIS measures have not been associated with common method issues as a primary concern (Mairesse & Mohnen, 2007, 2010). Nevertheless, such bias has been checked by using the Harman one-factor test (Podsakoff et al., 2003), which is one of the most widely used techniques carried out by researchers to address the issue of common method bias. This technique is based on exploratory factor analysis, whereby if the first unrotated factor accounts for a relatively small share of the total variance (not more than 50 per cent), the implication is usually that common method bias is not likely to be a significant problem.

The results are checked for common method bias using Harmon's one-factor test. A factor analysis is performed for each dependent variable including all of the explanatory and control variables. This, with the variables used in the model (testing H1 and H2 hypotheses), without industry dummies, retained 3 factors with eigenvalues greater than 1.00, and analysis including these dummies retained 17 factors with eigenvalues greater than 1.00. The first factor explained about 8 percent of the variance for the models including industry dummies in each analysis and about 25 percent of the variance when the industry dummies were excluded. For H3 and H4 hypotheses, this test retained 5 factors with eigenvalues greater than 1.00, and analysis including these dummies retained 18 factors with eigenvalues greater than 1.00. The first factor explained about 7 percent of the variance for the models including industry dummies in each analysis and about 17 percent of the variance when the industry dummies were excluded. For H5a, H5b H5c, H6a, H6b and H6c hypotheses, the test retained 4 factors with eigenvalues greater than 1.00, and analysis including these dummies retained 18 factors with eigenvalues greater than 1.00. The first factor explained about 7 percent of the variance for the models including industry dummies in each analysis and about 17 percent of the variance when the industry dummies were excluded. In the raw factor solution, search breadth and search depth did not load most strongly onto the same factor as the dependent variables. Also, collaboration with developed and emerging economy partners and

international market-based and science-based partners loaded onto a different factor than did the dependent variables, with these outcomes suggesting that common method bias is not a substantial problem. The test results are also in line with those reported in prior CIS analyses (Leiponen & Helfat, 2010, 2011; Klingebiel & Rammer, 2014; Love et al., 2014).

3.5 Measures

The measures relevant to the current study's framework are described below. First, the dependent variables involved in the hypotheses are discussed, followed by consideration of the independent and moderator variables and finally the control variables are explained. The operationalisation of these measures has frequently been used by related studies in the field (e.g. Faems et al., 2005; Cassiman & Veugelers, 2006; Laursen & Salter, 2006; Leiponen & Helfat, 2010; Kohler et al., 2012; Garriga et al., 2013; Klingebiel & Rammer, 2014). The innovation surveys for the 2006-2008 and 2008-2010 datasets showing the measures in detail are given in Appendix 3-1.

3.5.1 Dependent Variables

Performance in product innovation is conceptualised as the extent to which a firm generates commercially successful new products, as evidenced through the revenue from new product sales in 2010. It provides direct information on the success of commercialising the firm's inventions and can thus be regarded as a powerful complement to traditional innovation measures of patenting activity. Most patents are not commercialised and they are widely acknowledged to be a partial indicator of the innovation process only, since many innovations are only partly covered by patent protection or not patented at all (Cohen et al., 2000; Laursen & Salter, 2006; Carlina & Kerr, 2014). To account for potential differences in the novelty of the new products generated, two variables are created: Percentage of firm sales originating from *new to the market* products (referring to radical innovation) and sales from *new to the firm* products (pertaining to incremental innovation). A third variable captures

all sales from new products combining new to the market and new to the firm products. In detail, the first variable is the percentage of total firm sales revenues in 2010 that were derived from the sale of products new to the market during 2008-2010 (radical innovation). The second variable is the percentage of total firm sales revenues in 2010 resulting from the sale of products new to the firm during 2008-2010 (incremental innovation). The third variable is the total percentage of firm sales revenues in 2010 emanating from the sale of products new to the market and new to the firm during 2008-2010 (overall innovation). All three measures contain ratio values rather than raw values for new product sales, for because the data does not include sales values of firms, it is not possible to measure innovation performance with raw values. On average, 11 percent of the sample firms' sales are attributed to radical products, and 10 percent to incremental ones. The distribution of these variables is in line with prior CIS work (e.g. Grimpe & Kaiser, 2010; Leiponen, 2012; Garriga et al., 2013; Klingebiel & Rammer, 2014).

3.5.2 Independent Variables

The key independent variables in this study represent the breadth of external knowledge sources and the depth of these sources that firms utilised in their innovation activities. Other researchers, such as Laursen and Salter (2006), Leiponen and Helfat (2010), Garriga et al. (2013), Foss et al. (2013) and Salge et al. (2013), have adopted a very similar approach when investigating firms' search strategies using CIS data. The list of sources reflects a wide range within the innovation system, including suppliers, clients, and competitors as well as general institutions.

Search breadth

Search breadth refers to the number of external sources or search channels that firms rely upon in their innovative activities. The innovation survey asked respondents to identify the importance of nine sources of information used in innovation activities, as listed in Table 3-3. The survey asked each firm to use a Likert scale (four=not used, three=low, two=medium, and one=high) to evaluate the importance of each source of information to its innovation activities. Hence, search breadth is

constructed as a combination of the nine sources of knowledge or information for innovation and as a starting point, each is coded as a binary variable, with 0 being no use (four=not used) and 1 being use of the given knowledge source, which could be either three=low, two=medium or one=high. Subsequently, the outcomes for the nine sources are simply added up so that each firms gets a 0 when no knowledge sources are used, while the firm gets the value of 9, when all knowledge sources are used i.e. this variable has a maximum value of 9. The set of items appears to have a high degree of internal consistency (Cronbach's alpha coefficient = 0.84). As shown in Table 3-3, the most commonly used knowledge sources were suppliers of equipment, materials, or software, followed by clients or customers, and conferences, trade fairs, exhibitions and, scientific journals and trade/technical publications, respectively. As might be expected (see von Hippel, 1988), Turkish firms' innovation activities are strongly determined by relations between themselves and their suppliers and customers. In contrast, the least used knowledge sources were public research institutes and universities.

Table 3-3 Mean Score of Search Breadth Values for Knowledge Sources (*N* = 659)

Type	Knowledge Sources	Mean score in sample[a]
Market	Suppliers of equipment, materials, or software	2.2
	Clients or customers	2.3
	Competitors or other enterprises in your sector	2.7
	Consultants, commercial labs or private R&D institutes	2.9
Institutional	Universities or other higher education institutes	3.2
	Government or public research institutes	3.4
Other	Conferences, trade fairs, exhibitions	2.4
	Scientific journals and trade/technical publications	2.5
	Professional and industry associations	3.0

Note: [a] Rounded to the nearest tenth.

Search depth

Search depth reflects the extent to which firms draw deeply from the different external sources or search channels. It is constructed using the same nine sources of knowledge as those used in constructing search breadth. In this case, each source is coded with 1 when the firm in question reports that it uses the source to a high degree

(one) and 0 in the case of no (four), low (three), or medium (two) use of the given source. As in the case of search breadth, the results regarding the nine sources are subsequently added up so that each firm gets a score of 0 when no knowledge sources are used to a high degree, while a value of 9 is attributed when such sources are used to a high degree (Cronbach's alpha coefficient = 0.75). Even though it is assumed that search breadth covers search depth, these two constructs measure two different things. Search breadth measures the diversity whereas search depth measures the intensity. In order to measure intensity, this variable is constructed by focusing only on knowledge sources which have high importance for firms. Descriptive statistics also show that firms following search breadth and depth strategies have different variance in their choices. This will be further explained in the next chapter. In addition, the way that search depth variable is constructed was the only way to measure it and best for the dataset. However, since the data was limited and it was not possible to construct search depth variable differently, a more fine-grained measure for this variable would be useful and future studies should consider that. As shown in Table 3-4, the most deeply used knowledge sources were the customers and suppliers of equipment and materials, followed by knowledge from conferences, trade fairs and scientific journals and technical publications, respectively.

Table 3-4 Mean Score of Search Depth Values for Knowledge Sources (*N* = 659)

Type	Knowledge Sources	Mean score in sample[a]
Market	Suppliers of equipment, materials, or software	0.29
	Clients or customers	0.33
	Competitors or other enterprises in your sector	0.16
	Consultants, commercial labs or private R&D institutes	0.14
Institutional	Universities or other higher education institutes	0.09
	Government or public research institutes	0.06
Other	Conferences, trade fairs, exhibitions	0.24
	Scientific journals and trade/technical publications	0.18
	Professional and industry associations	0.09

Note: [a] Rounded to the nearest tenth.

3.5.3 Moderating Variables

Rosenkopf and Almeida (2003) suggest that two mechanisms - the mobility of inventors and the formation of strategic alliances - can enable firms to overcome geographic constraints. Accordingly, firms can extend their geographical boundaries by partnering with external actors outside the nation (Phene et al., 2006). Measuring firms' access to foreign knowledge has been undertaken by focusing on international collaboration. A similar approach was recently adopted by Patel et al. (2014), who measured foreign network collaboration by focusing international partners involved in the development of innovation, such as suppliers, customers and universities. Following prior studies, firstly, developed economy partners are distinguished from emerging economy partners as described below (Schmiele, 2012; Jacob, Belderbos & Gilsing, 2013). Secondly, international market-based partners are distinguished from international science-based partners (Baum et al., 2000; Faems et al., 2005; Du et al., 2014).

Developed economy collaboration

Innovation collaboration was defined as an "active participation with other organizations on innovation activities". Respondents to the questionnaire were asked "Did your enterprise co-operate on any of your innovation activities with other enterprises or institutions in the period 2006-2008?" Firms responding positively to this were then asked to identify the types of external partners with which they collaborated. Seven potential partner types were identified in the questionnaire: other enterprises within your enterprise group, suppliers, customers, competitors, consultants, universities and public research institutes. For each type of cooperation, firms are asked to indicate whether their partner is located within the national borders or is international. Respondents would indicate which type of partner they had in different locations (Turkey, EU, US, CH/IND, other). In order to capture collaboration in developed economies, firms' binary responses regarding each of these seven partners within the EU and US are used. In this way, 14 binary variables become available, each representing a combination of one specific type of partner with one specific geographical location, such as the EU and US (i.e., seven types of

collaboration in each two region). Hence, this variable ranges from 0 to 14, whereby a firm gets a value of 0 if it did not collaborate with any type of partner within EU or US nations and the value 14 if it collaborated with all types. This variable was then normalised by dividing it by 14 to receive a value between 0 and 1.

Emerging economy collaboration

As in the case of developed economy collaboration, in order to capture collaboration in emerging economies, firms' binary responses to each of these seven partners within China/India nations are used. In this way, 7 binary variables become available, each representing a combination of one specific type of partner with one specific geographical location such as China/India (i.e., seven types of collaboration in one region). Hence, this variable ranges from 0 to 7 showing that a firm gets a value of 0 if it did not collaborate with any type of partner within China/India nations and the value of 7 if it collaborated with all types of partners. This variable was then normalised by dividing it by 7 to receive a value between 0 and 1.

International market-based partners

Following previous studies, collaborations with suppliers and customers are referred to as market-based partners (e.g. Faems et al., 2005; Du et al., 2014; Vanhaverbeke et al., 2014; Gesing et al., 2015). A variable market-based partners was created for the present study by adding together all the binary variables representing collaborations with suppliers and customers from international contexts. Firms' binary responses to each of these two partners within the EU, US, CH/IND and other were used to construct this variable in international economies. This ranges from 0 to 8 (i.e., two types of collaboration in each four region), whereby a firm gets a value of 0 if it did not collaborate with market-based partners from international economies and 8 if it did so.

International science-based partners

Collaborations with universities and research institutes are considered as science-based partners, which focus on the creation of insights relating to new technologies

(e.g. Baum et al., 2000; Faems et al., 2005; Du et al., 2014; Gesing et al., 2015). Adding together all the binary variables that include collaborations with universities and research institutes within the EU, US, CH/IND and other regions result in the science-based collaboration partners from international economies variable. It ranges from 0 to 8 (i.e., two types of collaboration in each four region), whereby a firm gets a value of 0 if it did not collaborate with science-based partners from international economies and the value of 8 if the converse was the case.

3.5.4 Control Variables

The model contains controls that are frequently included in those explaining innovation performance (e.g. Grimpe & Kaiser, 2010; Leiponen & Helfat, 2010; Leiponen & Helfat, 2011; Garriga et al., 2013; Klingebiel & Rammer, 2014). First, I control for *firm size*, where the number of employees is used to account for this variable and the natural logarithmic transformation of the raw data for this is used. Although some studies have reported a positive effect of firm size on innovation performance, others have found a negative effect. However, it is mostly agreed that larger firms have access to greater financial and human resources and therefore, may generate greater new product sales. For, since these firms have a larger base of customers, they are likely to generate greater sales from a single innovation. Second, I control for *business group subsidiary*, with a dummy variable (yes/no) being used to measure whether the firm is a subsidiary of a larger company (coded as 1) and the one that is not (coded as 0). Economies of scale and scope along with cost spreading are some of the reasons thought to facilitate the innovative efforts of big organisations (Cohen & Levinthal, 1989). In addition to this, firms in a business group may have access to the internal sources of other firms in the group and knowledge spillovers from the research of such firms, which can influence innovation output. Third, the model is controlled for *process innovation*, for innovation can also occur within processes as well as from products and services. Consequently, process innovations can lead to more innovative output, as they are a complementary part of product innovations. In order to control for this type of innovation, the dummy variable (yes/no) is used to code firms that undertake process

innovation (coded as 1), and the ones that do not (coded as 0). Fourth, a *lagged dependent variable* is added into the model as a control so as to acknowledge the possibility that past innovation success could lead firms to undertaking greater search. A lagged dependent variable reflects factors associated with innovation success in the preceding period. Thus, this variable helps to control for unobservable firm-level factors such as innovation capability and pre-existing search activities (Leiponen & Helfat, 2011). This approach reduces the problems of simultaneity and unobserved heterogeneity that have plagued most extant research (Leiponen, 2012). In this case, the lagged dependent variable reflects the data for 2006-2008 for the binary indicator of any product or service innovations. Fifth, I control for *internal continuous R&D*, where a dummy variable (yes/no) is used to control for the extent to which firms carried out research and development on a continuous basis (coded as 1), and the ones that do not (coded as 0). Firms that carry out R&D activities permanently benefit from their prior related knowledge base and hence, they are better at leveraging external sources. This variable is also an indicator of absorptive capacity since it is generally developed through continuous funding of and engaging in R&D over time (Cohen & Levinthal, 1990). The extent to which a firm can screen, value, and utilise externally sourced technologies depends on the level of its absorptive capacity. Finally, 19 *industry dummy* controls have been included for each two-digit level NACE industry in the sample (the excluded industry is other business oriented services). The data make it difficult to utilise a more fine-grained classification of industry affiliation as this would result in some industries having just one or a few firms. This is to control for potential industry-level variations in firms' capacity to generate innovation performance. Because industry-level factors, such as rapid technological change and opportunities and appropriability of the returns to innovation might influence the incentives to innovation, firms in some industries (i.e., chemicals) can be more innovative than others.

3.6 Analysis

The strategy set out here describes the series of analysis employed in order to obtain valid results and conclusions for this study. First, the reliability of the scale

(Cronbach's alpha) is estimated for search breadth and search depth. Next, the descriptive statistics and Pearson's correlations are provided to verify the preliminary relationships among the study variables, as explained in the relevant theory. Following this, a number of regression models are run in order to test hypothesised relationships. Subsequently, in order to assess the threat of multicollinearity, the variance inflation factor (VIF) is calculated for each coefficient in each model. All regressions are estimated using the STATA 12 statistical package, which is powerful statistical software with a wide range of features and applications. In contrast with other statistical software packages, STATA offers a command based interface that allows for the execution of multiple commands through STATA-specific command files (DO files). This is a powerful feature when dealing with a wide range of models.

3.6.1 Estimation Technique

This research is concerned with dependent variables including three categories: new to the market (radical), new to the firm (incremental) and overall innovation performance. The dependent variables in the regression model are censored at zero. The variables are the percentages of innovative sales and therefore, by definition ranges between 0 and 100. Given the nature of dependent variables, estimation by the linear and the basic ordinary least square (OLS) techniques is insufficient (Ai & Norton, 2003; Hoetker, 2007) and instead, a nonlinear regression model is employed. Accordingly, Tobit maximum likelihood estimation is appropriate for application (Greene, 2000: 905-926). This research follows established designs for innovation performance models based on CIS (Laursen & Salter, 2006; Grimpe & Kaiser, 2010; Leiponen & Helfat, 2010; Klingebiel & Rammer, 2014). In contrast with the more straight forward application of linear regression models and the OLS estimator, limited dependent variable models, such as Tobit, are inherently more complex to apply and have been largely misinterpreted by strategy scholars (Hoetker, 2007). I discuss in detail this point in the next section (see subsection 3.6.2).

Additionally, for sensitivity analysis, the binary indicators are used for radical, incremental and overall innovation performance. Regarding which, firms introducing radical innovation are coded '1' and otherwise '0', with the same being employed for incremental and overall innovation performance. The appropriate statistical technique when using a binary dependent variable is Probit regression, which will lead to consistent and unbiased coefficient estimates (Greene, 2004).

In the regression models, search breadth and search depth are likely to be endogenous factors, affected by collaborations with partners from developed economies and those from emerging economies. Establishing collaborations with different nations may increase firms' ability to search the external environment (Belderbos, Carree, & Lokshin, 2004). In order to estimate the effects of search breadth and depth not explained by collaborations as well as the full impact of collaborations, it is necessary to "partial out" the effects of these variables and use the residuals of search breadth and depth for further analyses (e.g. Wooldridge, 2002; Slotegraaf, Moorman, and Inman, 2003; Belderbos et al., 2004; Belderbos et al., 2006; Luo et al., 2007; Sheng et al., 2011; Zhou & Li, 2012). In this way, it estimates the full impact of collaboration, by separating search breadth and search depth due to purposeful informational exchanges that arise in collaboration arrangements from search breadth and depth that are not due to such collaboration activities (Slotegraaf et al., 2003; Belderbos et al., 2006). This method has been employed in the context of management and marketing literature in order to remove a potential source of endogeneity and to account for collinearity problems (e.g. Wooldridge, 2002; Slotegraaf, Moorman, and Inman, 2003; Zaheer & Bell, 2005; Poppo et al., 2008; Kaul, 2012). In addition, for models including all exploratory and interactions together, VIF statistics exceeds the critical value of 10. For models including residuals of search breadth and search depth, the VIF statistics for the main exploratory variables and interaction terms are well below the usual 10 benchmark. This also confirms that it is important to use residuals of search breadth and search depth as indicators of these variables.

In Stage 1, as specified in Equation 1, search breadth and search depth are regressed against collaborations with developed economies and those with emerging economies, respectively, to obtain residuals free of the influence of these variables. This first stage is important in order to partial out the effect of collaborations on search breadth and depth so that the investigation can be focused on the effects of these factors not explained by collaborations.

Stage 1:

$SB_i = \alpha_1 + \beta_{11}\,(\text{Developed})_i + \beta_{12}\,(\text{Emerging})_i + \varepsilon i$

to obtain $SB_{residual} = SB - SB_{predicted}$ (Equation 1)

$SD_i = \alpha_1 + \beta_{11}\,(\text{Developed})_i + \beta_{12}\,(\text{Emerging})_i + \varepsilon i$

to obtain $SD_{residual} = SD - SD_{predicted}$ (Equation 2)

In Stage 2, the residuals from Equation 1 and 2 have been used as indicators of search breadth and depth, because they represent the level of these phenomena not accounted for by collaborations with partners from developed economies or other emerging economies. In Stage 2, as specified in Equation 3, the innovation performance is regressed against collaborations with partners from developed economies, those from emerging economies, the residual of search breadth, the interaction term between search breadth and collaborations from emerging economies, the residual of search depth, the interaction term between search depth and collaborations from developed economies and the controls. To deal with possible multicollinearity between the interaction terms and their components, each scale that constitutes an interaction term is mean-centred and the interaction terms are created by multiplying the relevant mean-centred scales (Aiken & West, 1991).

Stage 2 (Model 5 in Table 4-6):

$IP_{i} = \alpha_2 + \beta_{21}\,SB_{residual\ i} + \beta_{22}\,SD_{residual\ i} + \beta_{23}\,(\text{Developed})_i + \beta_{24}\,(\text{Emerging})_i + \beta_{25}\,SB_{residual\ i}\,X\,(\text{Emerging})_i + \beta_{26}\,SD_{residual\ i}\,X\,(\text{Developed})_i + \beta_{con}\,\text{Controls}_i + \varepsilon i$ (Equation 3)

In the regression models examining H5a, H5b, H5c and H6a, H6b, H6c search breadth and search depth are likely to be endogenous factors, affected by international market-based and science-based collaboration partners. The same method as explained above is applied to estimate the effects of search breadth and depth not explained by collaborations. In Stage 1, search breadth is regressed against international market-based and science-based partners, whilst, search depth is regressed against international market-based and science-based collaboration partners.

Stage 1:

$SB_i = \alpha_1 + \beta_{11}\,(\text{Market-based})_i + \beta_{12}\,(\text{Science-based})_i + \varepsilon i$

to obtain $SB_{residual} = SB - SB_{predicted}$ (Equation 1)

$SD_i = \alpha_1 + \beta_{11}\,(\text{Market-based})_i + \beta_{12}\,(\text{Science-based})_i + \varepsilon i$

to obtain $SD_{residual} = SD - SD_{predicted}$ (Equation 2)

In Stage 2, the residuals from Equation 1 and 2 are used as indicators of search breadth and depth, because they represent the level of search breadth and depth not accounted for by collaborations with international market-based and science-based partners. In Stage 2, as specified in Equation 3 and 4, the innovation performance (radical and incremental innovations) is regressed against international market-based as well as science-based partners, the residual of search breadth, the interaction terms between search breadth and partner types, the residual of search depth, the interaction terms between search depth and partner types and the controls.

Stage 2 (Model 5 in Table 4-7):

$RadI_i = \alpha_2 + \beta_{21}\,SB_{residual\ i} + \beta_{22}\,SD_{residual\ i} + \beta_{23}\,(\text{Market-based})_i + \beta_{24}\,(\text{Science-based})_i + \beta_{25}\,SB_{residual\ i}\,X(\text{Science-based})_i + \beta_{26}\,SB_{residual\ i}\,X(\text{Market-based})_i + \beta_{27}\,SD_{residual\ i}\,X(\text{Science-based})_i + \beta_{28}\,SD_{residual\ i}\,X(\text{Market-based})_i + \beta_{con}\,Controls_i + \varepsilon i$ (Equation 3)

$IncI_i = \alpha_2 + \beta_{21}\,SB_{residual\ i} + \beta_{22}\,SD_{residual\ i} + \beta_{23}\,(\text{Market-based})_i + \beta_{24}\,(\text{Science-based})_i + \beta_{25}\,SB_{residual\ i}\,X(\text{Science-based})_i + \beta_{26}\,SB_{residual\ i}\,X(\text{Market-based})_i + \beta_{27}\,SD_{residual\ i}\,X(\text{Science-based})_i + \beta_{28}\,SD_{residual\ i}\,X(\text{Market-based})_i + \beta_{con}\,Controls_i + \varepsilon i$ (Equation 4)

3.6.2 The Use of Limited Dependent Variable Models

There is considerable variation in the accuracy regarding the results from limited dependent variable (LDV) models when analysed and interpreted (Wiersema & Bowen, 2009). This variation arises because supplementary analysis is not undertaken to interpret the results correctly from an LDV model. This section explains the necessity of applying supplementary analysis for LDV models, which is also discussed in detail in the next chapter when I present the empirical results.

Since the limited dependent variable model (Tobit) is used, the results from this model do not entail the same straightforward interpretation as do those for OLS regression for the following reasons. First, an explanatory variable's marginal effect - the effect of a unit change in an explanatory variable on the dependent variable - does not equal the variable's model coefficient. Second, the value of this marginal effect varies with the value of all model variables. Consequently, it is potentially misleading to analyse and interpret the results from LDV models using the methods commonly used for OLS type models. For, testing a hypothesis about the nature of the relationship between an explanatory variable and the dependent variable in an LDV model requires supplementary analysis that examines the value and significance of the explanatory variable's marginal effect. A directional hypothesis in LDV models is tested by examining the sign (positive or negative) and statistical significance of the values of an explanatory variable's marginal effect over all values of the model variables. However, generally, the sign of a variable's marginal effect is the same as that of its model coefficient (Hoetker, 2007; Zelner, 2009).

In the strategy literature, it is also common to postulate that one or more variables moderate the relationship between an explanatory variable and the dependent variable. The coefficient of an interaction term in a nonlinear model does not provide direct information about the statistical significance or magnitude of the moderating relationship of interest (Holburn & Zelner, 2010). In particular, the equation for the moderating effect will be nonlinear and its value will depend on the values taken by all the model variables. Hence, a moderator hypothesis in an LDV model is tested by

examining the sign (positive or negative) and statistical significance of the values of the moderator variable's marginal effect on the relationship between the explanatory variable and the dependent variable over all sample values of the model variables (Wiersema & Bowen, 2009). For instance, it could be that the interaction effect may change signs over some set of the values of the sample. This means that there are many values of the true interaction effect, with each having its own standard error. Bowen (2012) introduces total and secondary moderating effects. The former refers to the values of the moderator variable in the model that includes the interaction variable. The latter refers to the value of the moderating effect that exists in the model that excludes the interaction variable. In other words, the total moderating effect equals the secondary moderating effect if the moderator variable is not a model variable. Bowen (2010, 2012) suggests that the moderating effect of interest when including an interaction variable in a model is one that indicates the contribution to an existing moderating effect, and not this type of effect that is in the model that contains the interaction variable. Hence, it is the secondary moderating effect that is the correct focus of an analysis that seeks to formulate and test a moderating hypothesis by including an interaction variable in an LDV model.

To address these issues, this study follows recent methodological advances to examine true interaction effects (Wiersema & Bowen, 2009; Bowen, 2010, 2012). The analysis suggested by Bowen (2010, 2012) is performed to examine how the secondary (i.e., true) moderating effect contributes to the total moderating effect. In doing this, a moderator hypothesis can be tested by examining the sign (positive or negative) and statistical significance of the values of the moderator variable's marginal effect on the relationship between firms' external search strategies and innovation performance over all sample values of the model variables (Wiersema & Bowen, 2009). First, the values of the true interaction effects and their z-statistic values at each observation are calculated. It is expected that the value and sign of the true interaction effect over its range of variation show no change (Wiersema & Bowen, 2009). This technique has been used in recent studies in the strategy literature (e.g. Gruber et al., 2013; Kim et al., 2013; Shinkle & McCann, 2013). The data analysis and results from this analytical strategy are provided in Chapter 4 that follows.

Chapter 4

Results

The main objective of this research is to investigate to what extent firms' search strategies are influenced by different contextual settings to produce innovative products. First, as a baseline model, the effects of breadth and depth of search on innovation performance have been investigated from the perspective of emerging economy firms. Second, I have put forward a conceptual framework that caters for the moderating effects of the context of collaboration - collaboration with partners from developed economies and collaboration with partners from other emerging economies - on the link between external search strategies and innovation performance. Third, I suggest that international partner types - market-based and science-based partners - moderate the relationship between external search strategies and radical and incremental innovation performance. This chapter provides descriptive statistics and the empirical results of the regression analyses regarding these three research interests.

4.1 Descriptive Results and Statistics

Using Turkish innovation surveys, this research explores the knowledge sources and collaboration partners for innovation in Turkey. Table 4-1 demonstrates the mean levels of search breadth and depth as well as those of collaborations with partners from developed and emerging economies across industrial sectors. Overall, firms cite six external sources of knowledge for innovation. The medical, precision and optical instruments industries exhibit the highest level of external search breadth followed by manufacturers of electrical equipment and electronics, thus indicating that firms in industries with medium to high levels of technology activity search widely. In contrast, firms in mining and quarrying and in service industries, such as wholesale trade have the lowest levels of external search breadth. For external search depth, on

average, firms draw deeply from only one source. Search depth is greatest in the manufacturing of furniture, jewellery, sports equipment and toys industries, and followed by the chemical and petroleum industries. Firms in business-oriented services, such as architecture have little external search depth. Both the level of external search breadth and depth are highest in industries with high levels of collaboration with partners from developed economies and collaboration with market-based partners. Manufacturers of medical, precision and optical instruments, and chemicals/petroleum, as well as those of motor vehicles have the highest levels of collaboration with partners from developed economies. In contrast, food/tobacco, mining and business-oriented services have the lowest levels of developed economy collaboration. Regarding collaboration with partners from emerging economies, medical, precision, and optical instruments firms have the highest level, whereas food/tobacco, paper/publishing, metal, electric/gas supply, and business-oriented services do not show any collaboration activities with emerging economy partners.

Table 4-1 Search Breadth, Search Depth, Developed Economy and Emerging Economy Collaborations by Industry

NACE code	Industry	Breadth Mean	Depth Mean	Developed Economy	Emerging Economy
10-14	Mining and quarrying	4.93	1.64	0.29	0.07
15-16	Food and tobacco	6.00	1.56	0.22	0
17-19	Textiles and leather	5.69	1.64	0.59	0.05
20-22	Wood/paper/publishing	6.57	1.67	0.48	0
24	Chemicals/petroleum	6.50	1.88	1.06	0.09
25	Plastics/rubber	6.08	1.04	0.73	0.08
26	Glass/ceramics	5.70	1.73	0.59	0.02
27-28	Metal	5.78	1.76	0.40	0
29	Mnf. of machinery and equipment	6.39	1.18	0.55	0.09
31-32	Mnf. of electrical equipment and electron.	7.07	1.66	0.45	0.10
33	Medical, precision and optical instruments	7.75	1.5	2.25	1.00
34-35	Manufacture of motor vehicles	6.17	1.78	1.04	0.09
36	Mnf. of furniture, jewellery, sports and toys	6.70	2.00	0.80	0.20
40	Electricity, gas and water supply	6.45	1.36	0.64	0
51	Wholesale trade	4.93	1.07	0.46	0.11
60-63, 64	Transportation and communication	5.37	1.49	0.61	0.10
65-67	Financial intermediation	5.75	1.75	0.38	0.02
72	Information-communication tech. services	5.58	1.80	0.44	0.02
74.2, 74.3	Other business-oriented services	6.10	0.80	0.10	0
	Average	6.08	1.54	0.64	0.11

Source: NACE Rev.1.1 (Statistical Classification of Economic Activities in the European Community, 2002). Mnf. indicates manufacture.

Table 4-2 presents the percentages of firms for radical and incremental innovations across industries. The most innovative (radical) industry is information-communication technology services followed by food/tobacco and the textiles/leather industries. Additionally, the most innovative (incremental) industry is information-communication technology services, followed by financial intermediation services and the food/tobacco industries. Thus, firms in low technology and service industries are more innovative relative to medium to high technology industries. In contrast, it is the reverse in terms of firms' openness to external sources of knowledge. As it is seen in Table 4-1, firms in industries with medium to high technologies have a higher level of search broadness and deepness. As Laursen and Salter (2006) argue, there is no direct relationship between innovativeness and openness at the industry level. Their data also suggest that some industries, such as basic metals, exhibit low rates

of innovation as well as broad and deep search patterns. This difference has been linked to the complexity of the technological knowledge bases in different industries. It could be that industries with simple technologies, but with high levels of innovation, have narrower search patterns than those with complex technologies, but low rates of innovation (Laursen & Salter, 2006). Additionally, Table 4-2 shows the average level of R&D intensity across industries. As it is seen, firms that are more innovative have a higher level of R&D expenditure (internal and external R&D activities). For instance, information-communication technology services industries exhibit the greatest percentage of radical and incremental innovations along with the largest R&D intensity among all industries. Moreover, the R&D intensities of some sectors are negligibly small relative to the R&D values of firms in other CIS studies (Ozcelik & Taymaz, 2004; Laursen & Salter, 2006; Leiponen, 2012). In fact, it is important to note that the share of R&D in GDP for business enterprises was 0.34% in Turkey compared to 1.62% for OECD countries in 2009 (OECD, 2011). I compared this outcome with Laursen and Salter's (2006) paper since they also demonstrated the average R&D intensity across industries. The comparison showed that Turkish firms have 0.033 average R&D intensity whereas UK firms have 0.59 average R&D intensity. These figures show that emerging economy firms are likely to lag in terms of absorptive capacity compared to those in developed economies.

Table 4-2 Percentages of Innovation and the Level of R&D Intensity by Industry

NACE code	Industry	Percentage of firms for radical innovations	Percentage of firms for incremental innovations	Average R&D Intensity
10-14	Mining and quarrying	1.21	1.21	0.003
15-16	Food and tobacco	3.95	3.19	0.001
17-19	Textiles and leather	3.19	2.43	0.003
20-22	Wood/paper/publishing	0.76	0.91	0.007
24	Chemicals/petroleum	1.97	1.97	0.025
25	Plastics/rubber	1.67	1.52	0.003
26	Glass/ceramics	2.88	2.73	0.004
27-28	Metal	1.67	1.97	0.010
29	Mnf. of machinery and equipment	2.88	3.04	0.026
31-32	Mnf. of electrical equipment and electronics	2.43	2.58	0.040
33	Medical, precision and optical instruments	0.46	0.46	0.003
34-35	Manufacture of motor vehicles	3.03	2.12	0.016
36	Mnf. of furniture, jewellery, sports and toys	1.67	1.97	0.006
40	Electricity, gas and water supply	0.46	0.30	0.002
51	Wholesale trade	1.97	1.06	0.008
60-63, 64	Transportation and communication	2.12	1.97	0.206
65-67	Financial intermediation	2.88	3.64	0.039
72	Information-communication tech. services	5.16	4.70	0.214
74.2, 74.3	Other business-oriented services	0.15	0.30	0.012
	Average	2.13	2.00	0.033

Source: NACE Rev.1.1 (Statistical Classification of Economic Activities in the European Community, 2002). Mnf. indicates manufacture.

Means and Standard Deviations

Table 4-3 displays the basic descriptive statistics for the variables used in this study, including the means, standard deviations and minimum and maximum values (except industry dummies). As it can be seen in Table 4-3, on average, 45% of the sampled firms are a part of a business group, whilst the rest are independent firms. The statistics also show that almost 40% of the sampled-innovation active firms carry out continuous R&D activities and thus, more than half of such firms have not engaged in regular R&D activities within their firms. In terms of innovativeness, on average, 11.3% of firms' sales can be attributed to products or services new to the market, while 10.4% of sales pertain to innovations new to the firm. A total of 74% of the firms innovated in the previous 3-year period, 2006-2008, whereas this dropped to

60% in the 2008-2010 period and 77% of them have made changes in their innovation processes.

In terms of search strategies, on average, firms use about 5.9 sources of knowledge for their innovative activities, but they use only about 1.6 sources deeply (with a high importance). Referring back to the difference between search breadth and search depth, the mean values of such variables also indicate that firms having broad search access to at least 6 different knowledge sources. In contrast, firms with a search depth strategy leverage only 1 or 2 knowledge sources with deep intensity. In addition, more detailed data investigation shows that for search breadth variable there are few observations having no access to any knowledge sources. On the contrary, for search depth variable, a third of the sample do not leverage any knowledge sources with a deep focus. In relation to firms' collaboration activities, they collaborate with 1.28 national partners and with 0.75 international partners, on average. This shows that international collaborations are important for emerging economy firms, almost as much as with national partners. These figures also indicate the importance of foreign knowledge for emerging economy firms. Regarding firms' collaboration activities in different geographic contexts, on average, firms have 0.56 collaborations with partners from developed economies as compared to 0.06 for those from emerging economies. This shows that firms are more likely to collaborate with developed economy partners than emerging economy ones. In relation to partner types, on average, firms have 0.38 international market-based partners, whereas they have 0.04 international science-based collaboration partners. This is in line with previous research that elicited that firms are less likely to collaborate with universities and research institutes compared to customers and suppliers (Cohen et al., 2002).

Table 4-3 Descriptive Statistics (*N* = 659)

Variable	Mean	Std. Dev.	Minimum	Maximum
Radical innovation (2010)	0.113	0.226	0	1
Incremental innovation (2010)	0.104	0.210	0	1
Overall innovation performance (2010)	0.217	0.327	0	1
Business group	0.448	0.498	0	1
Continuous R&D	0.398	0.490	0	1
Process innovation	0.768	0.423	0	1
Product innovation (lagged, 2008)	0.739	0.440	0	1
Firm size (logs)	5.936	1.452	2.30	10.42
Search breadth	5.882	2.737	0	9
Search depth	1.592	1.931	0	9
National collaborations	1.280	2.139	0	7
International collaborations	0.751	1.911	0	16
Developed economy collaborations	0.563	1.383	0	9
Emerging economy collaborations	0.062	0.379	0	5
International market-based partners	0.382	0.993	0	7
International science-based partners	0.036	0.256	0	4

Correlations

Table 4-4 presents the Pearson correlation coefficients for the variables examined in the study and the correlation matrix does not indicate high collinearity among the main variables. Radical innovation performance is positively correlated with incremental innovation performance ($r = 0.116$, $p < 0.05$). On the other hand, the exploratory variables of the models are positively correlated among each other. For example, as expected, there is strong correlation between search breadth and search depth ($r = 0.451$, $p < 0.05$). However, this correlation is to be expected given the causal mechanism between these variables. Developed economy collaborations are positively associated with search breadth and search depth, sequentially, $r = 0.286$, $p < 0.05$; $r = 0.332$, $p < 0.05$. Emerging economy collaborations are positively related to search breadth ($r = 0.109$, $p < 0.05$), but not to search depth, providing some initial evidence in support of Hypothesis 3. In addition, international market-based and science-based partners are positively correlated with search breadth, sequentially, $r =$

0.271, $p < 0.05$; $r = 0.105$, $p < 0.05$ and with search depth, sequentially, $r = 0.295$, $p < 0.05$; $r = 0.156$, $p < 0.05$.

Surprisingly, search breadth and search depth are not significantly correlated with radical and incremental innovation performance. Moreover, only search depth is significantly correlated with overall innovation performance ($r = 0.078$, $p < 0.05$). Additionally, only developed economy collaboration is significantly correlated with radical innovation performance ($r = 0.089$, $p < 0.05$). Emerging economy collaborations, international market-based and science-based partners are not significantly correlated with any type of innovation performance. Regarding the control variables, business group and firm size are not significantly correlated with innovation performance. As was expected, previous product innovation is significantly correlated with all three innovation performance variables, namely: radical, incremental and overall innovation performance ($r = 0.124$, $p < 0.05$; $r = 0.100$, $p < 0.05$; $r = 0.151$, $p < 0.05$). Firms that are innovative in previous years are more likely to follow innovative strategies. The correlations between process innovation and innovation performance show that firms that are improving their processes are more likely to produce incremental innovation products ($r = 0.088$, $p < 0.05$), but not likely to produce radical ones. In addition, continuous internal R&D activities are closely correlated with measures of innovation output, radical, incremental and overall innovation, sequentially, $r = 0.146$, $p < 0.05$; $r = 0.138$, $p < 0.05$; $r = 0.190$, $p < 0.05$. This indicates that firms investing in internal R&D continuously are likely to be innovative, which is consistent with the existing arguments in the literature (Cohen & Levinthal, 1989).

Table 4-4 Pearson Correlation Matrix

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Radical innovation	1.000												
2. Incremental innovation	0.116*	1.000											
3. Overall innovation performance	0.768*	0.724*	1.000										
4. Business group (d)	-0.069	0.037	-0.024	1.000									
5. Process innovation (d)	0.048	0.088*	0.090*	0.162*	1.000								
6. Product innovation (lagged) (d)	0.124*	0.100*	0.151*	0.104*	0.000	1.000							
7. Continuous R&D (d)	0.146*	0.138*	0.190*	0.129*	0.138*	0.278*	1.000						
8. Firm size	-0.003	-0.043	-0.030	0.246*	0.119*	0.124*	0.157*	1.000					
9. Search breadth	-0.000	0.043	0.028	0.081*	0.178*	0.146*	0.274*	0.196*	1.000				
10. Search depth	0.059	0.056	0.078*	0.086*	0.170*	0.094*	0.194*	0.093*	0.451*	1.000			
11. Developed economy collaborations	0.089*	0.001	0.063	0.150*	0.133*	0.167*	0.194*	0.195*	0.286*	0.332*	1.000		
12. Emerging economy collaborations	0.028	0.023	0.034	0.061	0.014	0.061	0.112*	0.072	0.109*	0.065	0.394*	1.000	
13. International market-based partners	0.050	0.009	0.041	0.138*	0.132*	0.155*	0.214*	0.168*	0.271*	0.295*	0.895*	0.538*	1.000
14. International science-based partners	0.012	-0.032	-0.012	0.038	-0.006	0.084*	-0.042	0.056	0.105*	0.156*	0.388*	0.227*	0.297*

Note: $N = 659$. *Denotes significance at the 5% level. (d) indicates a dummy variable.

4.2 Search Breadth and Search Depth: Direct Effects

Table 4-5 shows the results of the Tobit regression analysis. It reports the estimated effects of search breadth and search depth on the three dependent variables (standard errors in parentheses). Model 1 presents the control variables, including firm size, being part of a business group, producing process innovation, internal continuous R&D activities and lagged product innovation, and serves as the baseline model. Model 2 covers the search breadth and search depth independent variables. Model 3 contains the search breadth variable and its squared term, whilst Model 4 includes the search depth variable and its squared term. Finally, Model 5 includes all the variables and squared terms across the three dependent variables. To assess the threat of multicollinearity, the variance inflation factor (VIF) is calculated for each coefficient in Model 5. The value of the VIFs ranges from 1.14 to 7.02 with a mean of 3.57, well below the 10.0 benchmark, which indicates no multicollinearity concern.

Generally speaking, the results for the control variables remain very stable across all the model specifications. As expected, Model 1 shows significant effects of firm size, process innovation, continuous R&D and lagged product innovation on innovation performance. Continuous R&D becomes more significant through incremental product sales to radical product sales. These changes across the dependent variables are theoretically plausible as they indicate the greater challenges of generating truly novel product innovations. Additionally, process innovation becomes more effective for incremental innovations. Firm size loses its significance for two dependent variables, incremental innovation and overall innovation performance. Being part of a business group does not show any significance for innovation performance with the exception of radical innovation. These observations are consistent with other studies (e.g. Grimpe & Kaiser, 2010; Leiponen & Helfat, 2010; Klingebiel & Rammer, 2014). The models' McFadden R^2 values, which range from 0.1054 to 0.1226, indicate a level of fit that is comparable to prior CIS work (Laursen & Salter, 2006; Klingebiel & Rammer, 2014).

Model 5 in Table 4-5 introduces search breadth and the squared effects of search breadth in order to test Hypothesis 1 (i.e. search breadth has a curvilinear impact [inverted U] on innovation performance for emerging economy firms). The results indicate that search breadth and its squared effect are not statistically significant for any of the dependent variables, thus showing that searching for a wide range of knowledge sources is not an important factor in explaining innovation performance for emerging economy firms and hence, Hypothesis 1 is rejected. Model 5 in Table 4-5 introduces search depth and the squared effects of search depth so as to test Hypothesis 2 (i.e. search depth has a curvilinear impact [inverted U] on innovation performance for emerging economy firms). The results show that search depth and its squared effects are not statistically significant for all innovation outputs and thus, Hypothesis 2 is not supported. That is, drawing intensively from key knowledge sources does not affect emerging economy firms' innovation performance. These unexpected findings contrast with those in the extant literature (Katila & Ahuja, 2002; Laursen & Salter, 2006) and hence, will be further discussed in the next chapter.

Table 4-5 Results of Tobit Regression Analysis Predicting the Effects of Search Breadth and Search Depth on Innovation Performance

	Overall Innovation Performance				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables					
Business group	-.0117	-.0134	-.0154	-.0209	-.0222
	(.043)	(.043)	(.043)	(.043)	(.043)
Process innovation	.1306**	.1271**	.1446***	.1359**	.1466***
	(.053)	(.053)	(.053)	(.054)	(.054)
Product innovation (lagged)	.2245***	.2242***	.2314***	2270***	.2326***
	(.057)	(.057)	(.057)	(.058)	(.058)
Continuous R&D	.1554***	.1554***	.1594***	1517***	.1570***
	(.044)	(.045)	(.045)	(.044)	(.045)
Firm size (logs)	.0092	.0102	.0086	.0082	.0084
	(.017)	(.017)	(.017)	(.017)	(.017)
Predictors					
Search breadth **(H1)**		-.0068	-.0529		-.0442
		(.009)	(.033)		(.034)
Search breadth squared			.0049		.0039
			(.003)		(.003)
Search depth **(H2)**		.0129		-.0303	-.0223
		(.011)		(.025)	(.026)
Search depth squared				.0062*	.0049
				(.003)	(.003)
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes
_cons	-.4125	-.3849	-.3209	-.4143	-.3328
N	659	659	659	659	659
No. of obs. uncensored	358	358	358	358	358
Pseudo R^2	0.1150	0.1163	0.1181	0.1181	0.1202
Log likelihood	-434.078	-433.440	-432.578	-433.879	-431.531

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01.

Table 4-5 (Continued) Results of Tobit Regression Analysis Predicting the Effects of Search Breadth and Search Depth on Innovation Performance

	Radical Innovation					Incremental Innovation				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables										
Business group	-.0592	-.0613	-.0609	-.0671*	-.0677*	.0289	.0284	.0267	.0222	.0214
	(.040)	(.040)	(.040)	(.040)	(.040)	(.039)	(.039)	(.039)	(.039)	(.039)
Process innovation	.0836*	.0835*	.0964*	.0886*	.0962*	.1296***	.1243**	.1354***	.1354***	.1411***
	(.049)	(.049)	(.049)	(.049)	(.049)	(.049)	(.049)	(.049)	(.050)	(.051)
Product innovation (lagged)	.1991***	.2012***	.2059***	2018***	.2067***	.1481***	.1458**	.1505***	.1508***	.1529***
	(.054)	(.054)	(.054)	(.054)	(.054)	(.055)	(.056)	(.056)	(.056)	(.056)
Continuous R&D	.1182***	.1222***	.1255***	1163***	.1234***	.0997**	.0939**	.0969**	.0965**	.0955**
	(.041)	(.041)	(.041)	(.041)	(.041)	(.039)	(.041)	(.041)	(.040)	(.041)
Firm size (logs)	.0330*	.0349**	.0340**	.0321*	.0338*	-.0035	-.0044	-.0058	-.0043	-.0062
	(.017)	(.017)	(.017)	(.017)	(.017)	(.015)	(.016)	(.015)	(.015)	(.015)
Predictors										
Search breadth **(H1)**		-.0102	-.0333		-.0246		.0023	-.0329		-.0260
		(.008)	(.031)		(.032)		(.009)	(.030)		(.030)
Search breadth squared			.0026		.0015			.0035		.0029
			(.002)		(.002)			(.002)		(.002)
Search depth **(H2)**		.0121		-.0277	-.0185		.0048		-.0246	-.0258
		(.009)		(.022)	(.023)		(.010)		(.023)	(.024)
Search depth squared				.0053*	.0044				.0048	.0043
				(.002)	(.002)				(.003)	(.003)
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-.7397**	-.6968**	-.6708**	-.7418**	-.6809**	-.4291*	-.4354*	-.3810	-.4303*	-.3949
N	659	659	659	659	659	659	659	659	659	659
No. of obs. uncensored	267	267	267	267	267	251	251	251	251	251
Pseudo R^2	0.1175	0.1199	0.1196	0.1208	0.1226	0.1054	0.1060	0.1081	0.1082	0.1100
Log likelihood	-341.951	-340.998	-341.130	-340.668	-339.976	-333.238	-333.013	-332.214	-332.192	-331.516

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01.

4.3 Moderation Effects: Context of Collaboration

As it is explained in methodology chapter, the search variables are adjusted in order to separate the effects of search strategies - search breadth and search depth - from the effects of collaboration with partners from developed and other emerging economies (collaboration can have a direct effect on innovation but will at the same time increase the likelihood of firms' search activities from the collaboration partner). According to the stage one results, collaborations with partners from developed and emerging economies influence search breadth and search depth directly. Specifically, search depth is positively influenced by collaborations with partners from developed economies (β = 7.09, $p < 0.01$) and negatively influenced by such activities with those from other emerging ones (β = -2.75, $p < 0.05$). Search breadth is positively influenced by collaborations with partners from developed economies (β = 7.98, $p < 0.01$) and is not significantly influenced by collaborations with partners from other emerging economies and its sign is negative as is the case for search depth (β = -0.19, p = n.s.). Additionally, when each variable is regressed against search breadth and depth separately, collaborations with partners from developed and emerging economies significantly affect both search strategies.

In stage two, the residuals from stage one have been used as the indicators of search breadth and search depth. Table 4-6 reports the results of the Tobit regression models predicting a firm's innovation performance when its search breadth and search depth strategy and collaborations with partners from developed and other emerging economies interact. The coefficient estimates are reported (standard errors in parentheses), with Model 1 including only the control variables, whilst Model 2 covers the residuals of search breadth and search depth as well as those of developed and emerging economy collaborations. Model 3 includes the interaction between the residual of search breadth and emerging economy collaborations, whereas Model 4 includes the interaction between the residual of search depth and developed economy collaborations. Model 5 includes all the variables and interaction terms. Finally, Model 6 includes squared terms of search breadth and search depth variables and all interaction terms in the same model for full examination (Table 4-6). To minimise

possible collinearity between the main and interaction effects, all pertinent independent variables are mean-centred to create the interaction terms (Aiken & West, 1991). The VIFs are calculated for each coefficient in Model 6 and their values range from 1.12 to 6.93 with a mean of 3.28, well below the 10.0 benchmark, which indicates multicollinearity is not an issue in the analysis.

Model 1 gives the results for the control variables, which are the same as with the previous model (see section 4.2) and hence, are not explained here. The models' McFadden R^2 values, which range from 0.1054 to 0.1344, indicate a level of fit that is comparable to prior CIS work (Laursen & Salter, 2006; Grimpe & Kaiser, 2010; Klingebiel & Rammer, 2014). Model 2 in Table 4-6 shows that the residuals of search breadth and search depth do not have a direct effect on innovation performance for all of the three dependent variables. These outcomes are in line with the previous tables (see section 4.2). Likewise, developed economy and emerging economy collaborations do not affect firms' innovation performance as the relevant parameter estimate is insignificant. This result suggests that emerging economy firms do not leverage their search strategies and collaborations with international partners on their own when they produce innovative products.

Hypothesis 3 proposed that there is a moderating effect for collaborations with partners from other emerging economies on the relationship between search breadth and innovation performance. The findings for Model 5 and 6 provide support for Hypothesis 3 (i.e. search breadth has a positive impact on innovation performance for emerging economy firms collaborating with other emerging economy partners). Regarding overall innovation performance, Model 6 in Table 4-6 reveals an interaction effect between search breadth and emerging economy collaborations (Breadth*Emerging Economy Collaborations) given that the coefficient is positive and significant (β = 0.7034, $p < 0.01$). As noted in the methodology chapter, the properties of nonlinear models do not allow for direct substantive interpretation of interaction effects based on the estimated coefficients. Therefore, to assess this effect, the marginal effects of the interaction term over changes in the values of the key independent variables are computed. Furthermore, the analysis suggested by

Bowen (2010, 2012) is computed to examine how the secondary (i.e. true) moderating effect contributes to the total moderating effect. The values for the true (secondary) interaction effect of emerging economy collaborations on the relationship between search breadth and innovation performance (for overall innovation) range from -0.10 to 0.83, with a mean of 0.39 ($p < 0.01$) and the corresponding z-statistics range from -0.72 to 4.06. Therefore, this indicates a positive and significant interaction effect of emerging economy collaborations (with no sign change for any values).

For radical innovation performance, Model 6 also reveals an interaction effect between search breadth and emerging economy collaborations (Breadth*Emerging Economy Collaborations) as the coefficient is positive and significant ($\beta = 0.5987$, $p < 0.01$). According to supplementary analysis, the values for the true interaction effect of emerging economy collaborations on the relationship between search breadth and innovation performance range from -0.09 to 0.62, with a mean value of 0.24 ($p < 0.05$). The corresponding z-statistics range from -0.69 to 3.43 and the values with a negative sign are not significant. For incremental innovation performance, the coefficient for the interaction term (Breadth*Emerging Economy Collaborations) in Model 6 is positive and significant ($\beta = 0.4306$, $p < 0.10$). The values for the true interaction range from -0.02 to 0.42, with a mean of 0.17 ($p < 0.10$). The corresponding z-statistics range from -0.46 to 2.39 and the values with a negative sign are not significant. Therefore, this indicates a positive and significant interaction effect of emerging economy collaborations (with no sign change over any values). Accordingly, this provides evidence that the relationship between search breadth and innovation performance is consistently positive when firms collaborate with partners from other emerging economies, thereby supporting Hypothesis 3.

Hypothesis 4 proposed that there is a moderating effect for collaborations with partners from developed economies on the relationship between search depth and innovation performance. Regarding which, Models 5 and 6 serve to test Hypothesis 4 and provide support for overall innovation, radical and incremental innovation performance (i.e. search depth has a positive impact on innovation performance for

emerging economy firms collaborating with developed economy partners). For overall innovation performance, the outcomes for Model 6 in Table 4-6 reveal that the interaction effect of search depth and collaborations with partners from developed economies (Depth*Developed Economy Collaborations) is positive and significant (β = 0.1784, $p < 0.01$). By following Bowen (2010), the true (secondary) interaction effect over all values of the model variables are computed. The values for the true interaction effect of developed economy collaborations on the relationship between search depth and innovation performance range from -0.002 to 0.18, with a mean value of 0.092 ($p < 0.01$) and the corresponding z-statistics range from -0.068 to 3.49.

In relation to radical innovation performance, Model 6 supports Hypothesis 4 with a positive and significant interaction effect of search depth and developed economy collaborations (Depth*Developed Economy Collaborations) (β = 0.1295, $p < 0.05$). The values for the true interaction effect of developed economy collaborations on the relationship between search depth and innovation performance range from 0.004 to 0.13, with a mean value of 0.04 ($p < 0.05$) and the corresponding z-statistics range from 0.64 to 2.65. Regarding incremental innovation performance, Model 6 also provides a significant and positive result for the interaction effect (Depth*Developed Economy Collaborations) (β = 0.1112, $p < 0.10$). The values for the true interaction effect of developed economy collaborations on the relationship between search depth and innovation performance range from -0.006 to 0.082, with a mean value of 0.036 (p = n.s.) and the corresponding z-statistics range from -0.56 to 2.04. The values with negative sign are not significant. Therefore, this indicates a positive and significant interaction effect of developed economy collaborations (with no sign change over any values). Accordingly, this provides evidence that the relationship between search depth and innovation performance is consistently positive when firms collaborate with partners from developed economies, thereby supporting Hypothesis 4.

Table 4-6 Results of Tobit Regression Analysis for Moderation Effects of Context of Collaboration

	Overall Innovation Performance					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Control variables						
Business group	-.0117	-.0157	-.0168	-.0200	-.0207	-.0252
	(.043)	(.043)	(.043)	(.043)	(.043)	(.043)
Process innovation	.1306**	.1266**	.1353**	.1226**	.1309**	.1431***
	(.053)	(.053)	(.053)	(.053)	(.053)	(.054)
Product innovation (lagged)	.2245***	.2214***	.2241***	.2207***	.2232***	.2292***
	(.057)	(.058)	(.058)	(.058)	(.058)	(.058)
Continuous R&D	.1554***	.1521***	.1515***	.1499***	.1496***	.1516***
	(.044)	(.045)	(.045)	(.045)	(.045)	(.045)
Firm size (logs)	.0092	.0089	.0100	.0081	.0092	.0081
	(.017)	(.017)	(.017)	(.017)	(.017)	(.017)
Predictors						
Search breadth (residual)		-.0076	-.0102	-.0043	-.0070	-.0024
		(.009)	(.009)	(.009)	(.009)	(.010)
Developed economy collaborations		.1319	.2398	.1331	.2316	.2487
		(.204)	(.197)	(.188)	(.186)	(.205)
Emerging economy collaborations		.1718	-.0331	.1844	-.0088	.0375
		(.344)	(.257)	(.343)	(.250)	(.259)
Search depth (residual)		.0111	.0112	-.0044	-.0029	-.0117
		(.011)	(.011)	(.013)	(.014)	(.019)
Search breadth squared						.0030
						(.003)
Search depth squared						.0023
						(.003)
Interactions						
Breadth X Emerging economy **(H3)**			**.7651*** **		**.7090*** **	**.7034*** **
			(.204)		**(.195)**	**(.199)**
Depth X Developed economy **(H4)**				**.1775*** **	**.1613*** **	**.1784*** **
				(.060)	**(.060)**	**(.065)**
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-.4125	-.3966	-.4074	-.3961	-.4064	-.4537
N	659	659	659	659	659	659
No. of obs. uncensored	358	358	358	358	358	358
Pseudo R^2	0.1150	0.1171	0.1230	0.1219	0.1269	0.1284
Log likelihood	-434.07	-433.060	-430.170	-430.694	-428.233	-427.518

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation.

Table 4-6 (Continued) Results of Tobit Regression Analysis for Moderation Effects of Context of Collaboration

	Radical Innovation					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Control variables						
Business group	-.0592	-.0654	-.0659*	-.0679*	-.0683*	-.0710*
	(.040)	(.040)	(.039)	(.040)	(.039)	(.040)
Process innovation	.0836*	.0808	.0897*	.0779	.0865*	.0921*
	(.049)	(.049)	(.049)	(.048)	(.048)	(.049)
Product innovation (lagged)	.1991***	.1926***	.1952***	.1923***	.1948***	.1972***
	(.054)	(.054)	(.054)	(.054)	(.054)	(.054)
Continuous R&D	.1182***	.1167***	.1162***	.1152***	.1149***	.1154***
	(.041)	(.041)	(.041)	(.041)	(.041)	(.041)
Firm size (logs)	.0330*	.0318*	.0326*	.0310*	.0318*	.0315*
	(.017)	(.017)	(.017)	(.017)	(.017)	(.017)
Predictors						
Search breadth (residual)		-.0118	-.0143	-.0092	-.0118	-.0108
		(.008)	(.008)	(.008)	(.008)	(.009)
Developed economy collaborations		.2967	.3844**	.2933	.3745**	.3455*
		(.187)	(.178)	(.178)	(.173)	(.188)
Emerging economy collaborations		.0430	-.1152	.0531	-.0999	-.0633
		(.346)	(.256)	(.344)	(.250)	(.255)
Search depth (residual)		.0069	.0072	-.0050	-.0036	-.0116
		(.010)	(.010)	(.012)	(.012)	(.017)
Search breadth squared						.0003
						(.003)
Search depth squared						.0024
						(.003)
Interactions						
Breadth X Emerging economy **(H3)**			**.6381*** **		**.6049*** **	**.5987*** **
			(.214)		**(.206)**	**(.207)**
Depth X Developed economy **(H4)**				**.1249** **	**.1130** **	**.1295** **
				(.055)	**(.055)**	**(.058)**
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-.7397**	-.7136**	-.7215**	-.7130**	-.7207**	-.7429**
N	659	659	659	659	659	659
No. of obs. uncensored	267	267	267	267	267	267
Pseudo R^2	0.1175	0.1240	0.1307	0.1278	0.1339	0.1344
Log likelihood	-341.951	-339.434	-336.819	-337.937	-335.608	-335.408

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation.

Table 4-6 (Continued) Results of Tobit Regression Analysis for Moderation Effects of Context of Collaboration

	Incremental Innovation					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Control variables						
Business group	.0289	.0299	.0278	.0278	.0260	.0211
	(.039)	(.039)	(.039)	(.039)	(.039)	(.039)
Process innovation	.1296***	.1261**	.1315***	.1243**	.1294**	.1435***
	(.049)	(.049)	(.049)	(.049)	(.049)	(.051)
Product innovation (lagged)	.1481***	.1491***	.1520***	.1491***	.1517***	.1582***
	(.055)	(.056)	(.056)	(.056)	(.056)	(.056)
Continuous R&D	.0997**	.0953**	.0941**	.0937**	.0928**	.0957**
	(.039)	(.041)	(.041)	(.041)	(.041)	(.041)
Firm size (logs)	-.0035	-.0030	-.0024	-.0033	-.0026	-.0040
	(.015)	(.016)	(.015)	(.015)	(.015)	(.015)
Predictors						
Search breadth (residual)		.0027	.0012	.0044	.0028	.0076
		(.009)	(.009)	(.009)	(.009)	(.010)
Developed economy collaborations		-.1029	-.0434	-.1096	-.0549	-.0377
		(.175)	(.176)	(.171)	(.173)	(.188)
Emerging economy collaborations		.1346	.0448	.1446	.0609	.1111
		(.321)	(.306)	(.318)	(.304)	(.309)
Search depth (residual)		.0071	.0072	-.0011	-.0002	-.0106
		(.011)	(.011)	(.013)	(.013)	(.018)
Search breadth squared						.0032
						(.003)
Search depth squared						.0027
						(.003)
Interactions						
Breadth X Emerging economy **(H3)**			**.4706****		**.4354***	**.4306***
			(.225)		**(.230)**	**(.229)**
Depth X Developed economy **(H4)**				**.1023***	.0919	**.1112***
				(.059)	(.060)	**(.064)**
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-.4291*	-.4249*	-.4330*	-.4251*	-.4327*	-.4844*
N	659	659	659	659	659	659
No. of obs. uncensored	251	251	251	251	251	251
Pseudo R^2	0.1054	0.1068	0.1100	0.1092	0.1119	0.1146
Log likelihood	-333.238	-332.713	-331.522	-331.822	-330.812	-329.815

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation.

4.4 Moderation Effects: Partner Types

As explained in methodology chapter, in stage one search breadth and search depth are regressed against international market-based and science-based partners to obtain residuals free of the influence of these variables (Slotegraaf et al., 2003; Belderbos et al., 2004; Belderbos et al., 2006; Poppo et al., 2015). According to the stage one results, international market-based and science-based partners influence search breadth and search depth directly. Specifically, search breadth is positively influenced by international market-based partners (β = 0.53, p < 0.01), but not so by international science-based collaboration partners (β = 0.56, p = n.s.). Whilst search depth is positively influenced by international market-based partners (β = 0.72, p < 0.01) and not by international science-based partners, but its sign is positive as with search breadth (β = 0.29, p = n.s.). Accordingly, when each variable is regressed against search breadth and depth separately, international science-based partners significantly affect both search strategies. Then, in stage two, the residuals are used as the indicators of search breadth and search depth.

Table 4-7 reports the results of Tobit regression models predicting a firm's radical and incremental innovation performance when its search breadth and search depth strategy and international market-based and science-based partners interact. The coefficient estimates are reported (standard errors in parentheses). First, Model 1 regresses radical and incremental innovations against control variables. Then, Model 2 includes all the predictors, including international market-based and science-based partners as well as the residuals of the search breadth and depth variables. Model 3 includes the interaction terms between the residual of search breadth and international science-based and market-based partners, whereas Model 4 includes the interaction between the residual of search depth and international science-based and market-based partners. Finally, Model 5 introduces the squared terms of search breadth and depth along with all the variables and interaction terms (Table 4-7). All the pertinent independent variables are mean-centred in order to avoid potential multicollinearity when testing the interaction terms (Aiken & West, 1991). The VIF statistics are calculated for each variable in Model 5. For radical innovation the value

of the VIFs range from 1.11 to 6.93, with a mean of 3.26 and for incremental innovation, they range from 1.11 to 6.93, with a mean of 3.29, well below the 10 benchmark, which indicates that multicollinearity is not a major concern in the analysis. The models' McFadden R^2 values range from 0.1054 to 0.1289, thus indicating a level of fit that is comparable to prior CIS work (Laursen & Salter, 2006; Grimpe & Kaiser, 2010; Klingebiel & Rammer, 2014). Model 1 shows the coefficients for the control variables, which are not explained here since they are the same as in the previous section (see section 4.2). Model 2 in Table 4-7 shows that the residuals of search breadth and search depth do not have a direct effect on innovation performance for radical and incremental innovation performance. In addition, international market-based and science-based partners do not affect firms' radical and incremental innovation performance.

Search Breadth and Partner Types

Hypothesis 5a proposed that international science-based partners do not moderate the relationship between search breadth and radical innovation performance. Model 3 and Model 5 in Table 4-7 show that the coefficient for the interaction term between search breadth and such partners (Breadth*International Science-Based Partners) is not significant ($p > 0.10$). Hence, Hypothesis 5a is supported. In addition, Hypothesis 5b proposed a moderating effect for international market-based partners on the relationship between search breadth and radical innovation performance. The coefficient for the interaction term between search breadth and international market-based partners (Breadth*International Market-Based Partners) in Model 3 and 5 (Table 4-7) is positive and significant for radical innovation performance ($\beta = 0.0238$, $p < 0.05$). Since the dependent variable is limited in nature (Tobit analysis), the interaction effect in the model does not have the same straightforward interpretation. As explained in the above sections, to test the true interaction effect over all values of the model variables, the procedure suggested by Wiersema and Bowen (2009) is followed. The values for the true interaction effect of international market-based partners on the relationship between search breadth and radical innovation performance range from -0.0005 to 0.022, with a mean value of 0.009 (p

< 0.05) and the corresponding z-statistics range from -0.10 to 2.94. Therefore, this indicates a positive and significant interaction effect of international market-based partners (with no sign change for any values) and hence, Model 3 and 5 provide support for Hypothesis 5b (i.e. search breadth has a positive impact on radical innovation for emerging economy firms collaborating with international market-based partners).

Hypothesis 5c proposed a moderating effect for international market-based partners on the relationship between search breadth and incremental innovation performance. The coefficient for the interaction term between search breadth and international market-based partners (Breadth*International Market-Based Partners) in Model 3 (Table 4-7) is significant (β = 0.0176, p < 0.10), but not significant in Model 5 (β = 0.0108, p = n.s.). In addition, the values for the true interaction effects of international market-based partners on the link between search breadth and incremental innovation are not significant. Thus, Hypothesis 5c is not supported. This result shows an unexpected outcome for incremental innovation performance. It means that when firms produce such innovation performance, the benefits they accrue from international market-based collaborations decline when searching broadly. This shows that the use of a wide range of knowledge sources and international sources are not helpful in the refinement and improvement of existing products. One explanation for this outcome could be that firms have high uncertainty and costs that can hamper their ability to produce incremental changes in their products and this is revisited in the discussion chapter.

Search Depth and Partner Types

Hypothesis 6a proposed a moderating effect for international science-based partners on the relationship between search depth and radical innovation performance. The coefficient for the interaction term between search depth and international science-based collaboration partners (Depth*International Science-Based Partners) in Model 4 and 5 (Table 4-7) is positive, but not significant for radical innovation performance (β = 0.0231, p = n.s.). Thus, Hypothesis 6a is rejected. This means that when firms

produce such performance, the costs of the combination between search depth and international science-based partners outweigh their benefits. Emerging economy firms searching deeply whilst at the same time collaborating with science-based partners can increase integration and management problems, leading to the costs outweighing the benefits. It could also be that science-based partnerships require a longer time frame. This type of partnership benefit is unlikely to be identified in the short-term and hence, as the data used in this study are cross-sectional in nature, no evidence has been found. However, for this reason this benefit cannot be dismissed. In addition, Hypothesis 6b proposed that international market-based partners do not moderate the relationship between search depth and radical innovation performance. Model 4 and Model 5 in Table 4-7 show that the coefficient for the interaction term between search depth and such partners (Depth*International Market-Based Partners) is not significant ($p > 0.10$). Hence, Hypothesis 6b is supported.

Hypothesis 6c proposed a moderating effect for international market-based partners on the relationship between search depth and incremental innovation performance. The coefficient for the interaction term between search depth and international market-based partners (Depth*International Market-Based Partners) in Model 4 and 5 (Table 4-7) is positive and significant for incremental innovation performance ($\beta = 0.0121$, $p < 0.05$). The values for the true interaction effect of market-based partners from international economies on the relationship between search depth and incremental innovation performance range from 0.00001 to 0.009, with a mean value of 0.003 ($p < 0.10$). The corresponding z-statistics range from 0.01 to 2.32. Therefore, this indicates a positive and significant interaction effect of international market-based collaboration partners (with no sign change for any values). Thus, Model 4 provides support for Hypothesis 6c (i.e. search depth has a positive impact on incremental innovation for emerging economy firms collaborating with international market-based partners).

Table 4-7 Results of Tobit Regression Analysis for Moderation Effects of Types of Collaboration Partners

	Radical Innovation				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables					
Business group	-.0592	-.0632	-.0580	-.0652	-.0637
	(.040)	(.040)	(.039)	(.040)	(.040)
Process innovation	.0836*	.0824*	.0889*	.0789	.0925*
	(.049)	(.049)	(.049)	(.049)	(.049)
Product innovation (lagged)	.1991***	.1976***	.1942***	.1970***	.1982***
	(.054)	(.054)	(.054)	(.054)	(.054)
Continuous R&D	.1182***	.1210***	.1199***	.1215***	.1214***
	(.041)	(.042)	(.042)	(.042)	(.042)
Firm size (logs)	.0330*	.0338*	.0323*	.0332*	.0319*
	(.017)	(.017)	(.017)	(.017)	(.017)
Predictors					
Search breadth (residuals)		-.0108	-.0144	-.0089	-.0116
		(.008)	(.008)	(.008)	(.009)
Market-based collaboration		.0106	.0237	.0148	.0217
		(.016)	(.017)	(.016)	(.018)
Science-based collaboration		.0192	.0231	-.0103	-.0043
		(.054)	(.055)	(.082)	(.083)
Search depth (residuals)		.0101	.0057	.0001	-.0099
		(.010)	(.010)	(.012)	(.016)
Search breadth squared					.0004
					(.003)
Search depth squared					.0035
					(.003)
Interactions					
Breadth X Science-based **(H5a)**			.0361		.0261
			(.048)		(.050)
Breadth X Market-based **(H5b)**			**.0238****		**.0210***
			(.010)		**(.011)**
Depth X Science-based **(H6a)**				.0231	.0251
				(.031)	(.031)
Depth X Market-based **(H6b)**				.0093	.0044
				(.006)	(.006)
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes
_cons	-.7397**	-.7300**	-.7204**	-.7296**	-.7537**
N	659	659	659	659	659
No. of obs. uncensored	267	267	267	267	267
Pseudo R^2	0.1175	0.1207	0.1267	0.1239	0.1289
Log likelihood	-341.951	-340.707	-338.389	-339.460	-337.539

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of the search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation.

Table 4-7 (Continued) Results of Tobit Regression Analysis for Moderation Effects of Types of Collaboration Partners

	Incremental Innovation				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables					
Business group	.0289	.0301	.0357	.0286	.0271
	(.039)	(.039)	(.039)	(.039)	(.040)
Process innovation	.1296***	.1250**	.1227**	.1266**	.1379***
	(.049)	(.049)	(.050)	(.050)	(.051)
Product innovation (lagged)	.1481***	.1496***	.1482***	.1481***	.1541***
	(.055)	(.056)	(.055)	(.056)	(.056)
Continuous R&D	.0997**	.0918**	.0893**	.0890**	.0898**
	(.039)	(.042)	(.042)	(.042)	(.042)
Firm size (logs)	-.0035	-.0037	-.0023	-.0044	-.0041
	(.015)	(.016)	(.016)	(.016)	(.015)
Predictors					
Search breadth (residuals)		.0027	.0013	.0040	.0076
		(.009)	(.009)	(.009)	(.010)
Market-based collaboration		-.0001	.0058	.0022	.0061
		(.015)	(.016)	(.015)	(.017)
Science-based collaboration		-.0669	-.1000	-.0523	-.0885
		(.069)	(.073)	(.069)	(.072)
Search depth (residuals)		.0068	.0051	-.0007	-.0139
		(.011)	(.011)	(.013)	(.017)
Search breadth squared					.0028
					(.003)
Search depth squared					.0039
					(.003)
Interactions					
Breadth X Science-based			-.1004*		-.0926
			(.057)		(.057)
Breadth X Market-based **(H5c)**			**.0176***		.0108
			(.010)		(.011)
Depth X Science-based				-.0317	-.0126
				(.024)	(.026)
Depth X Market-based **(H6c)**				**.0121****	**.0104***
				(.005)	**(.006)**
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes
_cons	-.4291*	-.4208*	-.4259*	-.4175*	-.4801*
N	659	659	659	659	659
No. of obs. uncensored	251	251	251	251	251
Pseudo R^2	0.1054	0.1073	0.1122	0.1107	0.1165
Log likelihood	-333.238	-332.537	-330.711	-331.254	-329.092

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation.

4.5 Further Analysis

Even though the focus of this study to investigate the moderating effects of international market-based and science-based partners, it is also important to look at different partner types from different institutional environment. Therefore, in order to further investigate Hypotheses 5a, 5b, 5c and 6a, 6b, 6c, I also examine the moderation effects of international market-based and science-based partners from certain institutional settings, including developed and emerging economies. Firstly, I construct market-based and science-based collaboration variables by considering partners from only developed economies. I also construct market-based and science-based collaboration variables by considering partners from just emerging economies. However, unfortunately, as the firms in the sample did not tend to collaborate with science-based partners from emerging economies, I only present results related to the former variable construction. Table 4-8 reports the results of Tobit regression models predicting a firm's radical and incremental innovation performance when the breadth and depth of search strategies and market-based and science-based partners from developed economies interact.

The results in Model 3 suggest that Hypotheses 5a (Breadth*Science-Based Partners from Developed Economies), 5b and 5c (Breadth*Market-Based Partners from Developed Economies) are rejected. The rejection of Hypotheses 5a, 5b and 5c regarding the interaction effects between search breadth and science-based and market-based partners from developed economies suggests that search breadth does not have a positive impact on innovation performance for emerging economy firms collaborating with developed economy partners. This shows that the results are also robust when the effects of context of collaboration on the link between search strategies and innovation performance are investigated according to the partner types. In other words, the results support the idea that search breadth does not work with partners from developed economies. In regard to Hypotheses 6a, 6b and 6c, Model 4 in Table 4-8 provides support for the former (Depth*Science-Based Partners from Developed Economies, β = 0.0549, p < 0.10) and also for Hypothesis 6b (Depth*Market-Based Partners from Developed Economies, p > 0.10) regarding

radical innovation performance. The values for the true interaction effect of science-based partners from developed economies on the relationship between search depth and radical innovation performance range from -0.0019 to 0.062, with a mean value of 0.024 ($p < 0.10$) and the corresponding z-statistics range from -0.14 to 2.25. The results also provide support for the latter (Depth*Market-Based Partners from Developed Economies, $\beta = 0.0200$, $p < 0.01$) regarding incremental innovation performance. The values for the true interaction effect of market-based partners from developed economies on the relationship between search depth and incremental innovation performance range from -0.0004 to 0.016, with a mean value of 0.006 ($p < 0.05$) and the corresponding z-statistics range from -0.39 to 2.84. Unlike the results in Table 4-7, the interaction effect for Hypothesis 6a becomes significant when firms collaborate with science-based partners from developed economies. Previous formulation covers science-based partners both from developed and emerging economies. However, science-based partners from developed economies have a higher level of technological advancement and so provide more novelty, particularly for emerging economy firms, as compared with those science-based partners from emerging countries. Therefore, science-based partners from developed economies can have a stronger effect and hence, this provides support for Hypothesis 6a. Consequently, the findings also show that market-based and science-based partner types differently influence the relationship between search depth strategy and different types of innovation performance.

Table 4-8 Results of Tobit Regression Analysis for Moderation Effects of Types of Collaboration Partners (from developed economies only)

	Radical Innovation				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables					
Business group	-.0592	-.0633	-.0603	-.0639	-.0640
	(.040)	(.040)	(.040)	(.040)	(.040)
Process innovation	.0836*	.0800	.0822*	.0770	.0858*
	(.049)	(.049)	(.049)	(.049)	(.049)
Product innovation (lagged)	.1991***	.1942***	.1931***	.1933***	.1964***
	(.054)	(.054)	(.054)	(.054)	(.054)
Continuous R&D	.1182***	.1165***	.1138***	.1179***	.1164***
	(.041)	(.041)	(.042)	(.042)	(.042)
Firm size (logs)	.0330*	.0325*	.0319*	.0316*	.0315*
	(.017)	(.017)	(.017)	(.017)	(.017)
Predictors					
Search breadth (residuals)		-.0114	-.0132	-.0097	-.0096
		(.008)	(.008)	(.008)	(.009)
Market-based collaboration		.0353	.0419*	.0400*	.0416*
		(.022)	(.023)	(.022)	(.024)
Science-based collaboration		.0028	-.0103	-.0640	-.0792
		(.078)	(.081)	(.097)	(.103)
Search depth (residuals)		.0084	.0050	-.0014	-.0118
		(.009)	(.010)	(.012)	(.017)
Search breadth squared					.0008
					(.003)
Search depth squared					.0033
					(.003)
Interactions					
Breadth X Science-based **(H5a)**			.0626		-.0334
			(.091)		(.131)
Breadth X Market-based **(H5b)**			.0176		.0139
			(.014)		(.015)
Depth X Science-based **(H6a)**				**.0549***	**.0674+**
				(.031)	**(.041)**
Depth X Market-based **(H6b)**				.0081	.0067
				(.008)	(.008)
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes
_cons	-.7397**	-.6341***	-.6723**	-.6749**	-.7528**
N	659	659	659	659	659
No. of obs. uncensored	267	267	267	267	267
Pseudo R^2	0.1175	0.1222	0.1254	0.1274	0.1294
Log likelihood	-341.951	-340.130	-338.883	-338.125	-337.325

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of the search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation. + = Significant at P>|t| = 0.101

Table 4-8 (Continued) Results of Tobit Regression Analysis for Moderation Effects of Types of Collaboration Partners (from developed economies only)

	Incremental Innovation				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Control variables					
Business group	.0289	.0327	.0358	.0280	.0247
	(.039)	(.039)	(.039)	(.039)	(.040)
Process innovation	.1296***	.1253**	.1255**	.1268**	.1398***
	(.049)	(.049)	(.049)	(.049)	(.051)
Product innovation (lagged)	.1481***	.1508***	.1501***	.1501***	.1564***
	(.055)	(.056)	(.056)	(.055)	(.056)
Continuous R&D	.0997**	.0951**	.0896**	.0884**	.0899**
	(.039)	(.042)	(.042)	(.042)	(.042)
Firm size (logs)	-.0035	-.0022	-.0022	-.0030	-.0041
	(.015)	(.016)	(.016)	(.016)	(.015)
Predictors					
Search breadth (residuals)		.0031	.0016	.0047	.0090
		(.009)	(.009)	(.009)	(.010)
Market-based collaboration		-.0036	-.0042	-.0086	-.0042
		(.021)	(.021)	(.021)	(.022)
Science-based collaboration		-.0866	-.0995	-.0656	-.0753
		(.087)	(.087)	(.086)	(.091)
Search depth (residuals)		.0070	.0074	-.0018	-.0127
		(.011)	(.011)	(.013)	(.017)
Search breadth squared					.0031
					(.003)
Search depth squared					.0030
					(.003)
Interactions					
Breadth X Science-based			-.1011		-.0672
			(.073)		(.088)
Breadth X Market-based **(H5c)**			.0170		.0061
			(.013)		(.014)
Depth X Science-based				-.0551*	-.0276
				(.030)	(.037)
Depth X Market-based **(H6c)**				**.0200*** **	**.0200*** **
				(.007)	**(.007)**
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes
_cons	-.4291*	-.3043*	-.4300*	-.4280*	-.4769*
N	659	659	659	659	659
No. of obs. uncensored	251	251	251	251	251
Pseudo R^2	0.1054	0.1056	0.1106	0.1137	0.1170
Log likelihood	-333.238	-333.150	-331.310	-330.146	-328.909

Note: Standard errors in parentheses. Legend: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01. Values of the search breadth and search depth are residuals (Y-Ypredicted) from the Stage 1 estimation.

Probit Estimation Results

This section shows an alternative technique to ensure that the results are consistent across the different specifications. Therefore, Probit maximum likelihood estimation is used for the binary indicator. Probit models are run with an alternative operationalisation of innovation performance: whether or not firms were able to launch a new product (Leiponen & Helfat, 2010; Klingebiel & Rammer, 2014).

Search Breadth and Search Depth: Direct Effects

The results in Table 4-9 have remained similar to the findings with Model 5 in Table 4-5. That is, the Probit regression results show that search breadth and depth are not beneficial for increasing firms' innovation performance, thus leading to the rejection of Hypotheses 1 and 2.

Table 4-9 Results of Probit Models for the Effects of Search Breadth and Search Depth on Innovation Performance

	Overall Innovation Performance		**Radical Innovation**		**Incremental Innovation**	
	Model 2	**Model 5**	**Model 2**	**Model 5**	**Model 2**	**Model 5**
Control variables						
Business group	.1364	.1120	.0177	-.0109	.0052	-.0146
	(.112)	(.113)	(.110)	(.111)	(.113)	(.114)
Process innovation	.2792**	.3203**	.2440**	.2829**	.3476**	.3864***
	(.129)	(.131)	(.130)	(.132)	(.134)	(.136)
Product innovation (lagged)	.6025***	.6241***	.5713***	.5910***	.4790***	.4982***
	(.126)	(.127)	(.133)	(.134)	(.134)	(.136)
Continuous R&D	.4582***	.4610***	.3739***	.3767***	.2849**	.2902**
	(.120)	(.120)	(.117)	(.117)	(.116)	(.117)
Firm size (logs)	.0611	.0574	.1314***	.1292***	.0414	.0376
	(.042)	(.042)	(.043)	(.043)	(.042)	(.042)
Predictors						
Search breadth **(H1)**	.0113	-.0616	-.0121	.0080	.0193	-.0531
	(.022)	(.078)	(.022)	(.079)	(.023)	(.083)
Search depth **(H2)**	.0199	-.0754	.0195	-.1430**	.0148	-.0569
	(.030)	(.074)	(.030)	(.072)	(.030)	(.073)
Search breadth squared		.0077		-.0013		.0075
		(.007)		(.007)		(.007)
Search depth squared		.0147		.0260***		.0104
		(.010)		(.009)		(.010)
Industry dummies (18)	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-1.647***	-1.564***	-2.627***	-2.719***	-1.804***	-1.709***
N	659	659	659	659	659	659
Pseudo R^2	0.1513	0.1547	0.1319	0.1379	0.1174	0.1200
Log likelihood	-385.580	-384.013	-386.191	-383.532	-386.494	-385.366

Note: Standard errors in parentheses. Legend: *p ≤ 0.1; **p≤ 0.05; ***p≤ 0.01.

Moderation Effects: Context of Collaboration

The Probit regressions are also run to test the interaction terms between search breadth and collaborations with partners from other emerging economies as well as between search depth and collaborations with partners from developed economies. When using such a dummy variable for radical, incremental and overall innovation performance, the results in Table 4-10 are largely consistent with Model 6 in Table 4-6. However, the interaction of search depth with developed economy collaborations is not statistically significant for incremental innovation performance. This could be linked to firms' inclination towards producing radical innovative products rather than incremental ones when they collaborate with developed economy partners. As Hitt et al. (2005) suggest emerging economy firms partner with their developed economy counterparts in order to acquire advanced and cutting-edge technology. Apart from this, as seen in Table 4-10, the results are still consistent for all the dependent variables.

Moderation Effects: Partner Types

Probit models with an alternative operationalisation of innovation performance are also run for Hypotheses 5a-5b-5c and Hypotheses 6a-6b-6c. As it is shown in Table 4-11, the results are largely consistent with Model 3 and 4 in Table 4-7. Hypotheses 5a-5c and Hypotheses 6b-6c are supported. In addition, the interaction of international science-based partners becomes significant regarding the link between search depth and radical innovation performance (Hypothesis 6a). On the other hand, the interaction effect between search breadth and international market-based partners for radical innovation performance loses its significance (Hypothesis 5b).

Table 4-10 Results of Probit Models for Moderation Effects of Context of Collaboration

	Overall Innovation Performance	**Radical Innovation**	**Incremental Innovation**
	Model 6	**Model 6**	**Model 6**
Control variables			
Business group	.0974	-.0247	-.0144
	(.114)	(.112)	(.114)
Process innovation	.2994**	.2740**	.3876***
	(.132)	(.132)	(.137)
Product innovation (lagged)	.6183***	.5718***	.5006***
	(.129)	(.135)	(.136)
Continuous R&D	.4331***	.3510***	.2828**
	(.122)	(.117)	(.117)
Firm size (logs)	.0585	.1236***	.0411
	(.042)	(.043)	(.042)
Predictors			
Search breadth (residual)	.0147	-.0194	.0268
	(.025)	(.025)	(.025)
Developed economy collaborations	1.328*	.9648	.5081
	(.744)	(.654)	(.629)
Emerging economy collaborations	4.170*	.6701	.1293
	(2.28)	(1.16)	(1.04)
Search depth (residual)	-.0535	-.0929*	-.0233
	(.052)	(.051)	(.051)
Search breadth squared	.0034	-.0047	.0065
	(.007)	(.007)	(.008)
Search depth squared	.0087	.0219**	.0060
	(.011)	(.011)	(.011)
Interactions			
Breadth X Emerging economy **(H3)**	**5.230*** **	**2.112** **	**1.654** **
	(1.39)	**(.885)**	**(.824)**
Depth X Developed economy **(H4)**	**.7053*** **	**.6403*** **	.2564
	(.246)	**(.224)**	(.213)
Industry dummies	Yes	Yes	Yes
_cons	-1.672***	-2.772***	-1.818***
N	659	659	659
Pseudo R^2	0.1766	0.1519	0.1245
Log likelihood	-374.077	-377.282	-383.384

Note: Standard errors in parentheses. Legend: *p ≤ 0.1; **p≤ 0.05; ***p≤ 0.01.

Table 4-11 Results of Probit Models for Moderation Effects of Types of Collaboration Partners

	Radical Innovation		**Incremental Innovation**	
	Model 3	**Model 4**	**Model 3**	**Model 4**
Control variables				
Business group	.0145	.0050	.0175	-.0053
	(.111)	(.111)	(.114)	(.113)
Process innovation	.2528*	.2190*	.3304**	.3485**
	(.130)	(.130)	(.135)	(.136)
Product innovation (lagged)	.5509***	.5523***	.4764***	.4764***
	(.134)	(.134)	(.135)	(.135)
Continuous R&D	.3712***	.3780***	.2591**	.2591**
	(.119)	(.118)	(.119)	(.118)
Firm size (logs)	.1245***	.1252***	.0463	.0380
	(.043)	(.043)	(.043)	(.043)
Predictors				
Search breadth (residuals)	-.0228	-.0092	.0130	.0215
	(.023)	(.022)	(.023)	(.023)
Market-based collaboration	.0818	.0706	.0848	.0733
	(.060)	(.059)	(.059)	(.059)
Science-based collaboration	.0953	.1698	-.3026	-.1379
	(.198)	(.290)	(.240)	(.232)
Search depth (residuals)	.0031	-.0201	.0103	-.0039
	(.031)	(.036)	(.031)	(.035)
Interactions				
Breadth X Science-based **(H5a)**	.0425		-.3684*	
	(.142)		(.211)	
Breadth X Market-based **(H5b, H5c)**	.0539		**.0648***	
	(.033)		**(.033)**	
Depth X Science-based **(H6a)**		**.2111***		-.1038
		(.113)		(.074)
Depth X Market-based **(H6b, H5c)**		.0244		**.0376***
		(.022)		**(.022)**
Industry dummies (18)	Yes	Yes	Yes	Yes
_cons	-2.457***	-2.467***	-1.630***	-1.605***
N	659	659	659	659
Pseudo R^2	0.1365	0.1393	0.1255	0.1216
Log likelihood	-384.137	-382.881	-382.954	-384.636

Note: Standard errors in parentheses. Legend: *p ≤ 0.1; **p≤ 0.05; ***p≤ 0.01.

4.6 Robustness Checks

Additional analyses are undertaken in order to confirm the robustness of the results regarding the core ideas as represented by the hypotheses. First, the baseline model is analysed for the subsample separated by size including only large firms and the results are largely consistent with those reported above in Table 4-5. Second, regarding the moderating effects of context of collaboration, two other interaction terms (Breadth*Developed Economy Collaborations and Depth*Emerging Economy Collaborations) are added into the final Model 6 and the results (see Appendix 4-1) are largely consistent with those reported in Table 4-6. Moreover, whether physical distance influences firms' choices towards external search strategies is also investigated. To this end, developed economy collaborations are separated into those with US partners and those with EU ones. The results are consistent with the main Model 6 in Table 4-6. Regarding collaborations with US partners, firms do not show any indication of producing radical innovations, whereas those collaborating with EU partners do not produce incremental innovations. Whilst it is essential to gain access to novel knowledge sources, it is also important to have a certain level of understanding especially for radical innovations (Taylor & Greve, 2006). Geographic distance limits the knowledge transfer process and hence, increases the costs of integration and absorption (Tallman & Phene, 2007). Consequently, firms struggle more to yield benefits from US partners compared to those in the EU partners when investing in radical products.

Different control variables are also added to check the consistency of results. That is, international market experience and foreign ownership variables are added in order to control for international orientation of firms, however, the results remain same. These control variables are excluded from the main tables as they are insignificant across all innovation outcomes. In addition, continuous R&D activity is replaced by the logarithms of R&D expenditures, total amount of innovation expenditures. A control variable measuring whether firms have different government supports for innovation activities are also added. The results remain consistent for three dependent variables with those in Table 4-6. I then also analysed the results of

subsamples separated by size including only large firms and the results are largely consistent with those reported in Table 4-6. Finally, a different search depth variable was used, being constructed by taking the mean value of the means of each type of knowledge source. The results do not show any changes and are robust.

Third, regarding the moderating effects of different partner types, as explained for previous model, international market experience and foreign ownership are included into the model to control for international orientation of firms. The logarithm of R&D expenditures, total amount of innovation expenditures, and government support for innovation activities are also brought into the model. Overall, the results remain the same. Then, the model is considered for only large firms. The results of the models are largely consistent with those reported above in Table 4-7. In addition, Hypothesis 5c becomes significant for large firms, indicating that emerging economy firms produce incremental innovations when they combine their search breadth strategy with international market-based partners. This suggests that large firms can deal with high search costs when they produce incremental innovations.

Including a lagged dependent variable

In order to control for potential reverse causality such that past innovation performance might lead to greater external search strategies than vice versa, a lagged dependent variable is included in the models (Burton, Lauridsen, & Obel, 2002; Leiponen & Helfat, 2011; Leiponen, 2012; Klingebiel & Rammer, 2014). Including this variable also accounts for unobserved propensities to innovate, such as the innovation capability of the firm. This technique has been used in management studies (e.g. Leiponen & Helfat, 2011; Leiponen, 2012; Kim et al., 2013). However, despite this approach reducing the problems of simultaneity and unobserved heterogeneity that have plagued most extant research, issues of endogeneity might not be captured by the lagged innovation indicator. Including this variable introduces high levels of correlation between the lagged variable and the error term, potentially distorting the coefficient estimates (Honoré, 1993; Honoré & Kyriazidou, 2000). Least-squares regressions with lagged dependent variables produce consistent estimates if the error terms are uncorrelated over time (Greene, 1997). Under

autocorrelation, linear models using a lagged dependent variable produce downward-biased coefficient estimates of (other) explanatory variables. Nevertheless, Keele and Kelly (2006) find that if the model truly is dynamic, it is better to include a lagged dependent variable than to omit it, for more severe biases are caused by doing so. Standard errors may also be deflated in lagged dependent variable models with autocorrelation. Due to these issues, the models are also estimated without a lagged dependent variable. Even though including such variable may reduce the variance in the dependent variable explained by other variables, models using this approach and those not have provided the same findings. For this study, when the models are estimated without the lagged dependent variable, the results are substantively the same as those reported here regarding innovation performance, but the coefficient estimates reported here are slightly lower. However, the standard errors are almost identical in both the models with and without the lagged dependent variable.

4.7 Summary of Findings and Hypotheses

The hypotheses and findings are summarised in Table 4-12. The empirical results do not support the effects of search strategies on innovation performance for emerging economy firms (H1 and H2). The findings support the moderating effects of different contexts of collaboration on the link between search strategies and innovation performance (H3 and H4). Moreover, the moderating effects of partner types on the link between search strategies and different types of innovation performance receive modest support. That is, H5a, H5b and H6b, H6c are supported while H5c and H6a are rejected. However, H6a becomes significantly supported when firms' science-based partners are drawn from developed economies. Overall, the findings show that the link between search strategies and innovation performance is shaped by such factors as the different context of the collaboration and types of collaboration partners.

Table 4-12 Summary of the Hypotheses and Findings

Hypotheses	Results
H1: Search breadth has a curvilinear impact (inverted U) on innovation performance for emerging economy firms.	Not Supported
H2: Search depth has a curvilinear impact (inverted U) on innovation performance for emerging economy firms.	Not Supported
H3: Search breadth has a positive impact on innovation performance for emerging economy firms collaborating with other emerging economy firms.	**Supported**
H4: Search depth has a positive impact on innovation performance for emerging economy firms collaborating with developed economy firms.	**Supported**
H5a: Search breadth is not expected to have a significant impact on radical innovation for emerging economy firms collaborating with international science-based partners.	**Supported**
H5b: Search breadth has a positive impact on radical innovation for emerging economy firms collaborating with international market-based partners.	**Supported**
H5c: Search breadth has a positive impact on incremental innovation for emerging economy firms collaborating with international market-based partners.	Not Supported
H6a: Search depth has a positive impact on radical innovation for emerging economy firms collaborating with international science-based partners.	Not Supported
H6b: Search depth is not expected to have a significant impact on radical innovation for emerging economy firms collaborating with international market-based partners.	**Supported**
H6c: Search depth has a positive impact on incremental innovation for emerging economy firms collaborating with international market-based partners.	**Supported**

Chapter 5

Discussion

At the start of the study, the following research question was formulated: *How do emerging economy firms search effectively to be innovative?* This question is investigated by examining the context specificity of firms' search strategies. First, the focus is on emerging economy firms in order to take into account the importance of characteristics of such firms and context for the success of search. The unique characteristics of such firms suggest that they leverage international collaboration to benefit from search strategies. Then, in this vein, this study distinguishes international collaboration based on partners' national context, including collaboration with developed economy partners and collaboration with other emerging economy partners, to examine its effects on the link between search strategies and innovation performance. Next, a distinction is made between international collaboration based on partner types, namely, market-based partners and science-based partners, to investigate the impact of their differences on the link between search strategies and different types of innovation performance. This chapter discusses the key findings with respect to these three research interests. Specifically, I consider my empirical findings in relation to prior empirical studies and relevant theory. I then consider the outcomes in terms of their managerial and policy level implications.

5.1 Emerging Economy Firms and Search Strategies

This study contributes to innovation search literature by examining search strategies from the perspective of emerging economy firms. Existing studies on innovation search have mainly undertaken their research for developed economy firms (Rosenkopf & Nerkar, 2001; Katila & Ahuja, 2002; Laursen & Salter, 2006; Leiponen & Helfat, 2010; Garriga et al., 2013). Consequently, it is important to

consider firms from a different institutional setting and investigate how their characteristics impact on search (Vissa et al., 2010; Li et al., 2013; O'Brien & David, 2014; Asakawa et al., 2014). Emerging economy firms have unique characteristics that make them different from developed economy firms, and hence, this study investigates how emerging economy firms search effectively to be innovative (Hitt et al., 2000; Hoskisson et al., 2000; Wright et al., 2005). Accordingly, the effects of search breadth and search depth strategies on innovation performance are investigated with a particular focus on emerging economy firms. In doing so, a contribution is made to the innovation search literature by offering new empirical evidence explaining search strategies of such firms.

Unexpectedly, the results have revealed that search breadth and search depth do not significantly influence the innovation performance for emerging economy firms. Specifically, the findings do not provide support for the idea that firms searching broadly and deeply tend to be more innovative (Rosenkopf & Nerkar, 2001; Katila & Ahuja, 2002; Laursen & Salter, 2006; Garriga et al., 2013). These insignificant results related to the impact of search breadth and search depth on innovation performance deserve further exploration, because they contrast with those of Laursen and Salter (2006), who observed that searching the external environment broadly and deeply plays a significant role in explaining firms' innovation performance. These results are also counter to the findings of previous studies that have been undertaken in emerging economy markets (Chiang & Hung, 2010; Ren et al., 2015).

These unanticipated findings could be related to the difficulties emerging economy firms have owing to limitations in their absorptive capacities and the unique characteristics of such contexts. Sourcing knowledge can be particularly difficult for emerging economy firms. Recently Asakawa et al. (2014) note that many multinational corporations from emerging countries are not ready for inbound open innovation concerning advanced technology, due to a lack of absorptive capacity within their firm. Li et al. (2013) also suggest that emerging economy firms' limited absorptive capability can cause difficulties in terms of managing and choosing across different knowledge sources. The extent to which a firm can screen, value and utilize

externally sourced knowledge depends on the level of its absorptive capacity (Cohen & Levinthal, 1990). Thus, with inadequate understanding of differences across external actors and organizations, the firm might avoid even minor modifications to its innovative practices. In addition, the characteristics of the environmental context where the focal firm is embedded influences the search success. For instance, searching external environment can be very costly for emerging economy firms due to a lack of market institutions to support business and innovations (Zhang & Li, 2010; Li et al., 2013). Managers can face difficulties while allocating their time and resources between search and the efficient functioning of markets. In addition, lack of institutional support limits the search scope of emerging economy firms. These firms, for example, face problems relating to insufficient government protection of intellectual property rights, which can lead to them to continue pursuing their links with existing partners (Li, Eden, Hitt, & Ireland, 2008). Consequently, their chances of accessing new knowledge so as to be innovative will be reduced.

Moreover, the environmental context can influence the availability of resources in the external environment (Sidhu et al., 2004; Garriga et al., 2013; Li et al., 2013). If a firm's external environment is rich with diverse knowledge sources, it can leverage knowledge spillovers from suppliers, customers, universities and other formal and informal wells of knowledge, like conferences and publications. However, emerging economy contexts can cause firms to have not only internal but also external resource scarcity (Zhang & Li, 2010; Vissa et al., 2010). That is, complementary firms in emerging economies providing skills and equipment, such as suppliers and distributors, tend to be much weaker (Mahmood & Mitchell, 2004). Therefore, there may not be sufficient new knowledge in the external environment to make firms' search strategies worth it. Due to the potential internal and external resource constraints, emerging economy firms are likely to interact with similar and proximate knowledge sources. By building on the ideas of bounded rationality (Cyert & March, 1963), routines (Nelson & Winter, 1982), and past investments in specific knowledge (Cohen & Levinthal, 1989), a firm's search for knowledge has been shown to be bounded or localized with regard to its existing knowledge base (Helfat, 1994; Martin & Mitchell, 1998; Stuart & Podonly, 1996). Firms thus prefer interacting with other organizations that have similar technological specializations and expertise.

However, local knowledge often lacks the inspiration and variety required for problem solving, and the local environment might not offer enough opportunities for knowledge combination and recombination activities. This can cause path dependency and ultimately lead to failure.

On the other hand, these findings support previous research that has stressed the down sides of seeking external knowledge (Dahlander & Gann, 2010; West & Bogers, 2014; Cruz-Ganzalez et al., 2015). Regarding which, a few researchers have identified negative or insignificant effects of external search strategies, whether through reduced output or because improvements failed to exceed the cost of such strategies. Dahlander and Gann (2010), Faems et al. (2010), Foss et al. (2011), Tortoriello (2015) and Cruz-Ganzalez et al. (2015) are among the few to identify these effects, which can include increased costs due to coordination and integration, risks of knowledge leakage and entry by rivals. These studies have suggested that the costs are not paid-off by the benefits. In addition, they have stressed the importance of contingency factors for the explanation of negative or insignificant effects of search on innovation. Faems et al. (2010) have found an indirect effect between open innovation and innovation performance via internal innovation efforts, thus supporting the idea of a contingency approach. Likewise, Foss et al. (2011) found that interaction with customers is not a sufficient condition for securing innovative performance. Firms hence need to apply organizational variables to benefit from interaction with customers. These studies have highlighted that firms need to take into account other factors to increase the benefits of external knowledge search.

Even though the results of this study are different from the established arguments and findings, they provide important insights for innovation search and open innovation literatures. The findings suggest that institutional settings, such as in the context of emerging economy firms, influence the success of search strategies. This argument is consistent with existing studies on innovation search and open innovation that suggest that internal and external context characteristics shape firms' search success (Laursen & Salter, 2006; Chen & Miller, 2007; Huizingh, 2011). An explicit consideration of emerging economy firms helps to extend this line of inquiry. Most

importantly, the results draw attention to the down sides of search strategies and the importance of contingency factors in order to increase the benefits from external knowledge sources (Huizingh, 2011; West & Bogers, 2014). This aspect is discussed in detail in the next section.

5.2 Role of International Collaboration

5.2.1 Context of Collaboration

The outcomes from this research focus contribute to innovation search literature by advancing the understanding of the impact of context on the success of search strategies. The search literature recognizes the importance of the search context (Katila, 2002; Phene et al., 2006; Zhang & Li, 2010; Laursen, 2012; Garriga et al., 2013). In particular, Phene et al. (2006) previously introduced the idea that the geographic origin of search is a factor that has to be considered when firms are looking for external knowledge. Other studies have distinguished contexts with national and international origins and investigated how search in these contexts influences innovation performance (Ahuja & Katila, 2004; Phene et al., 2006). However, these studies have not considered to what extent the success of search strategies are influenced by the context from where knowledge is drawn (Laursen & Salter, 2006; Laursen, 2012). Consequently, this study complements this line of inquiry by proposing two different collaboration contexts including, "collaboration with developed economy partners" and "collaboration with other emerging economy partners" as well as subsequently, examining their effects on the success of search strategies in producing innovation. This contextual differentiation introduces differences between two settings in terms of the nature of the accessed knowledge, characteristics of the environment, and the absorptive capacity. In doing so, it has been possible to explain the trade-offs firms make between search breadth and search depth strategies when they collaborate from different international settings.

The results indicate that search breadth is beneficial for innovation performance when emerging economy firms collaborate with partners from other emerging economies, whereas search depth boosts such performance when they collaborate with partners from developed economies. These results highlight that the role of search strategies in producing innovation cannot be determined without considering the impact of context since they are context specific (Katila, 2002; Zhang & Li, 2010; Laursen, 2012; Vissa et al., 2010). In particular, developed economy and emerging economy partners provide firms different knowledge sources and each context has unique environmental features (Hitt et al., 2000). Thus, their ability to acquire knowledge from such contexts requires appropriate strategies and resources (Phene et al., 2006). This means that firms partnering in specific contexts should follow certain search strategies, if they are to utilize knowledge sources successfully by converting them into innovative products. Thus, environmental characteristics lead firms to have different level of broadness and focus in their search strategies (Terjesen & Patel, 2015). These results are consistent with the existing literature arguing that firms' search strategies depend on where they search (Chen & Miller, 2007; Vissa et al., 2010; Zhang & Li, 2010; Laursen, 2012; Garriga et al., 2013). The outcomes are in line with Katila's proposal that how firms search cannot be studied in isolation from where they do so (2002: 1006). What matters is not merely the amount of search, but rather, the amount with reference to a particular context.

The findings demonstrate that search breadth and search depth do not assure innovation; it is the interaction of external search strategies and international collaboration that enables emerging economy firms to produce innovative products. This provides evidence of complementarity between different external knowledge sourcing mechanisms (Roper et al., 2008; Dahlander & Gann, 2010; Ganotakis & Love, 2012). As it is explained in the previous section, the results show that neither search breadth nor depth have a significant impact on innovation performance for emerging economy firms. While this might be due to the limited number of observations, the more likely explanation is that, on average, emerging economy firms lack experience and hence, the resources that would enable them to search on their own. Consequently, emerging economy firms' interactions with external sources are not a sufficient condition for securing innovation performance (Faems et

al., 2010; Foss et al., 2011; Asakawa et al., 2014). However, the findings indicate that collaboration with foreign partners helps them to mitigate this effect. In particular, collaboration becomes important because it binds firms with legal agreements. It requires a firm and its external partner to adhere to an agreed structure for the exchange and is thus described as a hard form of openness (Kang & Kang, 2014; Laursen & Salter, 2014). This enables more sustained exchanges between the focal firm and its external environment, thereby playing a pipeline role in transferring knowledge (Dyer & Singh, 1998; Singh et al., 2015). As Levin and Barnard (2013) note, firms benefit from international sources as long as they have strong ties and interactions between each other. Therefore, it is essential for emerging economy firms to have international collaboration activities in order to complement this relationship and hence, result in them reaping the benefits from external search strategies.

This research focus differentiates developed economy partners from emerging economy partners since firms have different motives when they engage with partners from each context. In the former, firms' desire is to learn and transfer advanced technology and knowledge, whilst in the latter, they refine their products to be able to satisfy customer needs and to adapt to local markets (Li & Zhong, 2003; Tsang & Yip, 2007; Demirbag et al., 2009). This difference across the two contexts influences the nature of knowledge firms obtain from each. Developed economy partners provide knowledge that enables firms to depart from their existing focus. In contrast, emerging economy partners provide knowledge that facilitates firms extending their current focus (Kuemmerle, 1999). Consequently, firms have trade-offs between search breadth and search depth strategies so as to increase the benefits of collaboration. The results suggest that search depth works for the former, whereas search breadth works for the latter. This finding is analogous to Laursen and Salter's (2006) contention that firms' choices towards external search strategies are based on the type of innovation being pursued. They note that search breadth is more beneficial when the innovation is incremental, whereas search depth is so when the innovation is radical. This investigation is also consistent with international business studies, where it is argued that firms' nature of engagement is systematically different across developed economy and emerging economy contexts (Gassmann &

Han, 2004; Wright et al., 2005; Hitt et al., 2005; Tsang & Yip, 2007; Luo & Tung, 2007; Cuervo-Cazurra & Genc, 2008; Demirbag et al., 2009; Schmiele, 2012). This study provides insights for this body of literature by showing how emerging economy firms benefit both from developed economy and emerging economy partners. Extant studies have mostly focused on how emerging economy firms leverage developed economy partners or vice versa. However, it is important to look at what emerging economy firms also get from other emerging economy partners, which is another phenomenon investigated in the current research.

This differentiation also shows that firms need to have different levels of understanding and focus in their search strategies so as to be able to leverage the resources from each context. The support for a positive interaction between search breadth and collaborations with emerging economy partners indicates that emerging economy firms do not need deep focus in their search due to similar levels of economic development across such firms. They do not face the same challenges as those that have a large technological gap with their partners. In addition, emerging economy firms do not partner with other emerging economy organizations to transfer highly advanced knowledge and therefore, such firms do not need to draw rich knowledge to increase their understanding. On the other hand, the support for a positive interaction between search depth and collaborations with developed economy partners exposes the difficulties in integrating knowledge from technologically advanced nations. Thus, this finding indicates that the problems emerging economy firms face when absorbing knowledge from developed economies can be balanced when they focus on a narrow range of key knowledge sources, which will lead to an increase in the level of understanding. This argument is consistent with existing studies, which contend that search strategies enable firms to have different level of understanding by drawing rich or shallow knowledge from outside sources (Fabrizio, 2009; Cruz-Ganzalez et al., 2015; Terjesen & Patel, 2015).

In addition, the findings of this investigation suggest that absorptive capacity can be examined by looking at the environmental characteristics of the context (Phene et al., 2006; Tallman & Phene, 2007; Lavie & Miller, 2008). The literature on absorptive

capacity contends that a firm's ability to acquire valuable knowledge from other nations depends on the larger environment in which the knowledge is embedded (Lane et al., 2001; Phene et al., 2006; Tallman & Phene, 2007). Existing studies have investigated this inquiry by looking at the differences between national and international contexts (Phene et al., 2006; Lavie & Miller, 2008). This research enhances this argument by distinguishing the collaboration contexts as developed and emerging economies. For instance, the similarities across emerging economies in terms of economic development ease the knowledge transfer from such contexts. In contrast, the differences between emerging and developed economies in terms of level of technological development aggravate the ability of firms to transfer knowledge from developed contexts. In addition, the similarities and differences in the macro-regulatory environment and the level of national development can lead to firms having or lacking common knowledge bases as well as shared practices. That is, firms' ability to acquire knowledge will be affected by the differences between the context of the focal firm and that where the knowledge comes from (Phene et al., 2006; Tallman & Phene, 2007; Nooteboom et al., 2007; Gilsing et al., 2008). This is also consistent with Bertrand and Mol (2013), who have argued that cognitive distance augments the novelty but decreases absorption when firms are located in other countries. Therefore, not only firm specific factors but also the external environment especially the industry and country determine the absorption ability of firms.

Differentiation across developed and emerging economy partners also implies the importance of environmental features affecting firms' search strategies. Emerging economy firms can face problems, such as unpredictable changes in partners' preferences, along with changes in regulations and rules when they collaborate with other emerging economy partners (Luo & Park, 2001; Luo, 2003, 2003b; Luo, 2004). These uncertainties are not likely to happen in developed economies due to strong institutional infrastructure and market mechanisms (Hoskisson et al., 2000). For this reason, emerging economy firms need to mitigate the potential threats they might have when collaborating with other emerging economy partners. The results demonstrate that firms need to have a broad search to increase their innovation success when they face such challenges. This enables them to synchronize the

changes they encounter when they collaborate with such partners. Otherwise, a focused search would lead to emerging economy firms having rigidity problems, when they are likely to encounter such threats as demand uncertainty and/or changes in the supply of materials (Terjesen & Patel, 2015). This argument is consistent with existing studies claiming that firms need to have exploratory innovation in order to expand opportunities and so deal with environmental dynamism (Jansen et al., 2006).

The results also reveal that firms need to balance the associated costs they face while collaborating abroad and searching broadly and deeply. In particular, it is critical for emerging economy firms to balance the needs and the costs of information search for product innovation. Otherwise, the costs of search can exceed the benefits and result in negative consequences for the ability to produce innovations. The findings suggest that searching widely and collaborating with partners from emerging economies helps firms to balance the search cost. That is, emerging economy firms can deal with many new ideas when they collaborate with such partners. The similarity across contexts and lower costs in general mitigate the costs related to searching the external environment broadly. In addition, the results show that searching deeply and collaborating with partners from developed economies increases the benefits relative to the search cost. That is, the dissimilarity across the knowledge base between emerging and developed economies increases the transfer and assimilation costs. Searching deeply through firms' focus on a small number of sources, hence, enhances the transfer of knowledge. Thus, this helps firms to leverage the benefits which can outweigh the costs of collaborations with developed economy partners. Consequently, simultaneously incorporating diverse and essential knowledge while keeping the costs of coordination and knowledge transfer at a minimum increases the chances of producing innovative products.

This study also advances the research on innovation strategies in emerging economies. Extant literature has highlighted that emerging economy firms, such as Chinese ones, have extensive reliance on external resources (Peng & Heath, 1996; Hitt et al., 2000). Previous studies have focused on different mechanisms, including alliances (Rosenkopf & Almeida, 2003), inventor mobility (Almeida & Kogut, 1999;

Song, Almeida, & Wu, 2003; Liu et al., 2010), horizontal (i.e. within-industry) acquisitions (Ahuja & Katila, 2001), and interdivisional knowledge (Miller et al., 2007) to explain firms' access to external knowledge sources. In addition, FDI (Zhang et al., 2010) and export activities (Li et al., 2010) are described mechanisms that enable firms to make contact with a technologically advanced country. The findings of the current study highlight the role of international collaboration activities of emerging economy firms in transferring knowledge from other nations. That is, the results support the argument that collaborating with partners from different nations gives emerging economy firms access to a wider set of solutions. In particular, through international collaboration, firms can take advantage of key sources of technological knowledge from around the world.

This study also enhances the research on open innovation in several ways. First, it advances current knowledge by providing theoretical arguments and empirical evidence supporting a view of search strategies as a contingent phenomenon. Existing literature has stressed the importance of a contingency approach influencing firms' search openness (Huizingh, 2011; Salge et al., 2013; West & Bogers, 2014). Regarding which, this work introduces international collaboration as a contingency of search strategies. By uncovering this contingency factor, this research complements initial insights from studies that have started to examine possible contingency effects (Laursen & Salter, 2006; Grimpe & Sofka, 2009; Salge et al., 2013). In particular, the results highlight that search breadth and search depth strategies are not always the optimal strategy to follow. That is, the benefits of search strategies show variance depending on the location of the collaboration. Thus, international collaborations from developed and emerging economies might condition the effects of search strategies on innovation performance. Second, this study advances the open innovation concept by focusing on different knowledge sourcing mechanisms, namely, external search strategies and international collaboration. As Dahlander and Gann (2010) suggest, there have been few systematic attempts to investigate several different forms of openness. In line with this, the results suggest that the two different mechanisms complement each other to produce innovative products. Third, this work enhances the understanding of the international dimension of open innovation by considering the effects of international

collaboration on the link between search strategies and innovation performance. As Asakawa et al. (2014) note, rather limited attention has been paid to the international dimension of open innovation. Accordingly, the results highlight that international knowledge is important for the innovation search framework.

5.2.2 Collaboration Partner Types

This study contributes to innovation search literature by finding evidence that international market-based and science-based partner types condition the effect of search strategies on different types of innovation performance. Previous studies have highlighted that search breadth and search depth do not show what type of knowledge firms are trying to obtain (e.g. Sofka & Grimpe, 2010; Chen et al., 2011; Kohler et al., 2012). Firms interact with certain types of partners to be able to access specific knowledge, thereby producing different types of innovations (Faems et al., 2005; Nieto & Santamaria, 2007; Todtling et al., 2009). Accordingly, these partners require different capabilities and resources, if this knowledge is to be easily accessed and absorbed (Danneels, 2002; Rothaermel & Deeds, 2004; Vanhaverbeke et al., 2014). Existing studies have investigated the direct effects of different types of search strategies, i.e. market-driven and science-driven search, on innovation performance (Grimpe & Sofka, 2009; Sofka & Grimpe, 2010; Henttonen et al., 2011; Kohler et al., 2012). However, they have not investigated the potential interaction between search strategies and partner types. This research advances this line of inquiry by proposing that the effects of breadth and depth of search strategies on different types of innovation performance depend on different international collaboration partner types. In sum, the main contribution concerns the context specificity of search strategies in terms of the interaction between these and partner types in driving radical or incremental innovation performance.

Search Breadth and Partner Types

The findings indicate that an emerging economy firm with a broad search strategy is capable of developing radical innovation performance in the presence of international market-based partners rather than science-based partners. Broad search refers to firms scanning the external environment by interacting with a wide range of knowledge sources (Katila & Ahuja, 2002; Laursen & Salter, 2006). However, firms have shallow knowledge about those knowledge sources due to the complexity of search and limitations in terms of transfer (Cohen & Levinthal, 1990). Therefore, firms with a search breadth strategy do not benefit from science-based partners when they produce radical innovations. This outcome supports the existing argument that firms need to have in-depth understanding when they leverage knowledge from science-based partners (Fontana et al., 2006; Alcacer & Chung, 2007). On the other hand, market-based partners provide specialized knowledge about market opportunities, which increases the development of radical innovations. In particular, firms benefit from developing expertise and deep understanding in one particular area rather than a shallow focus on many different areas, when they are generating radical innovations. Therefore, close interactions with market-based partners increase the effect of search breadth on radical innovation performance. Accordingly, this result supports existing studies, in which it is argued that firms need to have access to deep and sophisticated knowledge for knowledge generation (Lane & Lubatkin, 1998; Grant & Baden-Fuller, 2004; Laursen & Salter, 2006; Bierly et al., 2009; Hsieh & Tidd, 2012).

The findings also show the importance of market related knowledge for producing radical innovation performance. Market-based partners provide information about current and future market opportunities and trends. Existing studies have shown that these partners provide knowledge that enhances and improves firms' present products and processes (Kaufmann & Todtling, 2001; Faems et al., 2005; Kohler et al., 2012). They perform more development and commercialization activities by providing complementary resources, such as manufacturing capabilities, market knowledge and access (Rothaermel & Deeds, 2004; Alcacer & Chung, 2007). On the other hand, the results of this study show that it is important to consider market-

based partners' potential impact on radical innovation performance. This finding is consistent with the research arguing that market knowledge acquisition increases the infusion of new information and ideas to generate radical innovations (Danneels & Sethi, 2011; Zhou & Li, 2012; Chatterji & Fabrizio, 2012, 2014). These partners provide firms diverse and heterogeneous knowledge and so varied problem solving approaches (Ozer & Zhang, 2015). By acquiring knowledge about potential markets and technologies, the firm may detect future market trends and invest to explore them. They subsequently become beneficial for producing innovative products (Cohen et al., 2002). This finding draws a connection between unique market-based partners, diverse knowledge and radical innovation performance.

In contrast to expectations, the results show that the interaction between search breadth and international market-based partners does not affect incremental innovation performance. This insignificant result needs further exploration because it contrasts with the argument that market-based partners and searching broadly the external environment are important strategies for producing incremental innovations (Faems et al., 2005; Laursen & Salter, 2006). One possible explanation for this unexpected outcome could be the excessive uncertainty and costs firms encounter when they have a search breadth strategy and collaborate with international partners at the same time. This can be detrimental especially for generating incremental innovations, for which coordination, control and certainty are essential (Benner & Tushman, 2002). Firms producing incremental innovations aim to fuel positive and consistent returns, having a profit emphasis that stresses the value of efficiency and managers thus need to allocate their resources carefully in order to foster such efficiency (Andriopoulos & Lewis, 2009). However, search complexity provides uncertainty and an uncontrollable nature of knowledge sources for incremental innovations. In particular, the differences between nations can increase uncertainties and difficulties regarding the transfer and assimilation of knowledge for market-based partners (Phene et al., 2006). These differences consume managerial investment in time and effort. Clearly, firms can face these challenges of dealing with these high uncertainties and management costs, in particular, this can be the case for emerging economy firms due to limitations in their resources and capabilities. Consequently, increased uncertainty and management problems can

outweigh the benefits of incremental innovation performance and hamper firms' intention to increase profits in the short-term with such innovations.

Search Depth and Partner Types

This research also involved examining the moderation effects of international market-based and science-based partners on the link between search depth and different types of innovation performance. In contrast to expectations, the findings show that international science-based partners do not influence the link between search depth and radical innovation performance. This needs further investigation as it is in contrast to previous research findings arguing that science-based partners lead firms to produce radical innovations (Kaufmann & Todtling, 2001; Rothaermel & Deeds, 2004; Kohler et al., 2012). On the other hand, the findings are in line with recent work on the effects of international science-based partners on innovation performance, which have found that science-based collaborations result in negative outcomes in the short term (Colombo et al., 2009). These partners require a longer time period to enable firms to reap the benefits since they typically involve basic research (Knudsen, 2007; Nieto & Santamaria, 2010). The scientific nature of knowledge and the barriers to knowledge sharing between firms and university partners support the delay in appropriating knowledge from such partners (Hall et al., 2001; Knudsen, 2007). Therefore, these partners are not likely to have short-term positive effects on innovation performance.

Another explanation can be attributed to mounting integration and management costs. Scientific partners provide basic knowledge which might be less useful for its application in industry (Cohen et al., 2002). In particular, being embedded in international contexts can limit firms' ability to transfer and assimilate knowledge from such partners (Phene et al., 2006). Emerging economy firms especially can face challenges in terms of transfer and application of knowledge from science-based partners. Firms lagging in their abilities face challenges when they try to reap the benefits from less commercial sources, such as universities (Alcacer & Chung, 2007). Additionally, obstacles to university-industry collaborations, such as different

institutional norms and administration issues related to intellectual property rights, create difficulties regarding firms effectively utilizing knowledge from such resources (Hall et al., 2001; Bruneel et al., 2010). For, this demands more focus, attention and resources and therefore can become a source of confusion and information overload. Time devoted to such activities inevitably reduce the time available for actual integration and application of the knowledge elements obtained.

Moreover, the results indicate that an emerging economy firm with a search depth strategy collaborating with international market-based partners generates increases in incremental innovative performance, but not radical innovation performance. This means that when firms match their deep understanding with market-based knowledge, they extend their existing knowledge base. Firms with search depth draw knowledge from one or two sources with strong and frequent connections (Laursen & Salter, 2006; Patel & Van der Have, 2010). In particular, they develop and maintain their knowledge about customers and suppliers due to their deep interactions with key sources in the innovation process. Consequently, market-based partners can further enhance the knowledge about markets and technology (Faems et al., 2005; Gesing et al., 2015). Specifically, they help construct a deeper and refined understanding of firms' existing knowledge, which prompts incremental improvements. This finding can help to explain the unobserved impact of market-based partners on the effects of search breadth on incremental innovation performance. That is, firms need to reduce the level of diversity and so the costs to increase this type of innovation performance. For, high costs related to managing a broad range of knowledge sources and international partners can pose as obstacles to producing incremental changes in the products. This outcome can be further explained by the difficulties of transferring knowledge from international customers, in particular, that which is tacit (Un et al., 2010; Laursen, 2011). As a consequence, firms might need to have a search depth rather than a search breadth strategy to increase the understanding and to decrease costs. This outcome, however, could be specific to emerging economy firms due to the scarcity in their resources and capabilities. It suggests that emerging economy firms with search depth help balance the costs and increase incremental innovation performance.

Although not formally hypothesized, the interaction effects of partner types on the relationship between search depth and different types of innovation performance are also analyzed for partners only from developed economies. The results suggest that the interaction between search depth and science-based partners from these economies results in radical innovation performance. That is, even though this does not hold for firms when they collaborate with science-based partners across all nations, it does work when their partners come from only developed economies. International science-based partners consist of those from emerging economies and developed economies. However, emerging economy firms might not get research-oriented benefits from science-based partners when they come from other emerging economies. For, emerging economy firms collaborate with other emerging economy partners primarily for development oriented reasons (Li & Zhong, 2003; Luo & Tung, 2007), which can reduce the chances of acquiring advanced knowledge from scientific partners. On the other hand, when emerging economy firms collaborate with developed economy partners, they typically have access to a high level of research and technologically advanced knowledge. Consequently, they collaborate with these countries to learn and transfer advanced knowledge into their activities (Wright et al., 2005; Tsang & Yip, 2007). That is, emerging economy firms can acquire research-oriented benefits from developed economy science-based partners. Hence, these partners can have a higher and stronger effect on the link between a search depth strategy and radical innovation performance than science-based partners who are from emerging economies.

This investigation also advances the understanding of how the context of collaboration influences the relationship between search strategies and innovation performance when firms collaborate with different partner types from developed economies in order to access specific kinds of knowledge. The results show that when emerging economy firms collaborate with science-based and market-based partners from developed economies they produce different types of innovation performance. Specifically, those emerging economy firms with a search depth strategy produce radical innovations when they collaborate with science-based partners from developed economies, whereas they produce incremental innovations when they collaborate with market-based partners from such economies. This finding

suggests that when the level of technology and knowledge they obtain from developed economies vary these firms' search depth strategy results in different types of innovation performance. The results also indicate that emerging economy firms with a search breadth strategy do not benefit from different types of partners from developed economies, further supporting the idea that this form of search is appropriate when collaborating with emerging economy partners.

To summarise, these findings enrich the extant literature by demonstrating that the interactions between search breadth and international market-based partners increase radical innovation performance rather than the interaction between search breadth and international science-based partners. In addition, the results indicate that the former interaction does not generate incremental innovations for emerging economy firms. By contrast, such market-based partners augment the impact of search depth on incremental innovation performance, but not radical innovation performance. These findings show that whether firms opt for a broader or deeper focus to acquire external knowledge sources results in their experiencing different types of innovation performance when they collaborate with international market-based partners. In addition, the results of this study also suggest that the effect of a search depth strategy on different types of innovation performance varies depending on partner types. Specifically, a firm with a search depth strategy produces radical innovations when it collaborates with science-based partners (from developed economies), whereas one with a search depth strategy delivers incremental innovations when it does so with market-based partners. These results suggest the importance of fit between partner types and innovation types (Faems et al., 2005; Todtling et al., 2009).

5.3 Managerial Implications

This study has provided insights into the management of emerging economy firms' search strategies. The findings suggest that these firms' managers should take into account both the benefits from and difficulties of search strategies aimed at integrating knowledge from external sources. They should also understand the

advantages and disadvantages of the environment that they are operating in. Emerging economy firms that lack experience and resources face challenges when they seek external knowledge. Additionally, the external environment can limit their chances of accessing novel and important knowledge for innovation and causes problems due to underdeveloped infrastructure problems. That is, the difficulties and costs can outweigh the benefits. Therefore, managers should consider other mechanisms that will enable them to benefit from external knowledge search. For example, the findings indicate that international collaboration mitigates the down sides of search strategies. That is, managers should consider collaborating with organizations to facilitate knowledge flow since they provide experience and understanding regarding how to combine the acquired knowledge. Moreover, managers should consider accessing diverse pools of resources and knowledge from different nations. In particular, they should realize that accessing international knowledge is not only confined to developed economy partnerships for emerging economy firms, for collaboration with partners from other emerging economies is a potential alternative for such firms.

However, the results point to the need of applying a cautious approach when collaborating with international partners. Managers need to realize that integrating knowledge from international contexts is a challenging process. They should understand the difficulties associated with transferring and applying knowledge from different nations. They also need to learn that nations are featured by unique environmental characteristics and hence, firms encounter different opportunities and threats from each. The findings suggest that emerging economy collaborations are systematically different to developed economy ones. Consequently, this difference requires firms to have different levels of focus and understanding in order to leverage the knowledge successfully. Managers thus need to learn the advantages and disadvantages they have while acquiring knowledge from developed economy and emerging economy contexts. For, if they pay too little attention to the characteristics of each context, this will hinder their ability to understand the foreign countries and hence their partners, fully.

Moreover, the findings of the study provide evidence for business managers that firms can successfully apply knowledge obtained from international contexts through following appropriate search strategies. The limitations of especially firms' capabilities and certain characteristics of the host country environment can reduce the advantages of collaboration with international partners and thus, fail to enhance innovative capabilities. This issue can be tackled by following an appropriate search strategy that will enable firms to allocate their resources and time more efficiently and effectively. Thus, managers should consider making a trade-off between search strategies, while collaborating with partners from developed economies or with those from other emerging economies. For instance, the results suggest that when they intend to collaborate with partners in developed economies, they should limit their attention and resources to a small number of key knowledge sources rather than expanding their search portfolio. In contrast, when deciding to collaborate with partners in other emerging economies, they should allocate their resources across a wide range of knowledge sources so as to expand their search scope. In sum, the findings suggest that managers need to learn how to leverage their search strategies according to the contexts from which they find partners.

The results of the study also suggest that managers should know that not all partner types have the same influence on innovation performance. That is, international market-based and science-based partners contribute to different types of such performance. Specifically, science-based partners enable firms to produce radical innovation performance, whereas market-based ones increase the chances of producing both radical and incremental innovations. However, firms' innovation strategies might entail different arrangements across external search strategies and partner types, depending on whether radical or incremental innovation performance is the goal. Managers can distinguish themselves in competition, on the one hand, through exclusive access to particular knowledge and on the other hand, by their ability to find the valuable parts within an enormous amount of potentially available knowledge. That is, the results suggest that international market-based partners enable firms to produce radical innovations rather then incremental innovations when they search across a wide range of knowledge sources. On the other hand, international science-based partners do not enable firms to produce radical

innovations when they search broadly. Additionally, the findings indicate that when managers intend to produce radical innovation performance, collaboration with science-based partners (from developed economies) increases the effects of search depth. In contrast, collaboration with market-based partners increases the effects of search depth on incremental innovations. These outcomes imply that managers employing search breadth and search depth aimed at producing radical or incremental innovations should consider collaborating with different partner types.

The findings also suggest that managers should carefully select the partners for their international collaboration. They need to learn that difficulties to acquire and transfer knowledge vary across the type of knowledge they are obtaining from international partners. In particular, firms intending to obtain market-based knowledge should have different capabilities and resources from those that require knowledge from science-based partners. Regarding which, the findings show that managers should understand the difficulties they could encounter when they collaborate with science-based partners. In particular, interacting with a wide range of knowledge sources in a collaboration with such partners can lead to firms failing to reap any benefits from the relationship. Consequently, such collaboration appears to be less suitable for emerging economy firms when they have a great diversity of knowledge sources. Additionally, the results suggest that managers should be aware of the national context if they are to obtain the outcomes provided by science-based partners. In particular, it should be noted that emerging economy firm managers leverage more benefits from science-based partners when they are from developed economies rather than emerging ones.

The study findings also provide important guidelines and practical implications for business managers in Turkey. Turkey has a more established manufacturing system compared to other emerging countries. However, the level of innovativeness is lower than many countries in the OECD and European Union. It is well understood in that country that firms cannot survive in the competing world without developing capabilities in research and development and hence, innovation. The findings provide managers with direct implications about how to manage external knowledge sources

for innovative outcomes. This research emphasizes the important role of Turkish firms' collaborations with international partners and for accessing novel knowledge. Turkish firms need to manage their ties with other organizations within and outside national boundaries carefully in order to search for new ideas as well as develop new products and technologies. Accordingly, this research provides the insight to managers that it is important to follow appropriate search strategies to facilitate the knowledge transfer process and to reduce management and coordination costs. This is exemplified in the success of Vestel Electronics (a group firm of Zorlu Holding), which became a partner with internationally well-known universities and companies from developed economies, including Austria, Canada and France (Senturk, 2011). They were jointly involved in a long-term project aimed at transferring advanced technology and knowledge. This process required firms to have deep understanding and higher capacity to learn. The learning and knowledge transfer process can be facilitated when firms focus on key knowledge sources, thereby drawing richer knowledge than were it otherwise. On the other hand, the same company looked for partners from emerging economies, namely, China, Russia and India, to expand as a manufacturer and be able to produce products designed for those markets. They benefited from such collaborations by adjusting their products and meeting customer requirements. In sum, careful consideration of partners and search strategies will increase Turkish firms' innovativeness and hence, their competitiveness in the global world.

5.4 Policy Implications

This study also has some practical implications at the policy level. The results suggest that emerging economy firms searching the external environment encounter difficulties in absorbing and utilizing the knowledge. Consequently, policymakers need to develop policies that will mitigate problems firms face when they search the external environment. For instance, they could provide incentives for developing firms' R&D activities and absorptive capacities. They could also adjust the regulatory framework to provide transparency that would reduce the transaction and coordination costs of knowledge transfer from external sources. This would help

emerging economies to have stronger institutional frameworks for innovation and thereby, strengthen their national innovation systems. In addition, the findings of this study suggest that international collaborations with developed economy and emerging economy partners can boost local firms' innovativeness. Traditionally, governments in emerging economies, such as China, Brazil, India and Russia, were mainly focused on trade and inward FDI as mechanisms to promote local technological development. In particular, it has long been recognized that FDI can be an important source for emerging economy firms to learn advanced technologies and management practices. In addition to those mechanisms, the findings suggest that policymakers in emerging economies need to develop policies that enable firms to be open to the external environment through collaboration with foreign partners and organizations. In fact, public policymakers have incorporated incentives for firms to engage in inter-organizational networks during innovation projects. However, these incentives should also recognise the greater importance of international collaborations than interactions with local partners. The policy should thus promote the open innovation model often used by emerging economy firms as found in the current research.

Turkey is in the process of aligning its institutions with those of the European Union. As a consequence, firms are closely following the European technology platforms and project calls of the European Union Seventh Framework Programme, making intensive effort to be partners in these projects. From this standpoint, it is fundamental to enable firms to benefit from these projects. In particular, policy schemes helping Turkish firms to find suitable collaboration partners could be very beneficial for these firms. For instance, policymakers could arrange meeting points where firms from the local context and foreign nations can get know each other and hence, form collaborations. Business innovation and technology centres as well as science parks could support Turkish firms in their network building activity, e.g. Ege University Science and Technology Centre in Izmir helped Vestel Electronics to build relationships with universities from other nations. Consistent with this logic, the results also suggest that policymakers should provide incentives that target the promotion of collaborations with emerging economy partners. This would be beneficial for firms' innovation performance and the home economies in general. In

sum, public policies should help firms find suitable partners from developed and emerging economies, which in turn will positively affect their innovation performance.

5.5 Summary

The research findings that have emerged from this study have been discussed in this chapter. Firstly, the implications of the effects of search strategies on innovation performance from the perspective of emerging economy firms were discussed. The results demonstrate that search breadth and search depth are not effective for explaining innovation performance for Turkish firms. This finding is not in line with the existing literature, which argues that firms' search strategies boost innovation performance (Katila & Ahuja, 2002; Laursen & Salter, 2006; Leiponen & Helfat, 2010; Garriga et al., 2013). However, this outcome supports the view that different firm and environmental level factors hamper emerging economy firms benefiting from external search strategies (Li et al., 2013; West & Boger, 2014; Asakawa et al., 2014; Cruz-Ganzalez et al., 2015). Accordingly, this finding provides evidence that emerging economy firms might leverage external knowledge sources differently from developed economy firms (Li et al., 2013; Asakawa et al., 2014). Secondly, the implications for the impact of different collaboration contexts on the link between search strategies and innovation performance were discussed. The findings indicate that an emerging economy firm with a search breadth strategy benefits from collaboration with partners from emerging economies so as to produce innovative outcomes, whereas one with a search depth strategy does so from having partners from developed economies. These results suggest the potential trade-off across search strategies depending on the collaboration context (Katila, 2002; Zhang & Li, 2010; Laursen, 2012). The findings provide a more nuanced understanding of how collaboration in different settings influences the success of search strategies. In particular, the outcomes indicate that international collaboration plays a crucial role as a contingency factor. The positive interaction between search strategies and international collaboration also helps to explain the unfound relationship between search strategies and innovation performance. That is, the findings demonstrate that

search breadth and search depth do not assure innovation; it is the interaction of external search strategies and collaboration that enables emerging economy firms to produce innovative products.

Thirdly, the implications of the effects of different types of collaboration partners on the relationship between search strategies and different types of innovation performance were discussed. The results indicate that international market-based partners rather than science-based partners increase the effects of search breadth strategy on radical innovation performance. In addition, the results demonstrate that market-based partners do not affect the link between search breadth and incremental innovation performance. Regarding a search depth strategy, the findings also indicate that when an emerging economy firm pursues this whilst collaborating with international science-based partners (from developed economies), it has an impact on radical innovation performance, whereas when such a firm joins up with international market-based partners, this affects incremental innovation performance. These results suggest that different partner types condition the effect of search strategies on radical and incremental innovation performance (Todtling et al., 2009; Chen et al., 2011; Kohler et al., 2012). This research thus advances the understanding of how a specific kind of knowledge influences the effects of search strategies on innovation performance by having involved investigating the nature of partner types. Finally, the practical implications at the managerial and policy level for business managers, particularly those in Turkey, were discussed. The next chapter will conclude the thesis with explanation of the contributions that have been made. In addition, the limitations of this research will be discussed and ideas for further studies put forward.

Chapter 6

Conclusion

In this thesis, the external search strategies and innovation performance relationship has been explored by adopting a contingency approach for emerging economy firms. It has become apparent that by incorporating an international collaboration factor into the external search strategies and innovation performance investigation, this study has achieved the objectives set out in Chapter 1. That is, a contribution has been made to the innovation search literature by providing a theoretical explanation regarding how emerging economy firms effectively search the external environment. Accordingly, this research has provided insights regarding to what extent different characteristics of international collaboration influence the success of search strategies in producing innovative products. Furthermore, the study findings have provided the evidence to allow for all the research inquiries set out in Chapter 1 and 2 to be thoroughly addressed. The objective of this concluding chapter is to synthesize the main findings of the study and draw out their implications for the wider context of strategic management literature, to acknowledge the limitations that the study has had and hence, propose potential future research avenues that can address these. This chapter ends with final remarks.

6.1 Theoretical Contributions

Innovation search literature suggests that contextual factors matter for the success of search strategies, such as the context in terms of country of origin (Chen & Miller, 2007), the context in terms of where the collaboration is conducted (Katila, 2002) and the nature of partner types (Chen et al., 2011; Salge et al., 2013). The reasoning and results support the notion that: (1) emerging economy contexts matter for firms' search strategies; (2) the impact of external search strategies on innovation performance show differences for emerging economy firms; (3) the context of

collaboration influences firms' optimal search strategy choices in order to be innovative; and (4) the impact of breadth and depth of search on different types of innovation performance varies depending on partner types. Accordingly, this research makes theoretical contributions to the literature on innovation search and has implications for absorptive capacity and open innovation as well as the wider literature, including that on international business and emerging economies.

6.1.1 Contributions to Research on Innovation Search

The findings of this research contribute to a better understanding of innovation search, particularly in the context of emerging economy firms. First, this study provides evidence that the unique characteristics of emerging economy firms influence the success of their search strategies in producing innovation. The extant literature has highlighted the importance of search for innovation success from the perspective of developed economy firms (e.g. Katila & Ahuja, 2002; Laursen & Salter, 2006; Leiponen & Helfat, 2010; Garriga et al., 2013). In particular, developed economy firms have strong capabilities and effective resources for searching external environment. Investigating search processes for emerging economy firms has become salient for strategy scholars (Li et al., 2013; Asakawa et al., 2014). Compared to their developed counterparts, these firms are characterised by their limited capabilities and resources in the internal and external environment (Hitt et al., 2000; Mahmood & Mitchell, 2004; Zhang et al., 2010). They typically lag behind in terms of technological knowledge and capabilities relative to firms in developed economies. Additionally, environmental constraints, such as lack of institutional support or environmental volatility, pose challenges for those firms to search the external environment and utilize the knowledge available (Li et al., 2013; Garriga et al., 2013). These differences between developed and emerging economy firms raise the question of whether emerging economy firms benefit from searching the external environment.

Second, the results suggest that emerging economy firms do not benefit from searching the external environment. Therefore, emerging economy firms need to

expand their search scope to be able to access new and novel knowledge essential for innovation success. Accordingly, the results provide evidence that emerging economy firms increase the benefits of their interactions with external knowledge sources through their collaborations. The experience and knowledge they learn from their collaboration partners complement the link between search strategies and innovation performance (Ahuja, 2000; Hagedoorn, 2002; Hagedoorn et al., 2002). This outcome advances the importance of collaboration linkages for nurturing the link between search and innovation performance. In particular, international collaboration plays an important pipeline role that enables emerging economy firms to gain the knowledge provided and increase the success of search strategies. These findings also enhance the understanding of the importance of international knowledge sources by incorporating international collaboration into the framework between search strategies and innovation performance.

Third, the findings also contribute to the understanding of the context specificity of innovation search. The extant literature on innovation search has highlighted the important role of context in firms' search behaviour (Katila, 2002; Zhang & Li, 2010; Laursen, 2012). In particular, previous studies have examined the importance of context by differentiating it across national and international settings (Katila & Ahuja, 2004; Phene et al., 2006). Building on their work, this research has involved investigating the impact of the collaboration context on the success of search strategies. It has distinguished international collaborations based on partners' national contexts, including collaboration with developed economy partners and that with other emerging economy partners (Hitt et al., 2005; Wright et al., 2005; Schmiele, 2012; Jacob et al., 2013). In doing so, this research enhances the understanding of the importance of context specificity of innovation search by suggesting that firms have a trade-off between search breadth and search depth strategies when they collaborate with partners from certain contexts. The results indicate that searching the external environment broadly has a significant impact on innovation performance when emerging economy firms collaborate with partners from other emerging economies. On the other hand, the findings show that searching the external environment deeply has a significant impact on innovation performance when emerging economy firms collaborate with partners from developed economies.

These findings provide evidence to support the argument that firms' search strategies depend upon where they obtain the knowledge (Katila, 2002; Zhang & Li, 2010).

Fourth, this study also contributes to the innovation search literature by examining the effects of collaboration partner types on the link between search strategies and different types of innovation performance. Previous studies have emphasized different contextual factors, such as project types, product complexity, product novelty and industry membership (Laursen & Salter, 2006; Grimpe & Sofka, 2009; Almirall & Casadesus-Masanell, 2010; Salge et al., 2013). In addition to these factors, existing studies on search have also stressed the importance of specific knowledge types (Chen et al., 2011; Laursen, 2011; Kohler et al., 2012). Studies focusing on only breadth and depth do not provide much guidance on which knowledge type to combine in a broad or deep search strategy in relation to boosting firms' radical or incremental innovation performance. Several scholars have drawn attention to market-driven and science-driven search strategies to achieve this (Sofka & Grimpe, 2010; Chen et al., 2011; Kohler et al., 2012). Extending their work, this study adds insights to this literature by showing that international market-based and science-based partners influence the relationship between search strategies and different types of innovation performance. The findings suggest that market-based partners strengthen the link between search breadth and radical innovation performance, but this is not the case regarding incremental innovation performance. In terms of science-based partners, the results show that such partners do not influence the link between search breadth and radical innovation performance. In addition, the results show that science-based partners (from developed economies) influence the relationship between search depth strategy and radical innovation performance, whereas market-based partners affect the link between search depth and incremental innovation performance. These findings also provide evidence to support the argument that innovation search strategies are context specific.

6.1.2 Contributions to Research on Absorptive Capacity

This study contributes to absorptive capacity research by examining firms' ability to acquire knowledge considering the larger context that embeds the external

knowledge. A large body of absorptive capacity literature emphasizes that internal abilities and capabilities of firms, such as R&D capabilities, affect their capacity to benefit from external knowledge sources (e.g. Cohen & Levinthal, 1990; Rosenkopf & Nerkar, 2001; Cassiman & Veugelers, 2006). In addition, firms' abilities to transfer knowledge vary depending on the differences between their nation and that of their partners (Lane et al., 2001; Phene et al., 2006; Lavie & Miller, 2008). This is further explained by the cognitive distance argument, which suggests that differences in institutions and cultures increase distance, but decrease absorption (Nooteboom et al., 2007; Nooteboom, 2009; Bertrand & Mol, 2013). The findings of this research indicate that in collaboration contexts differences in technological development affect firms' abilities to absorb external knowledge sources. When emerging economy firms collaborate with developed economy partners, distances increases and absorption decreases. Thus, the former face challenges when they assimilate knowledge from their developed economy partners. This insight complements the argument of Phene et al. (2006), who contend that a firm's ability to absorb knowledge across international contexts decreases when compared to the source being found locally. In addition, the outcomes of this study also suggest that the ability of firms to acquire knowledge depends on the type (Cohen & Levinthal, 1990; Lane et al., 2006). Consequently, this work advances absorptive capacity research by showing that firms face more difficulties in terms of knowledge transfer when they collaborate with science-based partners relative to market-based ones. That is, when the accessed knowledge is away from firms' own knowledge base, the absorption decreases. Overall, the findings provide evidence to support the argument that differences across national contexts and knowledge types influence absorptive capabilities, i.e. the adoption and implementation of new technologies.

6.1.3 Contributions to Research on Open Innovation

The findings of this research advance understanding of open innovation by suggesting a contingency approach is appropriate for external search strategies. Previous studies on open innovation have highlighted the importance of moderators of the benefits of external search (Huizingh, 2011; West & Bogers, 2014). Extant

research suggests that a contingency approach is needed that focuses on the internal and external context characteristics determining open innovation effectiveness (Huizingh, 2011; Salge et al., 2013). This study enhances the research on open innovation by demonstrating that search strategies are context specific. This research also adds to open innovation studies by focusing on the international knowledge sources which have not been considered in detail (Asakawa et al., 2014). The results support the notion that international collaboration should be included in a broader conception of open innovation, whereby firms take advantage of a variety of external sources of knowledge to create innovations (Chesbrough, 2003, 2006). Additionally, as Dahlander and Gann (2010) note, there have been few systematic attempts to investigate several different forms of openness. This research adds to the literature by looking at both knowledge sources and collaboration. By establishing international collaboration alongside other external knowledge sources for openness, this study lays the foundation for future work that will incorporate a more complete model of the open innovation ecosystem (Dahlander & Gann, 2010; Laursen & Salter, 2014).

6.1.4 Contributions to Research on International Business and Emerging Economies

This research has implications for the wider literature including international business and scholarship on emerging economies. International business studies have addressed firms having different motives for entering into developed economies and emerging economies (Hitt et al., 2005; Wright et al., 2005; Tsang & Yip, 2007; Luo & Tung, 2007; Schmiele, 2012). However, these studies have mostly focused on the reasons for market entry of emerging economy firms to developed economies and vice versa. This study further advances this literature by explaining the nature of the engagement of emerging economy firms with partners from developed economies and with those from other emerging economies. The results show that emerging economy firms gain access to a different form of knowledge when they collaborate with partners from developed economies versus emerging economies. Regarding the former, emerging economy firms look for advanced knowledge and technology,

whereas in the latter case they look for refinements in their products so as to be able to satisfy customer and market needs.

This study also adds new insights to the research on the innovation strategies of emerging economy firms. Previous studies have stressed the importance of external knowledge access for emerging economy firms (e.g. Zhang & Li, 2010; Li et al., 2013). However, research focusing on innovation and learning in emerging economies has mostly examined MNEs operating in emerging economies and the transfer of knowledge between different units (Xu & Meyer, 2013). They have also focused on FDI and export activities to obtain foreign knowledge (Zhang et al., 2010). The results of this study draw attention to the importance of external search and international collaboration for increasing innovation success. In particular, the findings of this research stress the importance of collaborations with external actors for accessing knowledge for emerging economy firms.

6.2 Limitations and Future Research Directions

6.2.1 Theoretical Limitations

Notwithstanding its theoretical and managerial contributions, this research is not without its limitations, which might serve as a starting point for future inquiry. First, given that the sample only included Turkish firms, issues regarding the generalizability of the findings to other settings arise. That is, although context-specific research provides practitioner insights for firms operating in Turkey, it is unclear whether this context imposes a boundary constraint on the conceptual model and findings. In particular, it is important to understand whether only Turkish firms need to form international collaboration to increase innovation success. Accordingly, it is also important to understand whether the trade-off between search strategies based on collaboration context is particular to the Turkey. Additionally, the context of this research is emerging economy firms. This is important since the majority of innovation studies have been undertaken focusing on developed economies and

insights from there are not necessarily transferable. However, this raises the question of what the study findings mean for developed economy firms. They are typically more advanced in terms of technology and market, in particular, not facing the problem of limited absorptive capacity that emerging economy firms do. In addition, at first glance it might be seem that they have little to gain from knowledge embedded in emerging economies. This is not necessarily the case as recent attention on reversed innovation suggests knowledge in emerging economies is different and hence, potentially valuable (Govindarajan & Trimble, 2012). Consequently, whether searching broadly or deeply when firms collaborate with developed and emerging economy partners is more beneficial for the former is subject to further research. Similarly, whether the effect of different partner types on the link between search strategies and different types of innovation performance shows differences for developed economy firms requires further investigation. In sum, empirical analysis using data from other populations and geographical settings is needed to validate and generalize the association between firms' search strategies and different features of international collaboration examined in this work.

Second, prior experience is recognized as central to the development of organizational capabilities including for those emerging economy firms. Experienced firms might benefit from searching broadly when they collaborate with partners from developed economies. Accordingly, those firms might benefit from searching broadly when they interact with international science-based partners. Similarly, this could be the case for firms that have substantial foreign subsidiaries and a high level of international orientation. This raises an interesting research issue: whether emerging economy firms' search strategies start to resemble those of developed economy ones when they become more global and experienced. Another related matter is how the development of entire economies shifts the appropriateness of collaboration and search strategy matches. Turkey is in a process of aligning its institutions to the European Union. Future CIS surveys might enable scholars to explore how this shift manifests itself in the national innovation system and hence, the way Turkish firms have changed their search behaviour.

Third, this research has focused on the limitations of emerging economy firms' abilities when striving to utilize knowledge from different nations effectively. However, the data did not allow for the testing of how distant is the technology that firms source. Future research could investigate whether search for distant technology has an impact on the relationship between the context of collaboration and search. The literature suggests that firms take this into consideration before they decide where to search (Rosenkopf & Almeida, 2003; Tallman & Phene, 2007), i.e. if they try to access remote technology they go to distant, advanced countries. Most likely though, these decisions happen simultaneously and the location of the collaboration might determine the technology path rather than the other way round. Firms might also decide to collaborate with different types of institutions and organizations when they try to access distant technology. Regarding which, research focused institutions, such as universities or laboratories, might be more appropriate for radical innovation, while incremental innovation might benefit more from collaboration with market facing institutions and hence the ability to benefit from customer knowledge. This issue has only been explored for developed economy collaborations and not emerging economy ones owing to no firms collaborating with universities in such contexts and therefore, future research could investigate this issue further.

Fourth, the hypothesized relationships between firms' search strategies and international collaboration so as to be innovative could also be shaped by the form of the collaborations. Partnerships can be based on contractual terms or equity-based joint ventures and the governance modes affect the effective transfer of distant knowledge (Mowery et al., 1996; Hagedoorn, 2002; Van de Vrande et al., 2013). Moreover, depending on the governance of collaborations, firms' level of commitment, degree of integration and learning exhibit differences (Jiang et al., 2010; Lavie et al., 2012). Equity-based governance fosters knowledge integration by enabling firms to work closely, whilst non-equity based governance involves lower levels of coordination. Thus, future studies could develop a measurement covering whether firms collaborate under certain types of contractual partnership. In addition, not only the formal governance mode, but also, relational governance influences the knowledge integration process from international collaborations. Trust and shared value between partners facilitate knowledge integration by increasing efficiency and

enhancing flexibility. Strong ties are characterized by trust as well as shared understanding, and increase the amount of knowledge sharing in established collaborations (Van Wijk et al., 2008). Therefore, it can be important to consider whether each partnership has a strong or weak relationship with firms. A limitation of the framework proposed here is that despite it captured the importance of knowledge sources for search strategies it does not extend to allowing for analysis of the importance of collaborations. Future research should examine this issue by developing several fine-grained items for each type of collaboration.

Fifth, the data did not allow for learning whether firms use collaborations for different objectives (i.e. developing existing technologies or creating new ones). For this study it was assumed that market-based partners provide knowledge about customer preferences and information about the market and technology, whereas science-based partners relate to the discovery of scientific knowledge. However, it would be useful if the objectives of collaborative agreements were known as this would provide a clearer idea of firms' aims behind certain types of collaborations. Moreover, the stage of product development can be influential on firms' decisions to collaborate with certain types of partners while producing radical and incremental innovations (Song & Thieme, 2009). For instance, firms focusing on the later stages of innovation for radical products can benefit from market-based partners to gain market acceptance (Belderbos et al., 2012). Thus, future studies can differentiate innovations depending on their stage so as to have a more fine-grained understanding. Despite these limitations, the results of this study have provided interesting new insights that advance the understanding of the context specificity of search strategies for emerging economy firms.

6.2.2 Methodological Limitations

There are a number of weaknesses owing to the nature of the data used in this research. First, it was cross-sectional in design and hence, it was not possible to construct a panel dataset to account for fixed effects. The design of the study raises concerns of reverse causality and endogeneity. That is, the causal relationship

between search strategies and international collaboration and innovation may differ in ways that have not been captured. It is possible that the direction of causality may be reversed. That is, firms who are better at generating innovations have learned over time to search the external environment broadly and deeply, and/or are effectively utilizing knowledge from different international contexts. However, findings in the extant literature generally support the idea that searching the external environment enhances innovation output rather than the latter attracting the former (Laursen & Salter, 2006; Sidhu et al., 2007; Garriga et al., 2013). Regarding the endogeneity concern, the pattern of results observed is difficult to reconcile with an endogeneity-based theory. For instance, if firms could over time learn that some international contexts are better than others for generating innovations and leverage resources from such contexts accordingly, one would expect to see a positive and significant main effect for such international collaboration (i.e. collaborations with partners from developed economies) on innovation performance. However, a positive association between international collaboration and innovation performance was only observed in conjunction with external search strategies in this research. In addition, in order to minimize this concern, first, the full time lag between independent and dependent variables was used. This mitigated the respondent bias problem and avoided reversed causality. Second, a lagged dependent variable was added into the regression models. While these robustness checks are encouraging, it would be useful to have a longitudinal design and more sources of data so as to be able to assess the direction of the relationship better.

Second, the data did not allow for a distinction between West European and Eastern European countries when constructing the measure of developed economy collaborations. However, as many Eastern European countries are part of the European Union, they are likely to have a common institutional background to those in Western Europe. In addition, many nations that were poor as economic liberalization swept the world in the 1990s are not so today. In the 1990s, scholars could easily have classified Poland as an emergent economy, but today it is a member of European Union (EU) and has one of the highest growth rates in the EU as well as having rapidly increasing incomes. Thus, it would be a mistake to classify Poland or other former Soviet Bloc countries, such as the Czech Republic or

Hungary, as emergent (Bruton, Filatotchev, Si, & Wright, 2013). Recently, Jacob, Belderbos and Gilsing (2013) analysed the drivers for European firms' technology alliance formation with emerging economy firms, in comparison with those for such formation with firms based in developed countries. In their analysis, they also combined Europe (all current Europe-27 countries), the United States and Japan as developed economies. Unfortunately, the data used for the current research were only aggregated for the whole and hence, it was not possible to separate out any countries in Eastern Europe that could not yet be termed as being developed. Consequently, future research could involve performing such an exercise in order to see if the results of the current study hold or vary in some way.

Third, control variables were included in this study in order to account for the international orientation of firms. These variables were whether firms sell in international markets and have foreign ownership, with the results being robust when they are added into the model. However, future studies could further investigate the model by adding other variables to control for the internationalization of firms. In addition, the sample is biased towards larger firms. Even though this helps to show the search pattern of firms with higher capabilities and resources, future research could use a more representative sample for emerging economy contexts by including small and medium sized firms. Moreover, the dependent variables employed in this research are ratio values (new product sales/overall sales), which is because the available data do not include sales values for each individual firm. Thus, future studies using absolute numbers for sales of new products would be useful to confirm the estimations of this study.

6.3 Concluding Remarks

Firms have long tapped different external sources of knowledge to develop new products and thereby gain competitive advantage. They use different search strategies to leverage these knowledge sources and their search strategies are classified in terms of search breadth and search depth. Drawing on these strategies, the outcomes of this research have suggested that the success of search in producing

innovation depends on different factors. In particular, the focus has been on emerging economy firms since they are systematically different from developed economy ones. This led to consideration of the importance of international collaboration for an innovation search framework and to investigate its effects in two different ways. Accordingly, this study first looked at whether the impact of search breadth and search depth strategies on innovation performance shows differences from the perspective of emerging economy firms. Next, whether the context of international collaboration, including collaboration with partners from developed economies and collaboration with those from emerging economies, moderate the link between search strategies and innovation performance was investigated. Subsequently, there was examination of the extent to which the nature of partnership, in this case, international market-based and science-based partners, affects the breadth and depth of search strategies in producing different types of innovation performance, namely, radical or incremental.

In general, the findings have confirmed the notion that the environmental context where a firm is embedded influences the effects of its search strategies on innovation performance. The results have shown that emerging economy firms' search strategies need an ongoing interaction with international collaboration partners to increase the benefits. The empirical evidence has also provided support for the argument that firms make a trade-off across optimal search strategies depending on the context where the international partnership is undertaken. Specifically, it has emerged that search breadth is beneficial when firms collaborate with partners from emerging economies, while search depth is so when firms collaborate with partners from developed ones. Last but not least, the findings have indicated that different types of collaboration partners moderate the relationship between search strategies and different types of innovation performance. In particular, the outcomes suggest that firms with a broad search strategy produce radical innovations when they collaborate with market-based partners rather than science-based partners. The results also suggest that firms searching broadly do not produce incremental innovations when they collaborate with market-based partners. In addition, firms with a search depth strategy produce radical innovations when they collaborate with science-based partners (from developed economies), whereas they produce incremental innovations

when the partners are market-based. In conclusion, the results of the study have stressed that the success of search strategies in producing innovations depends on different contingency factors.

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Appendix 3-1 Innovation Survey Questionnaire (2006-2008)

T.R.
PRIME MINISTRY
TURKISH STATISTICAL
INSTITUTE

2008
INNOVATION SURVEY

TurkStat

General Information;

This survey collects information on your enterprise's innovations and innovation activities between 2006 and 2008 inclusive. The results obtained this innovation study will provide a better understanding of relationship between innovation and economic growth. In addition, decision-makers will have information on science policy, industrial policy, and depending on them in the creation of general economic policy initiatives to create new factors that affect their capacity and will make international comparisons about similar issues.

Confidentiality;

Collected information will only be used in statistical studies and confidentiality was guaranteed with the Statistics Law of Turkey No. 5429. Information can not be used as evidence to make investigation or course of action. This privacy is the legal responsibility of Turkish Statistical Institute.

Methods and Scope

Statistical unit is enterprises with 10 or more persons employed in industry and service sector. Stratified random sample method was used to determine the sample size of study by economic activities and size classes. Reference and observation period were 2008 and 2006-2008 respectively.

Questionnaire shall be filled by a responsible person or administrator for innovation activities and include one or more than one connected units (central and local unit) details.

Questionnaire shall not be filled by accounting or financial consulting firm in the unit.

We kindly request that, questionnaire should be filled in accordance with the above description. We wish you success in your business.

Yours truly,

FOR INFORMATION CALL:

PROVINCE	AREA CODE	TELEPHONE	PROVINCE	AREA CODE	TELEPHONE	PROVINCE	AREA CODE	TELEPHONE
ADANA	322	457 65 56	GAZİANTEP	342	336 94 00	MALATYA	422	323 30 41
ANKARA	312	481 94 00	HATAY	326	216 00 77	MANİSA	236	211 49 94
ANTALYA	242	243 45 60	İSTANBUL	212	258 92 96	NEVŞEHİR	384	212 82 23
BALIKESİR	266	244 99 45	İZMİR	232	483 14 54	SAMSUN	362	431 25 08
BURSA	224	361 75 25	KARS	474	223 26 02	SİİRT	484	223 49 00
DENİZLİ	258	266 65 22	KASTAMONU	366	215 50 92	TRABZON	462	321 57 49
DİYARBAKIR	412	223 80 24	KAYSERİ	352	233 42 32	VAN	432	214 25 11
EDİRNE	284	225 31 47	KOCAELİ	262	321 52 86	ZONGULDAK	372	253 79 70
ERZURUM	442	235 20 15	KONYA	332	353 25 60			

Industry and Business Statistics Departmant **web page** : http://www.tuik.gov.tr
0 (312) 410 04 12 - 410 04 15 - 410 04 19 **e-mail** : biltek@tuik.gov.tr

Legal title Name:

Business Register Number (This will be filled by TurkStat)

1

Go to Page 2

SECTION 1. General information about the enterprise(*)

(*) Enterprise: Enterprise is an organization producing commodity and rendering services by exploiting its first level of authority on decision making. Enterprise may have one or more activities. The relationship between an enterprise and an establishment may be defined as follows. An enterprise corresponds to the combination of local units. In case there is no establishment associated with an enterprise, the establishment and the enterprise refer to the same organizational structure.

Establishment (local unit): It is a unit which is discharged with the activities pertaining to goods and services or a part of these activities in a geographically defined location. It is a settled part of an enterprise such as bureau, store, buffet, factory, workshop, mine, construction yard, hotel, restaurant, cafe, school, hospital etc. An establishment carries out the economic activity in this place on behalf of the associated enterprise through employing one or more persons as full-time or part-time employees. The centre of an enterprise as well as each of the units which fulfill the auxiliary activities also represents one establishment.

1.1 What is your legal title?

1.2 In 2008, was your enterprise part of an enterprise group?

Yes 1 → No 2 → Go to question 1.3

In which country is the head office of your group located and name of the group?

1. Name of group
2. Country

1.3 How is the distribution of your enterprise capital?

1. Share of domestic capital (%)	
2. Share of foreign capital (%)	
Total	100

1.4 What was your enterprise's total turnover for 2006 and 2008?

Total turnover for 2006 (Except VAT)	YTL
Total turnover for 2008 (Except VAT)	YTL

1.5 What was your enterprise's total number of employees in 2006 and 2008?

Months	Number of employees (Owners, shareholders and unpaid family workers, exclude shareholders not working actively) 2006	2008
1. February		
2. May		
3. August		
4. November		
5. TOTAL (sum of the 4 months above)		
6. AVERAGE = (TOTAL / 4)		

EMPLOYEES :
The number of employees is defined as those persons who work for an employer and who have a contract of employment and receive compensation in the form of wages, salaries, fees, quantities, piecework pay or renumaration in kind. The number of employees includes part time workers, seasonal workers, persons on strike or a short term leave, but persons on long-term leave are excluded. Meanwhile voluntary workers are not included.
OWNERS and PARTNERS:
It consists of owners and partners who spend most of the working time in an individual proprietorship, simple partnership, general partnership or limited liability company. If owners and partners receive wages and salaries for their labour, they are included in the employee category

UNPAID FAMILY WORKERS:
It includes persons who live with the owner of unit or regularly work for the unit but who have not a contract and not receive wages and salaries in kind. Persons who work as a permanent staff in other place of employment are excluded.

1.6 In which geographic markets did your enterprise sell goods and/or services during the three years 2006 to 2008? (Thick all that apply)

Local / regional within Turkey	1
National (other regions of Turkey)	2
Other European Union (EU), EFTA, or EU candidate countries*	3
All other countries	4

European Union (EU), EFTA, or EU candidate countries : Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Spain, Sweden and the United Kingdom.

1.7 Which of these geographic areas was your largest market in terms of turnover between 2006 and 2008? (Give corresponding letter)

Go to Page 3

SECTION 2. Product (good or service) innovation

Product innovation: A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

Of product innovations (new or significantly improved / improved goods or services) you for your new venture is important. Whether you are new to the sector or market is not important. Innovation as the first developed by other initiatives that also does not matter.

New products are goods and services that differ significantly in their characteristics or intended uses from products previously produced by the firm. The first microprocessors and digital cameras were examples of new products using new technologies. Significant improvements to existing products can occur through changes in materials, components and other characteristics that enhance performance.The use of breathable fabrics in clothing is an example of a product innovation involving the use of new materials that improves the performance of the product.

Product innovations in services can include significant improvements in how they are provided (for example, in terms of their efficiency or speed), the addition of new functions or characteristics to existing services, or the introduction of entirely new services. An example of this, on the Internet, product information and various support functions, such as new services at no charge to customers can be offered web sites creation, highly improved the speed and ease of use brings internet banking services or customers rent access to tools that are convenient for home delivery, home buying services further, such as significant improvements be given.

Product innovation, small-scale changes or improvements, routine upgrades (upgrade), a regular seasonal changes (such as apparel model), goods or services function, the use of prescribed or technical characteristics do not change the design changes, other initiatives of the purchased goods or services being sold again, not included.

2.1 During the three years 2006 to 2008, did your enterprise introduce new or significantly improved goods or services?

Yes ☐ 1 → No ☐ 2 → **Go to Section 3.**

(Thick all that apply)

New or significantly improved goods	☐ 1
New or significantly improved services	☐ 2

2.2 Who developed these product innovations? (Select the most appropriate option only)

Mainly your enterprise or enterprise group	☐ 1
Mainly your enterprise together with other enterprises or institutions	☐ 2
Mainly other enterprises or institutions	☐ 3

2.3 Were any of your product innovations during the three years 2006 to 2008? (Select the most appropriate option only)

2.3.1. New to your market?	Your enterprise introduced a new or significantly improved good or service onto your market before your competitors (it may have already been available in other markets)	☐ 1
2.3.2. Only new to your firm?	Your enterprise introduced a new or significantly improved good or service that was already available from your competitors in your market	☐ 2

2.4 Please give the percentage of your total turnover in 2008 from:

	%
New or significantly improved goods and services introduced during 2006 to 2008 that were new to your market	☐☐☐,☐
New or significantly improved goods and services introduced during 2006 to 2008 that were only new to your firm	☐☐☐,☐
Goods and services that were unchanged or only marginally modified during 2006 to 2008 (include the resale of new goods or services purchased from other enterprises)	☐☐☐,☐
Total turnover in 2008	1 0 0 , 0

Go to Page 4

SECTION 3. Process Innovation

A process innovation is the implementation of a new or significantly improved production or delivery method.

Process of innovation (new or significantly improved / improved) you for your new venture is important. Whether you are new to the sector or market is not important. Innovation as the first developed by other initiatives that also does not matter. Completely new organizational structure that occur in the innovation process are not counted.

The innovations in production methods for the implementation of a production line of new automation equipment, automatic packaging and products to develop computer-aided design realization can be given as examples.

The innovations in the methods for distribution, supply chain product to follow the barcode application, transport of the global positioning system (GPS) and monitoring can be given as examples.

Support for innovation activities, is applied to determine the most appropriate delivery route software, purchasing, accounting and maintenance systems applied to new or improved software can be given as examples.

3.1 During the three years 2006 to 2008, did your enterprise introduce process innovation?

Yes ☐ 1 → **No** ☐ 2 → **Go to the section 4.**

Which of the following process was applied to innovation? (Thick all that apply.)

New or significantly improved methods of manufacturing or producing goods or services	☐ 1
New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services	☐ 2
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing	☐ 3

3.2 Who developed these process innovations? (Select the most appropriate option only)

Mainly your enterprise or enterprise group	☐ 1
Mainly your enterprise together with other enterprises or institutions	☐ 2
Mainly other enterprises or institutions	☐ 3

3.3 Were any of your process innovations introduced between 2006 and 2008 new to your market?

Yes	☐ 1
No	☐ 2
Do not know	☐ 3

SECTION 4. Ongoing or abandoned innovation activities for process and product innovations

Innovation activities include the acquisition of machinery, equipment, software, and licenses; engineering and development work, industrial design, training, marketing and R&D when they are specifically undertaken to develop and/or implement a product or process innovation. Also include basic R&D as an innovation activity even when not related to a product and/or process innovation.

4.1 During 2006 to 2008, did your enterprise have any innovation activities that did not result in a product or process innovation because the activities were:

	Yes	No
Abandoned or suspended before completion	☐ 1	☐ 2
Still ongoing at the end of the 2008	☐ 1	☐ 2

If no to <u>all options</u> in questions 2.1, 3.1, and 4.1, go to section 8.
Otherwise, go to section 5.

SECTION 5. Innovation activities and expenditures for process and product innovations

5.1 During the three years 2006 to 2008, did your enterprise engage in the following innovation activities: (Include abondened innovation activities)

	Yes	No
5.1.1 In-house R&D Creative work undertaken within your enterprise to increase the stock of knowledge for developing new and improved products and processes (include software development in-house that meets this requirement)	1	2 → Go to question 5.1.2
5.1.1.1. If yes, did your enterprise perform R&D during 2006 to 2008:		
Continuously	1	
Occasionally	2	
5.1.2 External R&D Same activities as above, but performed by other enterprises (including other enterprises or subsidiaries within your group) or by public or private research organisations and purchased by your enterprise	1	2
5.1.3 Acquisition of machinery, equipment and software for product or process innovation Acquisition of advanced machinery, equipment and computer hardware or software to produce new or significantly improved products and processes	1	2
5.1.4 Acquisition of external knowledge Purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other enterprises or organisations	1	2
5.1.5 Training for innovative activities Internal or external training for your personnel specifically for the development and/or introduction of new or significantly improved products and processes	1	2
5.1.6 Market introduction of innovations Activities for the market introduction of your new or significantly improved goods and services, including market research and launch advertising	1	2
5.1.7 Other Other activities to implement new or significantly improved products and processes such as feasibility studies, testing, routine software development, tooling up, industrial engineering, etc.	1	2

5.2 Please estimate the amount of expenditure for each of the following four innovation activities in 2008 only (Include personnel and related costs)

	Expenditure in 2008 (Million / Thousand)	
5.2.1 In-house R&D (Include capital expenditures on buildings and equipment specifically for R&D)		YTL
5.2.2 Purchase of external R&D		YTL
5.2.3 Acquisition of machinery, equipment and software (Exclude expenditures on equipment for R&D)		YTL
5.2.4 Acquisition of external knowledge (Patents, licences, know-how, etc)		YTL
Total (5.2.1+5.2.2+5.2.3+5.2.4)		YTL

5.3 During the three years 2006 to 2008, did your enterprise receive any public financial support for innovation activities from the following levels of government? (Include financial support via tax credits or deductions, grants, subsidised loans, and loan guarantees. Exclude research and other innovation activities conducted entirely for the public sector under contract.)

	Yes	No
5.3.1 Central public institutions / organizations and Techonolgy Development Foundation of Turkey (The Scientific and Technological Research Council of Turkey, Technology and Inovation Funding Programs Directorate, Small and Medium Enterprises Development Organization, Republic of Turkey Ministry of Finance, Undersecreteria of Treasury etc.)	1	2
5.3.2 Local or regional public agencies (municipalities, governorships, etc.)	1	2
5.3.3 European Union (EU) institutions	1	2
5.3.3.1 If yes, did your enterprise participate in the EU 6th or 7th Framework Programme for Research and Technical Development?	1	2

SECTION 6. Sources of information and co-operation for innovation activities

6.1 During the three years 2006 to 2008, how important to your enterprise's innovation activities were each of the following information sources? (Please identify information sources that provided information for new innovation projects or contributed to the completion of existing innovation

Information source	Degree of importance: High	Medium	Low	Not used
Internal				
6.1.1 Within your enterprise or enterprise group	1	2	3	4
Market sources				
6.1.2 Suppliers of equipment, materials, components, or	1	2	3	4
6.1.3 Clients or customers	1	2	3	4
6.1.4 Competitors or other enterprises in your sector	1	2	3	4
6.1.5 Consultants, commercial labs, or private R&D institutes	1	2	3	4
Institutional sources				
6.1.6 Universities or other higher education institutions	1	2	3	4
6.1.7 Government or public research institutes	1	2	3	4
Other sources				
6.1.8 Conferences, trade fairs, exhibitions	1	2	3	4
6.1.9 Scientific journals and trade/technical publications	1	2	3	4
6.1.10 Professional and industry associations	1	2	3	4

6.2 During the three years 2006 to 2008, did your enterprise co-operate on any of your innovation activities with other enterprises or institutions?

(Innovation co-operation is active participation with other enterprises or non-commercial institutions on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.)

Yes 1 No 2 → Please go to question 7.

6.3 Please indicate the type of innovation co-operation partner by location?

Type of co-operation partner	From Turkey	Other Europe*	United States	China and India	All Other Countries
6.3.1 Other enterprises within your enterprise group	1	2	3	4	5
6.3.2 Suppliers of equipment, materials, components, or software	1	2	3	4	5
6.3.3 Clients or customers	1	2	3	4	5
6.3.4 Competitors or other enterprises in your sector	1	2	3	4	5
6.3.5 Consultants, commercial labs, or private R&D institutes	1	2	3	4	5
6.3.6 Universities or other higher education institutions	1	2	3	4	5
6.3.7 Government or public research institutes	1	2	3	4	5

*: Include the following European Union (EU) countries, EFTA, or EU candidate countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech, Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.

6.4 Which type of co-operation partner did you find the most valuable for your enterprise's innovation activities?

Have the greatest importance to the sequence number of the person or organization enter 6 . 3 .

SECTİON 7. Innovation objectives during 2006-2008

7.1 How important were each of the following objectives for your activities to develop product (good or service) or process innovations between 2006 and 2008? (If your enterprise had several projects for product and process innovations, make an overall evaluation)

	Observed degree of influence			
	High	Medium	Low	Not relevant
7.1.1 Increase range of goods or services	1	2	3	4
7.1.2 Replace outdated products or processes	1	2	3	4
7.1.3 Enter new markets	1	2	3	4
7.1.4 Increase market share	1	2	3	4
7.1.5 Improve quality of goods or services	1	2	3	4
7.1.6 Improve flexibility for producing goods or services	1	2	3	4
7.1.7 Increase capacity for producing goods or services	1	2	3	4
7.1.8 Improve health and safety	1	2	3	4
7.1.9 Reduce labour costs per unit output	1	2	3	4

SECTİON 8. Organisational innovation

Organisational innovation: The initiative's use of information, goods and service quality or work flow in order to increase the efficiency of structure or management company in the form of innovation or significant change is made. Mergers with other initiatives, other initiatives, acquisitions, unless accompanied by a new method of organizational changes in management strategy, organizational innovation are not counted.

8.1 During the three years 2006 to 2008, did your enterprise introduce?

Yes 1 → No 2 → **Please go to section 9.**

Which of the following organizations applied innovation? (Thick all that apply)

	Yes	No
8.1.1 New business practices for organising procedures (i.e. supply chain management, business reengineering, knowledge management, lean production, quality management, etc)	1	2
8.1.2 New methods of organising work responsibilities and decision making (i.e. first use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc)	1	2
8.1.3 New methods of organising external relations with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc)	1	2

8.2 How important were each of the following objectives for your enterprise's organisational innovations introduced between 2006 and 2008 inclusive? (If your enterprise introduced several organisational innovations, make an overall evaluation)

	Observed degree of influence			
	High	Medium	Low	Not relevant
8.2.1 Reduce time to respond to customer or supplier needs	1	2	3	4
8.2.2. Improve ability to develop new products or processes	1	2	3	4
8.2.3 Improve quality of your goods or services	1	2	3	4
8.2.4 Reduce costs per unit output	1	2	3	4
8.2.5 Improve communication or information sharing within your enterprise or with other enterprises or institutions	1	2	3	4

SECTION 9. Marketing innovation

Marketing innovation: Initiative significantly different from your existing marketing methods and previously unused becoming a new marketing concept and strategy is the implementation. Product design, packaging, presentation, or require significant changes to pricing. The seasonal marketing methods, regular and other routine changes are not included.

9.1 During the three years 2006 to 2008, did your enterprise introduce?

Yes 1 → No 2 → Survey is over.

Which of the following marketing innovations have been implemented?

(If your enterprise introduced several marketing innovations, make an overall evaluation.)

9.1.1 Significant changes to the aesthetic design or packaging of a good or service (exclude changes that alter the product's functional or user characteristics – these are product innovations)	1	2
9.1.2 New media or techniques for product promotion (i.e. the first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc)	1	2
9.1.3 New methods for product placement or sales channels (i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)	1	2
9.1.4 New methods of pricing goods or services (i.e. first time use of variable pricing by demand, discount systems, etc)	1	2

9.2 How important were each of the following objectives for your enterprise's marketing innovations introduced between 2006 and 2008 inclusive? If your enterprise introduced several marketing innovations, make an overall evaluation.)

	Observed degree of influence			
	High	Medium	Low	Not relevant
9.2.1 Increase or maintain market share	1	2	3	4
9.2.2 Introduce products to new customer groups	1	2	3	4
9.2.3 Introduce products to new geographic markets	1	2	3	4

	CONTACT PERSON	SURVEY TAKER	DATA ENRTY PERSON
Name			
Date			
Job title			
Phone			
Web Address	http://		
E-mail			
Signiture			

Appendix 4-1 Results of Tobit Regression Analysis for Moderation Effects of Context of Collaboration (all interaction effects)

	Overall Innovation Performance	**Radical Innovation**	**Incremental Innovation**
Control variables			
Business group	-.0243	-.0685*	.0187
	(.043)	(.040)	(.039)
Process innovation	.1436***	.0934*	.1432***
	(.054)	(.049)	(.051)
Product innovation (lagged)	.2282***	.1949***	.1599***
	(.058)	(.054)	(.056)
Continuous R&D	.1500***	.1139***	.0950**
	(.045)	(.041)	(.041)
Firm size (logs)	.0084	.0319*	-.0045
	(.017)	(.017)	(.015)
Predictors			
Search breadth (residuals)	-.0039	-.0128	.0083
	(.010)	(.009)	(.010)
Developed economy collaboration	.2746	.3946*	-.1142
	(.221)	(.205)	(.194)
Emerging economy collaboration	.0728	-.1055	.3254
	(.404)	(.307)	(.399)
Search depth (residuals)	-.0116	-.0116	-.0095
	(.019)	(.017)	(.017)
Search breadth squared	.0030	.0003	.0032
	(.003)	(.003)	(.003)
Search depth squared	.0024	.0026	.0024
	(.003)	(.003)	(.003)
Interactions			
Breadth X Developed economy	.1172	.1511	-.0964
	(.147)	(.137)	(.104)
Breadth X Emerging economy **(H3)**	**.6295*** **	**.5038** **	**.5086** **
	(.219)	**(.218)**	**(.238)**
Depth X Developed economy **(H4)**	**.1596** **	.0977	**.1580** **
	(.079)	(.068)	**(.068)**
Depth X Emerging economy	-.0080	.0959	-.2940
	(.261)	(.199)	(.244)
Industry dummies (18)	Yes	Yes	Yes
_cons	-.4428	-.6984**	-.4849**
N	659	659	659
No. of obs. uncensored	358	267	251
Pseudo R2	0.1289	0.1358	0.1163
Log likelihood	-427.265	-334.844	-329.183

Note: *p≤ 0.1; **p≤ 0.05; ***p≤ 0.01.