Innovation and firm's interaction behaviour: Is innovation associated with local or non-local interactions? An investigation of clustered micro and small technology-based firms in Brazil.

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"In an increasingly knowledge-driven global economy, sustained economic growth is inextricably linked to the ability to innovate successfully……It is important to remember that innovation is not the sole preserve of large high-tech firms and research laboratories, but it is simply the application of knowledge in order to do things better, more quickly, more economically and more efficiently." (Micheál Martin, Ireland's Minister for Enterprise, Trade and Employment, 2006)

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Abstract

The changes in the nature of the global economy in the last 30 years have increased the focus on the role of innovation directly affecting competitiveness of organizations and countries. These changes have provoked the need for new strategies to enable companies to compete with each other in a dynamic and globalized market. Academics from different disciplines such as economic geography, business management and sociology have attempted to explain the gains in competitiveness through innovation. The great majority seem to agree that innovation depends on many factors that include location and network-based environments. From the spatial perspective, previous research shows that innovation seems to be influenced by locational factors which in essence, due to geographic proximity, tend to facilitate local relational linkages impacting the firm's innovation activities. In this context, this thesis focuses on Brazilian clustered micro and small technology-based firms and investigates the extent to which innovation is associated with local or non-local interactions. The results of this study reveal that innovation is not a solitary phenomenon restricted to the firm itself. Innovation seems to be an interactive phenomenon where geographic distance does not seem to be a problem but both local and non-local interactions are important to the development of innovation activities. In fact, the empirical evidence suggests that innovation arises in many contexts involving both local and non-local interactions. According to this study, the general level of interactivity does not seem to be determined by the geographic scope of the relational linkages, but by the quality and perception of gains or benefits of the innovation sources.

Key Words: innovation, local interaction, spatial agglomeration, geographic proximity and micro and small sized firms.

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List of abbreviations and acronyms

BA	Business Arrangement
BNDES	Brazilian Development Bank
CI	Campinas Incamp Enterprises
CIATEC	Campinas High Technology Pole Management Unit
CIS	Community Innovation Survey
CSC	Campinas Softex and Ciatec Enterprises
EUROSTAT	European Statistical Office
FINEP	Research and Projects Financing Agency
GCR	Global Competitive Report
GDP	Gross Domestic Product
GCI	Global Competitive Index
IBGE	Brazilian Institute of Geography and Statistics
ICT	Information and Communication Technology
INCAMP	Technology-based Enterprises Incubation Agency
LBA	Local Business Arrangement
MIT	Massachusetts Institute of Technology
MSE	Micro and Small Enterprises
NGPD	Porto Digital Management Unit
OECD	Organization for Economic Co-operation and Development
PINTEC	Innovation and Technology Survey
R&D	Research and Development
RPD	Recife Porto Digital Enterprises
RQ	Research Question

SEBRAE	Brazilian Service of Support for Micro and Small Sized Firms
SME	Small and Medium-sized Enterprises
SOFTEX	Brazilian Software Enterprise Organization
UNICAMP	University of Campinas
USA	United States of America
WEF	World Economic Forum

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CHAPTER 1

INTRODUCTION

This research is the culmination of intense work over the last three years and approaches one of the most important themes in the business literature in this century: innovation. Innovation is a multifaceted theme related to many issues such as competitiveness, organizational practices and networking as well as local, regional and country economic development and globalization.

The changes in the nature of the global economy in the last 30 years have increased the focus on the role of innovation directly affecting competitiveness of organizations and countries. A new paradigm or model of competitiveness based on global market expansion, trade liberalisation, intensive international flows of goods, capital and information as well as new knowledge and advanced technologies have provoked changes in how companies compete with each other and, how regions and countries experience growth and decline in the global arena (Rothwell, 1994, Porter, 1998b; OECD, 1996 and 2000 and Svetina and Prodan, 2008). So, to cope with so many changes or to prevent collapses, companies, in particular, have promoted innovation initiatives to compete in such a dynamic and globalized market. In this economic paradigm, the long term capability of firms to prosper and gain competitive advantage is based on the continuous improvement of innovation performance, production flexibility, and adaptability of organizational frontiers (Best, 1990).

In this new economic scenario, the increase of innovation initiatives plays a central role at the heart of economic changes, keeping economies moving forward. Innovation is a broad and complex concept and may allow many interpretations. To Schumpeter (1979) innovation is the mechanism of introduction into the market of a new product, process or service. To Motta (1989), it is the outcome of the creative process. To Tidd, Bessant and Pavitt (2001), innovation is a combination of knowledge, experiences and abilities

to create new products, process and services. However, these different definitions share a common aspect that is the capacity of the firms to create and develop something new.

Since the 1990's, innovation became a buzzword and it is the favourite target of many scholars. Academics such as Granovetter (1973 and 1983), Oliver (1990), Lundvall (1992), Freeman (1995), Gray (1996), Powell, Kenneth and Laurel (1996), Edquist (1997), Rosenfeld (1997), Davenport (1998), Porter (1998a, 1998b, 1998c and 1998d), Castell (1999), Longhi and Keeble (2000), Ahuja (2000), Simmie (2004) and Malmberg and Power (2005) have written about the theme of innovation in accordance to their field of specialization. These authors argue that innovation depends on many factors such as location, infrastructure, legal environment and more recently on networks, which tend to facilitate the sharing of knowledge, technologies and information leading to the increase of the development of innovation.

Scholars from the field of economic geography, for instance, use to argue that location and spatial agglomerations provide the ideal environment able to foster innovation due to the increase of interactions favoured by the geographic proximity of actors. The sociologists, on the other hand, emphasize the benefits and advantages of networked environments which facilitate the exchange of knowledge, experiences and technologies able to impact the development of innovation activities.

Other scholars, such as Michael Porter, tried to explain countries' gain in competitiveness through firms' improvement of innovativeness. He suggested that the generation of competitive advantage comes through innovation and differentiation and clusters provide the ideal environment to booster innovation; therefore, firms within such agglomeration are more likely to be innovative.

Porter's views (Porter 1998a, 1998b, 1998c and 1998d) on competitiveness had a strong influence on cluster policies around the world, especially in Europe and USA. According to Porter's type view, location and spatial agglomerations such as clusters generate competitive advantage. Location provides conditions (i.e. infrastructure, government incentives, public policies) to stimulate new innovation initiatives and

clusters, due to geographic proximity, facilitate the sharing of information, knowledge and new technologies able to increase firms' levels of innovation activities.

So, this research focuses on the examination of the importance of local interactions to the development of firm's innovation activities, in particular, it examines if the relation of interaction behaviours and innovation performance of clustered firms are still valid. In practice, the theorization of the innovation process as regards these factors needs to be revised as most of the important studies on the impact of these factors on firm's innovation initiatives are dated from the 1990's.

In this new and dynamic environment of so many technology changes, the final outcome may indicate whether theories formulated in the past about the role of geographic proximity and local interactions within the context of spatial agglomerations are still vital for the development of firm's innovation activities.

Objectively, this study aims to approach the theme of innovation focusing on the examination of the relation between interaction behaviour and innovation performance of firms within spatial agglomerations mainly. In other words, the aim is to examine whether interactions in that particular context effectively impact or influence the development of innovation initiatives. Additionally, this study also identifies problems hampering interaction and innovation processes and respondents' perceptions of the importance of: networking, clustering and different economic agents to the development of innovation initiatives.

In general, this research investigates both organizations and entrepreneurs. From these perspectives, the purpose of this study is not solely to learn about the impact interactions within spatial agglomerations might have on firms' innovativeness or to capture respondents' perceptions of the importance of networking to the development of innovation activities, but to become a critical piece of study for entrepreneurs, government, policy makers and other stakeholders interested in the development of innovation initiatives. Finally, the outcome of this research shall provide government,

institutions, universities, research centres and others, with important clues about the development of sustained policies based on competitiveness and innovation.

1.1 Stimulus for this research

The discussion that the innovation phenomenon is a multifaceted phenomenon and that it is strongly related to the economic context as well as to a wide variety of factors has accelerated in the past twenty years. At the same time, the acceleration of technological changes has directly impacted economic growth and created an environment where innovation is crucial to keep economies moving forward. Thus, the heavy influence of innovation on economic growth has caught the attention of this researcher to investigate innovation in Brazil.

All these considerations are results of years of this researcher's professional and academic experience. Over a period of almost twenty five years, the author of the current study accumulated experience in the business and education sectors and always has been particularly interested in issues related to micro and small sized firms (internationalization, competitiveness and innovativeness of small sized firms). For five years, this researcher travelled around the country as a business adviser and facilitator for the Brazilian Service of Support for Micro and Small Sized Firms (SEBRAE). The SEBRAE's main objectives are as follows: to encourage entrepreneurship, to stimulate the establishment of new micro and small sized firms, to promote interaction relationships among small firms and between firms and government institutions, to organize local business agglomerations able to facilitate firms to get advantages from geographic proximity, to facilitate the internationalization of small firms and to collaborate with the improvement of the competitiveness of Brazilian firms in the domestic and global markets.

During that time, this researcher mapped many difficulties and barriers faced by small businesses. Those difficulties therefore have motivated this author to investigate strategic alternatives to overcome size disadvantages. One of the alternatives which

instigated this author to perform this investigation was the SEBRAE's strategy to stimulate small firms to locate their business inside local business arrangements. According to SEBRAE, spatial business agglomerations were most appropriate for micro and small firms to overcome size difficulties and to gain competitive advantages. SEBRAE believes that geographic proximity facilitates interactions between firms and other economic agents, creating a local innovation system able to stimulate the overall improvement of the level of firms' innovativeness. To this author, however, this alternative was very simplistic and did not reflect the complexity of difficulties faced by micro and small firms in the country. So, the professional background and the academic experience as a lecturer in higher education institutions in different regions in Brazil contributed to the formation of a solid understanding of the problems faced by the country to increase the innovation capacity of Brazilian firms; therefore, this was the main motivation driving this researcher to perform the current study.

1.2 THESIS STRUCTURE

Aiming to give a general perspective of this study, this section presents the structure of the current thesis. Chapter 1 introduces the main theme of this thesis, identifies the research problem and objectives and the main stimulus for this research. Chapter 2 provides theoretical references and the academic foundation for this study. This researcher investigates important national and international bibliographic references, case studies and surveys about the main issues covered by this study. In the third chapter, this researcher outlines the methodological principles and methods of this study. It highlights the research question and objectives, conceptual framework, the research purpose and design as well as describing the data analysis procedures. Chapter 4 presents an overview of the economic and innovation landscape in Brazil as well as introduces the main study areas, the choices of the sampling population and a descriptive approach of the selected areas for investigation. The fifth chapter describes in detail the results of the field investigation. This description involves many aspects posed in the investigation such as the interaction behaviour and innovation performance of firms, problems hampering interaction and innovation processes and entrepreneurs' perceptions about the importance of networking, spatial agglomerations and innovation

agents for innovation activities. Chapter 6 critically discusses the results presented in the previous chapter in relation to theoretical references posed in the literature and specialized publications. Other sources such as innovation surveys are also used to discuss some empirical evidence presented in this investigation. Finally, Chapter 7 combines the topics covered by this study to present the conclusions and to answer the research questions. Also, in this chapter, the researcher describes the main limitations of this research and provides suggestions for future studies as a follow-up of this investigation.

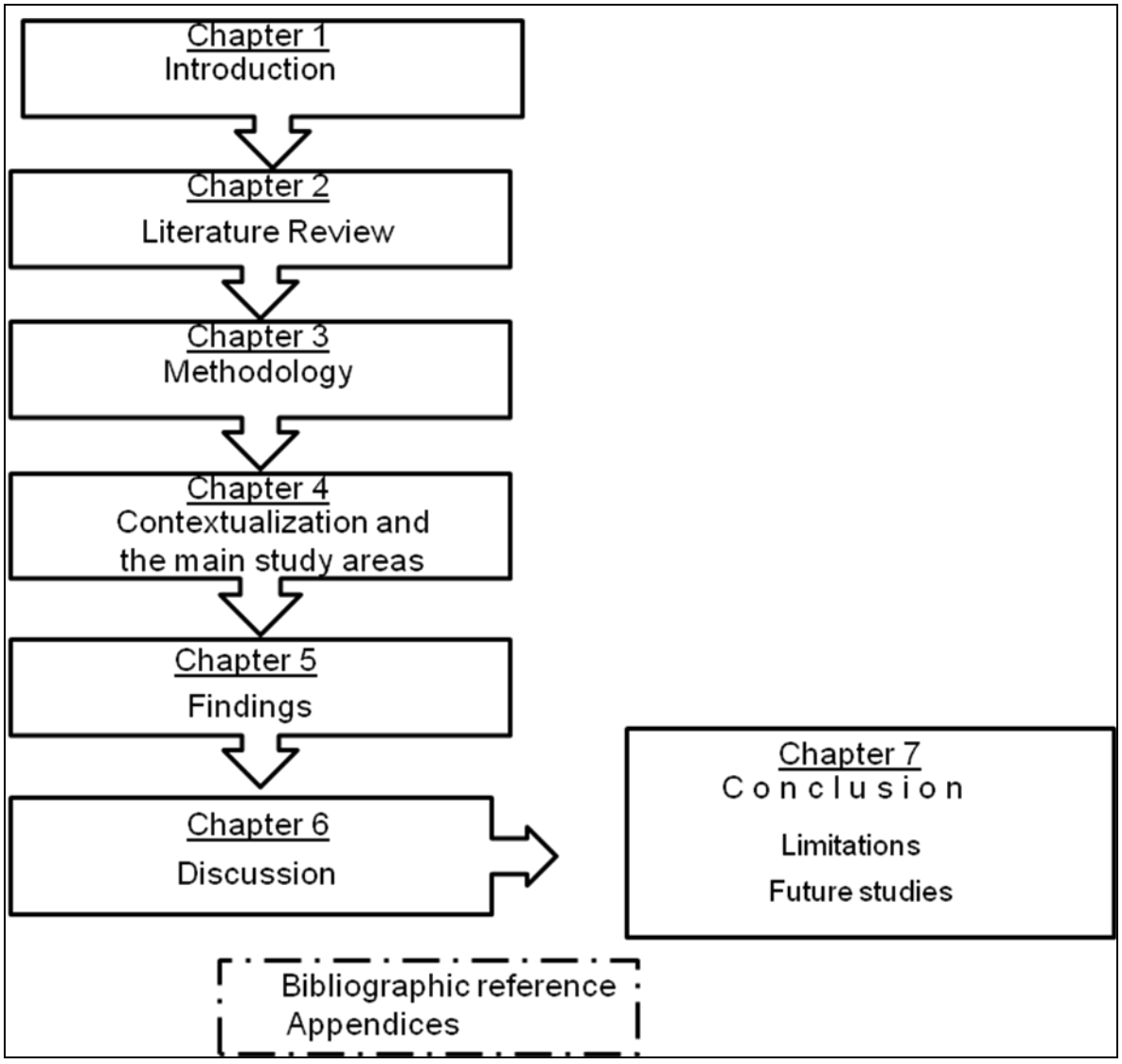

Figure 1.1 **Thesis structure** [Source: current study]

CHAPTER 2

ECONOMIC, SOCIAL, BUSINESS MANAGEMENT AND SPATIAL PERSPECTIVES ON INNOVATION

This chapter provides the academic grounding and a review of some national and international literature for this research. The core discussion in this chapter is about the innovation phenomenon and its relationship (not apparently related) with three other disciplines: i) economics - from the historical to contemporary perspectives; ii) business sociology, through the understanding of the business networking process and the way firms access innovation inputs such as new knowledge and technologies able to improve their innovation capabilities and iii) business management and entrepreneurship, focusing on innovation as an organizational strategy, the entrepreneurship aspect of innovation and the important role of the entrepreneurs in the decision making process of the innovation strategy, in particular, in the micro and small sized firms and iv) spatial geography and territoriality - as innovation happens inside firms and those firms are embedded in a spatial context, this investigation examines some of the main theories about territorial business agglomeration models, where geographic proximity may or may not be crucial for the development of firm's innovation activities.

Innovation seems to be a complex and multidisciplinary phenomenon that can hardly be explained by a single family of authors or within a single knowledge field. So, under this circumstance, the challenge is to explore a set of existing literature, from some different knowledge fields and connecting them to the main theme covered by this research. The central discussion relates innovation to the business strategy: firms need to innovate in order to survive in the domestic and global environments; so, in this context, innovation is linked to firm's competitiveness locally as well as internationally. So, despite this, this is a general and broad perspective of study, the focus of this investigation is to understand how clustered firms, in particular micro and small sized firms, manage their network of partners inside and outside the cluster in order to

effectively integrate firm's needs to new sources of innovation able to promote and sustain a competitive advantage strategy through innovation.

Setting this scene, in the academic literature there are many theories from different knowledge areas such as economics, sociology and business management able to explain innovation and most of them explain it from its own perspective. This chapter addresses this issue from a multidisciplinary perspective and investigates how existing academic literature explains how business networking from a local dimension affects firm's innovation process. So, as innovation happens inside firms and those firms are embedded in a spatial context, this investigation examines some of the main theories about territorial business agglomeration models, in particular, the cluster model of industrial agglomeration, where geographic proximity seems to be a key issue and may or may not be crucial for the development of firm's innovation activities.

In Section I, this researcher describes some innovation theories from the historical to the contemporary approaches covering themes such as economics of innovation and knowledge-based economy; Section II considers the sociological perspective of innovation and investigates some literature on the social-network model; Section III approaches the geographic perspective of the innovation phenomenon introducing some concepts of territorial innovation models such as innovative milieux, new industrial spaces and spatial clusters of innovation as well as some relatively new issues such as local buzz and global pipelines. The aim of this Section is not to have an in depth discussion on each of these models or to establish any comparison pattern between them, but to present them as part of the broader issue of constructing the best relationship between the firm and the external environment. At last, in Section IV, this researcher discusses some theories about the relationship between innovation and business management, entrepreneurship, and the influence of the entrepreneur on the business innovation performance, specifically considering the micro and small sized firm context. The last Section is dedicated to the Chapter Summary (final considerations and critiques).

2.1 Economics perspective on innovation: origin (economics), history, evolution and theoretical Foundation

Over the last few decades, there has been a growing interest in innovation as a business strategy with focus on competitive advantage. Scholars from many knowledge fields such as management, sociology and economics, have been discussing this theme from their own perspective. So, the main challenge of this chapter is to select a group of authors and literature able to explain the connection between them. To do so, this researcher selected and organized this Chapter based on the logic of the Austrian School of Economics. Methodologically, the Austrian School of Economics rejects mathematical models as the core means to explain economic phenomenon; instead, it defends that the economic phenomenon derives from human actions. So, from this point of view, it considers innovation a result of the free-market system, the increase of competition, the endless dynamic process of creative destruction (term coined by Schumpeter in his book "Capitalism, Socialism and Democracy" in 1942 to denote an economic process of mutation that incessantly destroy the old production structures, creating a new one), the interaction of different economic actors and the entrepreneurial spirit through a system in which firms are social entities and a depository of knowledge (Kiessling and Richey, 2004). Therefore, the development of the current research focuses on the premise that innovation is a result of interactions between different economic actors within and outside different spatial innovation models of business agglomeration and the important role of the entrepreneurs in fostering the development of new innovation activities. These activities are placed in a spatial context where the firm is embedded which may or may not be influenced by local interactions. So, the theoretical frame of reference from which this chapter is founded and the selection of authors for the development of this Chapter reflects predominantly the logic of this school of thought.

Following this school of thought, this researcher calls attention to two aspects: firstly, from the micro-economics point of view, one of the paradigms is innovation as a business strategy to enhance the level of firm's competitiveness, especially the analysis of the firm's interaction behaviour under geographic circumstances and the impact on

the firm's innovation performance. Some of the studies about competitive advantages through innovation are related to gains in interactions facilitated by geographic proximity. These studies were performed in the last decade and the models derived from these studies are still accepted and have influenced many academics, policy-makers, institutions and national governments around the world. Secondly, from the macro-economic point of view, innovation is a result of the free-market system as well as the intervention of government in the sense of fostering prosperity through policies that stimulate and support companies to compete efficiently. Therefore, firms tend to respond to those stimuli through innovative projects which enable them to compete in such a dynamic and globalized world. The assumption is that with the increase of innovation initiatives, firms and countries become more competitive (Porter, 1998b).

Historically, the emphasis on studies of innovation began in early 1930's by economists from the Austrian School of Economics mainly; but studies on the relationship between innovation and economic growth began with the work of Robert Solow in the late 1950's. The foundations of his idea however, were provided by earlier scholars, notably Schumpeter. Joseph Schumpeter was the first economist to draw special attention to the importance of innovation in early 1930's. He was born in central Europe and studied in Vienna, is one of the most brilliant and prominent economist influenced by the Austrian School of Economics' thoughts. To Schumpeter (1979), innovation is a complex mechanism of introduction of a new product, method of production, new source of supply, opening of a new market, implementation of a new organizational method or the establishment of new business. Solow's work presented empirically that a great part of the economic growth in the United States during the first half of the twentieth century was accounted for by technological changes. The most important point is the demonstration of the impact of new knowledge, technologies and innovations on the increasing of countries' economic growth (Feldman, 2004). His idea justified the first generation of innovation theories demonstrated by Rothwell in which innovation was derived from science and technological changes.

Other neo-Schumpeterian authors such as Dosi (1988) and Freeman (1988) emphasized the study of innovation on a more dynamic approach. Even though both authors,

emphasized that innovation is of fundamental importance to the development and economic growth of countries (which is not a new idea), at the same time they introduced new elements to this discussion such as the importance of the social dynamic of the firms as an influential variable of the technological changes.

Dosi (1988) argued that innovation is about the development, search, imitation or adoption of new products, production processes or even new organizational methods. In this context, according to Dosi (1988), entrepreneurs will allocate resources to innovative activities only if they believe there will be a market for their new products or expect some economic benefits from the changes introduced in the processes. In turn, the success of firms in introducing new products or services is believed to change firm's production cost affecting its market competitiveness by creating a unique competitive advantage by the innovations.

Freeman (1988) suggested that the technological changes involved in the innovation process have the power to establish new standards for the transformation of the economy. To Freeman and Perez (1988), changes in the paradigm of innovation that it can be so significant that can impact directly the economic performance of countries and societies as a whole.

These premises establishes a new paradigm in which innovation seems to be definitely an economic and social phenomenon as a consequence of organizational strategy and firm's internal attitudes of implementation of operational procedures of knowledge accumulation, influenced by internal and external factors and which lead to the increase of a firm's and country's competitiveness.

This view is one of the main contributions of the Austrian School of Economics which is based on the understanding that the economic phenomenon is an interdisciplinary phenomenon and can be explained not only by mathematical models but by the social context, by the changes in the people's perceptions and by generation of new

knowledge and technologies. Schumpeter introduced the concept of "creative destruction" in which the key element is innovation. His general idea was that innovation was what keeps capitalist engines moving. He not only called attention to the importance of innovation to economic progress but also contributed to the general understanding of the process of innovation itself.

Also, he was the first modern economists to recognize the importance of the complex role of entrepreneurs for the development of the process of innovation. He argued the following:

> *"(…) the function of an entrepreneur is to reform or revolutionize the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way, by opening up a new source of supply of material or a new outlet for products, by reorganizing an industry and so on."* (Schumpeter 1979, p. 132)

He pointed out the entrepreneur as the 'innovator', the one who actually implements the changes and who is crucially important to the success of the organization. Since Schumpeter, a substantial body of work has been undertaken to understand the innovation process and how the progressive evolution of innovation theories migrated from simple technological changes to the complex inclusion of social ingredients to the formula of successful innovation processes.

To understand how the innovation theories evolved from the "creative destruction" to the strategic networking approaches, this researcher presents the "Rothwell" framework which describes the evolution of the innovation theories in five phases during the past fifty years (Figure 2.1). This framework constitutes the backbone upon which this chapter is founded and influenced directly the development of the researcher's logic for the choice of the selected authors throughout the chapter.

Rothwell's first phase of the evolution of innovation theories occurred during the first twenty years after the Second World War (1950 / mid-1960s). An extraordinary advance in industrial innovation and expansion of new enterprises was based largely on new technological opportunities. Those opportunities were mainly supported by government through technology support policies and stimulation of the supply side through investments in R&D. During this phase it was assumed that more investments in R&D resulted in more successful products (Rothwell, 1994). While the expansion of industrial businesses based on existing technological innovations continued to grow, the competition was intensified dramatically. Thus, firms started to fight for market-share. At this time, other organizational strategies, such as marketing begun to replace the technology approach. Organizational and market factors were also recognized to influence the innovation process.

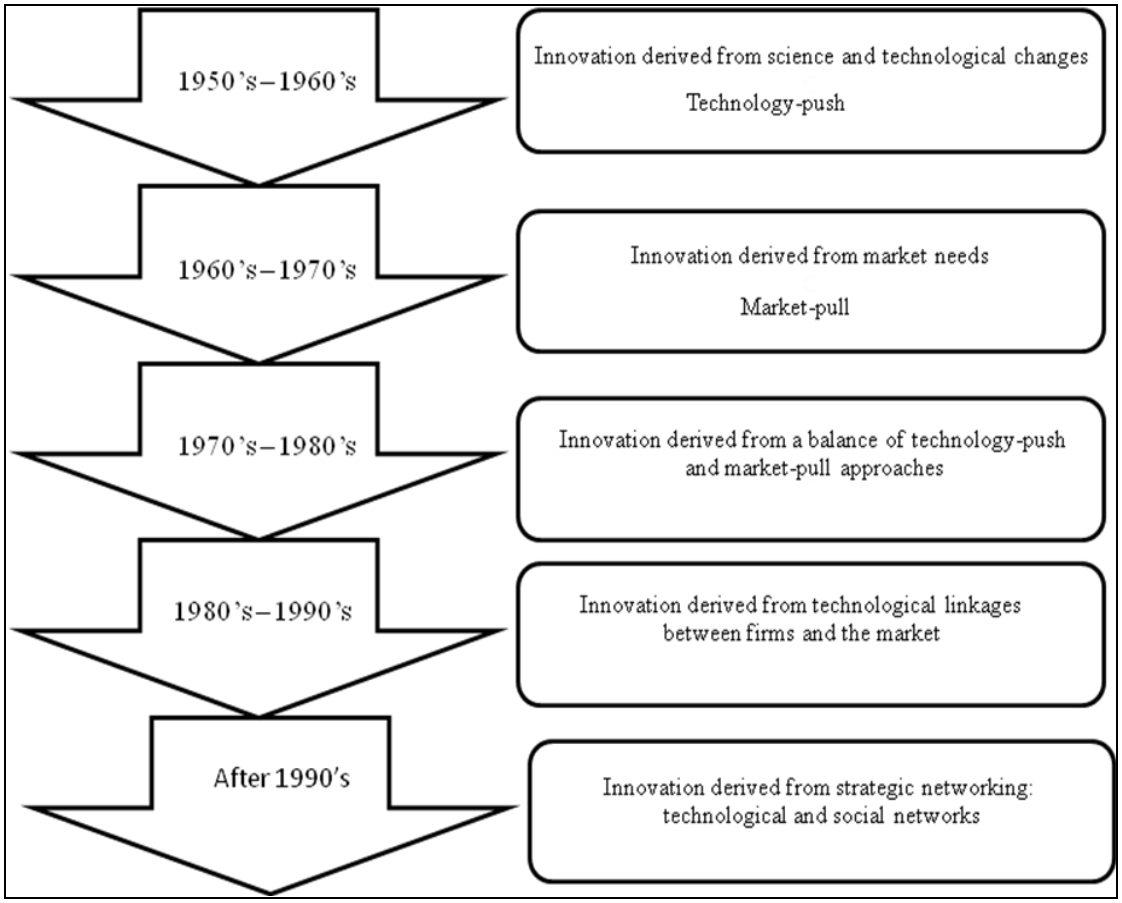

Figure 2.1 Evolution of innovation theories [Source: current study (based on Rothwell, 1994)]

From around the mid-1960s, Rothwell argued that innovation theories changed their emphasis and entered the second phase (mid-1960s – early 1970s) characterised by "market-pull" innovation. This phase emphasized the market as the main source of ideas directing R&D (Rothwell, 1994). This stage gave a central role to the market as the main contributor to the development of new products and services. Even though, the technical feasibility was still considered as a necessary condition of innovation, it was no longer sufficient in itself for successful innovation (European Commission, 2004).

The next phase or the third phase of innovation theories (early 1970's – mid 1980's) was marked by the need to rationalize resources. After two major oil crises, firms were pushed to emphasize cost control and cost reduction (Rothwell, 1994). During years of severe resource constraints, many empirical studies were undertaken to properly understand the innovation process and to reduce the incidence of wasteful failures. Those studies indicated that previous approaches were extreme and atypical (Mowery and Rosenberg, 1978). So, this third generation or "coupling" model was in essence a balance between technological-push and market-pull theories with an overall pattern of complex intra and external organizational linkages. This model linked various in-house functions to the broad scientific, technological and market communities (Rothwell and Zegveld, 1985).

The fourth phase also called "parallel and integrated model" (Rothwell, 1994) happened between mid 1980'and early 1990's. This phase was marked by economic recovery and many changes of some paradigms such as strengthening the linkages between firms, suppliers and customers, the emergence of new ICT-based firms, notion of global strategy, quality-oriented production procedures, increasing of strategic alliances and the engagement of small firms in intensive external networking activities (Rothwell, 1994). At this moment, the concept of a system of innovation emerged and innovative firms were identified as those linked to a highly diversified set of agents through collaborative networks. This view stressed the importance of external sources of information and knowledge (e.g. clients, suppliers, consultants and others) to the increasing of innovativeness (European Commission, 2004). In the following years, this phase evolved into the fifth stage of innovation theories, which presented itself as an

advance of the fourth one. Evidence exists that some elements are still the same as described in the fourth phase, but with a few differences. One of the differences is that the speed of development of new products and services has accelerated immensely. In the information and communication technology (ICT) sector, for instance, the rate of technological ruptures and product development were high and the product life was shorter; therefore firms needed to be "fast innovators" otherwise they would not survive in this competitive environment (Rothwell, 1994).

In the fifth phase, the technology is the innovation itself. Another difference was presented by empirical studies which described that leading innovators were adopting a variety of practices to transform new technologies into innovation (Rothwell, 1994). One of those practices was based on the increasing importance of technical knowledge accumulation over time and the intensive use of communication technologies to become new knowledge available rapidly on a worldwide scale accelerating the innovation process.

This analysis of the historical evolution of innovation suggests that this trajectory from a technology-pull innovation process (mid-1960's) to a more complex model with social ingredients required firms to acquire new capabilities such as to manage a network of interactions with different actors and to become flexible enough to get information and knowledge retained by a variety of different actors (European Commission, 2004). In this sense, there seems to be a relative consensus that knowledge and information became an important innovation input and may be generated not only inside firms, universities or R&D centres, but in a wide range of different agents and locations within the economy. This has demanded from firms the acquirement of new capabilities, competences and techniques to access that knowledge from different sources with invaluable gains to increase their firms' innovativeness.

2.1.1 Innovation and the Knowledge-based economy

Since Schumpeter, innovation cannot be disassociated to the generation of new knowledge and technologies and, as Rothwell (1994) explained in his fifth phase of the evolution of innovation theories, the focus on new knowledge has accelerated the innovation processes and forced firms to adopt new practices rapidly. These premises are the basis of the so called knowledge-based economy which emphasises the importance of knowledge generation and diffusion to innovation. For this reason, the Organization for Economic Co-operation and Development (OECD) characterized the 21st century economy as the period of the important presence of knowledge for the development of nations and firms.

Even though knowledge is recognized to be an important input that promotes innovation and generates competitiveness at both: firm and country levels, it was only by mid-1990s and early-2000s that studies on knowledge as a production factor with significant transaction value started to call the attention of academics, governments and entrepreneurs as a result of the emergence of new competition models now based on the growing accumulation and at the same time sharing of knowledge and resources through continuous learning processes. One of the authors which translated the importance of knowledge to innovation and consequently to the economic development of countries was Howell (2002). He stated that

> *"(...) knowledge is crucial in helping to create innovation which in turn stimulates economic growth and development. It also plays a more specific role in establishing and sustaining the long-term capabilities and performance of firms and organisations and in enhancing the success and well-being of individuals and communities"* (p. 871).

To him, the generation, diffusion, transfer and use of knowledge to produce innovation and stimulate economic growth and impact on the capabilities and performance of firms and organizations; thus, knowledge has been central to the economic and social development of countries.

Other authors followed Howell such as Abrunhosa (2003) who argued that knowledge is so essential to innovation that it determines firms' and countries' economic success. To Sbragio (2006), knowledge is much more relevant than machines or equipment to generate sustained competitive advantage and while more firms apply knowledge in the various corporate processes, the more competitive and innovative they tend to be.

Historically, from the second half of 19th century and first half of 20th century, many social and economic changes happened; however, those changes did not affect organizations instantly. At that time, the gap between those ruptures was relatively long and the impact was gradually absorbed by firms so they had enough time to adapt to new situations. After the Second World War the situation changed dramatically with the increase of speed of changes through the rapid generation of new knowledge and technologies. Knowledge and information became important resources to economic development, replacing traditional inputs, such as raw materials and financial capital. While competitive advantage was generated from accesses to or control of raw materials, cheap labour and financial resources, nowadays, it is a result of what firms know, how they use what they know and the speed of learning processes regarding new emerging knowledge. Academics are now exploring ways to incorporate this new model to their theories as an attempt to explain the role of knowledge in driving productivity and economic growth (OECD, 1996).

In practice, some academics, including Howells (2002) and Cooke (2002), for instance, proposed that the impact of this new economic model based on knowledge shall repeat the deep transformation caused by the industrial revolution in the 19th century. The difference is that now, according to Cooke (2002), the role of muscles will be replaced by brains and the consequences are a new displacement of human work from simple manipulation of knowledge and information to a more sophisticated treatment, leading to new products and services. Cooke (2002) also called attention to the geographic component in the knowledge-based economy because this new economic dynamic is grounded in communication networks. The geographical dimension of analysis provides the notion of technological trajectories from a perspective of regional systems of innovation. According to him, this notion of "regional system of innovation" combines the notions of regional development with a systemic perspective.

Sbragia, Stal, Campanario and Andreassi (2006) argued that knowledge is much more relevant than machines or equipment to generate sustained competitive advantage, because it resides in people; therefore, it can be used to generate more knowledge. It is unquestionable that the success of firms in this century is intrinsically linked to the quality of knowledge applied in corporate processes. This knowledge based on people assumes basically two forms: explicit and tacit. Explicit knowledge consists of formal knowledge. It is related to procedures, patents and data banks. Tacit knowledge, on the other hand, is the informal knowledge embedded in personal relationships, individual experiences, personal values and beliefs (Sbragia, et al., 2006). Tacit knowledge then may be shared and improved from previous experiences of users and scientific research; therefore, knowledge generation, diffusion and transfer processes may be characterized as an interactive process (Sbragia, et al., 2006).

One of the major challenges in this new economic model (knowledge-based economy) is how to acquire new knowledge and information. According to Madhok and Tallman (1998) there are four mechanisms to acquire these resources: (i) firms develop and create new resources internally, (ii) firms buy them from the market, (iii) it involves the acquisition of the firm itself which possesses the resources or new technologies or finally, (iv) firms acquire the resources through cooperative partnerships.

In recent years, the acquisition of new knowledge which has led to a substantial increase of innovative initiatives came from external sources through cooperative partnerships. The development of new applications of information and communication technologies has accelerated the formation of cooperative partnerships and facilitated the access to new sources of innovation. Thus, successful innovative firms tend to be those which not only manage and mobilize internal knowledge and information flows transforming those inputs into innovation, but also firms which build their competitive advantages through cooperative partnerships and network of relationships beyond the boundaries of the organization. Such a strategy demands firms to change the traditional linear model of innovation (technology-push and market-pull) to a model in which innovation is driven by interactions consisting of flows of relationships between knowledge

producers and users throughout different spatial systems of innovation (e.g. local, regional and national).

This approach allows highlighting the impact of the diffusion of knowledge spillovers at various levels of the innovation systems: local, regional and national levels. Two of the authors who emphasize the impact of innovations on a geographic context are Crescenzi and Rodriguez (2006). In the article "R&D spillovers, innovation systems and the genesis of regional growth in Europe", they presented empirical evidence of how a region's innovation capacity is determined by interactions between different innovation sources. In the same study, they showed that, in the case of Europe, the geographic proximity is important to the transmission of economically productive knowledge; however, as far as the effectiveness of assimilation is concerned, this knowledge flows from central to the peripheral regions and the impact of knowledge spillovers on the local development do not exceed to 200 km radius. Even though this is a geographic limitation of the impact knowledge spillovers have on local development, innovations generated from these knowledge spillovers "...may be a better short term solution in order to generate greater economic growth" (Crescenzi and Rodriguez, 2006, p. 23).

As a result, in contemporary society, undoubtedly, the creation of firm's competitive advantage in large measure comes from the capacity of firms to reach new sources of innovation regardless of whether they are geographically close or not and to mobilize knowledge and information to generate innovation, through new products, processes and services (Tidd, Bessant and Pavitt, 2001). Then, the innovation dynamic on a large scale depends on the generation of new knowledge. In this context, firms must search for new knowledge sources to systematically sustain a competitive advantage.

According to Bathelt, Malmberg and Maskell (2004), the contemporary literature on learning and innovation proposes that knowledge generation is a result of an interactive process and may take place within or/and across firms. Either way, endogenous and exogenous sources alone are not sufficient to secure the inflow of new ideas that eventually lead to innovations (Svetina and Prodan, 2008). In the article "How internal

and external sources of knowledge contribute to firm's innovation performance", both authors argued that from the perspective of innovation, knowledge is not only developed in R&D departments but also in cooperation with suppliers, customers, universities, laboratories and even with competitors. The knowledge flows, both within and external to the organization, determines the process of innovation as an interactive model between the organization and the environment (Svetina and Prodan, 2008; Santos, 2000).

Endogenous sources of innovation are those localized within the enterprises such as R&D, production, marketing, distribution and other departments. According to Svetina and Prodan (2008), internally firms acquire knowledge through in-house R&D projects, from continuous improvements in processes and from employees' skill. According to the same authors, firms organize internal education and training programs to improve the internal knowledge base and therefore stimulating new creative and innovative ideas. In this case, the innovation outcome depends on the capacity of the firms to offer internal conditions able to stimulate the continuous learning process among employees.

The process of knowledge generation and transfer happens differently according to the size of firms. In large organizations, most of the knowledge transfer process happens through functional interactions among firm's departments; on the other hand, small sized firms increasingly need to rely on external knowledge sources (Svetina and Prodan, 2008).

In the context of global competitiveness, external agents become important sources to new solutions for organizational or operational problems. Competitors, clients, suppliers, consultants, government agencies, universities or research centres, are among the main external sources of innovation (OECD/EUROSTAT, 2005).

The process of diffusion of new knowledge from external sources comes from different origins. According to the Oslo Manual (OECD/EUROSTAT, 2005) there are three basic forms: i) open sources of knowledge and information; ii) acquisition of innovation

inputs, especially knowledge or new technologies through purchases of capital goods or services and finally iii) acquisition of innovation inputs through co-operation arrangements with other enterprises or institutions.

According to the Oslo Manual, external sources can be classified into two main groups: Market/commercial and educational/institutional. Market sources of innovation are as follows: suppliers, clients, competitors and consultants. Universities, private research centres and government agencies are the main educational/institutional sources (OECD/EUROSTAT, 2005).

The analysis of the selected literature suggests that innovation is a result of knowledge, experiences and abilities to create new products, processes and services (Tidd, Bessant and Pavitt, 2001). Overall, it is a result of the practical use and application of knowledge generating new knowledge and technologies. New knowledge generates more new knowledge, stimulating a virtuous innovation circle. In contemporary economies, this process plays a key role at the heart of economic changes and is seen as vital to keep economies moving forward. The challenge, however, is not the generation of new knowledge only but to improve the firm's ability to use it.

2.2. Sociological perspectives: Social Networks and Systems of Innovation

Innovation is a phenomenon that has been explored by a variety of perspectives. Business management gurus, economists, geographers and sociologists have explored innovation offering a coherent understanding of this phenomenon, but from their own points of view. If from the sociological aspect of innovation, for instance, sociologists primarily attempt to examine innovation from the perspective of the social structures and the way they can influence innovation processes and outcomes, economic interpretations of the innovation phenomenon usually reflect lack of conceptualization of the role of social elements in influencing innovation. Rarely, authors combine different perspectives. To Gordon and McCann (2000), all economic relations even

specific business ones are socially embedded in the sense that they depend upon norms, institutions and sets of assumptions shared among a group of actors and are not simply the outcome of economic decisions. This human and social dimension of innovation is largely studied by authors such as Fleck, Webster and Williams (1990), MacKenzie and Wajcman (1999) and Bessant and Tidd (2007) in the field of sociology, mostly related to the rapid development of technological innovations and the changes in the society. To Bessant and Tidd (2007), innovation is strongly associated to a social exercise and therefore the examination of the social dimension is important to the complete understanding of the innovation phenomenon.

In considering this social exercise as a consequence of the technological changes associated with shorter product cycles forcing firms to forge new alliances to seek greater efficiency and flexibility to cope with the rapid changes in the market, Rothwell (1994) recognizes the importance of the social integration of different stakeholders in the innovation process. In other words, Rothwell (1994) in his fifth phase of innovation theories suggested that innovation may be associated to the result of the increase of technical knowledge and the expansion of the social-networked model.

Other authors such as Chesbrough (2003) agree with Rothwell (1994) and additionally argue that the innovation process combines both internal and external ideas and should be based on a landscape of abundant cooperation and networking. This concept is placed in opposition to the 'old' models that considered the innovation process as an internal process only, and firms should not disclose their 'secrets' to anyone. In fact, the Chesbrough's idea is not a new proposition or interpretation of innovation, but a Schumpeterian vision of the innovation process which stresses innovation as a result or combination of internal and external factors able to generate wealth.

The ideas discussed above suggest that successful innovation depends on many factors such as internal and external factors. According to Smith (1995), the improvement of the firm's overall performance depends not only on the firms themselves, but on how they interact with institutions. So, this section discusses the networking approach from

the perspective of the importance of how firms interact and cooperate in a system of knowledge exchange. Overall, this researcher agrees with Pittaway, Robertson, Munir and Neely (2004) who argued that firms which do not co-operate

> "...and which do not formally or informally exchange knowledge limit their knowledge base long term and ultimately reduce their ability to enter into exchange relationships" (p. 137).

The economy at the end of the 20th century is characterized by three main features: it's global, informational, and networked (Castell, 1999), the increase of competitiveness through networks of innovation agents interacting collaboratively in an extensive process of exchanging knowledge, information and competencies is increasing substantially. It is also increasing the consensus among entrepreneurs, policy-makers and scholars that individuals or firms themselves are no longer the locus of innovation but the network in which a firm or individual is embedded (Powell, Kenneth and Laurel, 1996). So, business networks which facilitate access to new knowledge and information that cannot be generated internally may serve as a new locus of innovation (Nelson, 1990).

Networking is a complex concept and may cover a variety of forms in order to attend specific objectives. Despite that there are many forms and objectives (e.g. social, communication, production and innovation), networks are created with the objective to face the pressure and challenges of the external environment (Oliver, 1990). In the context of a business network, the pressure and challenges narrow or limit the capacity of entrepreneurs and firms to get competitive gains individually. To reduce or diminish this pressure, individuals and/or firms participate in networks (Oliver, 1990). Finally, according to Balestrin and Verschoore (2008), the networking approach reflects the search for competitive gains which could not be obtained by individual efforts.

Networks have many definitions. To Tidd, et al. (2001), in the context of the inter-organization approach, networks can be thought of as *"(...) consisting of a number of positions or nodes, occupied by firms, business units, universities, governments,*

customers or other actors, and links or interactions between these nodes" (p. 210). To Hunt, Doyle, McDermott and McCormack (2005), network is about fostering cooperation, allowing firms to share risks and costs, enhancing the learning process, facilitating the transfer of tacit knowledge between firms and opening new channels for information and opportunities. To Unido (2001), organizational network, in general, may be seen as a group of firms that *"cooperate on a joint development project complementing each other and specializing in order to overcome common problems, achieve collective efficiency and penetrate markets beyond their individual reach*" (p. 9).

In inter-organizational networks the characteristics of internal flows determine the differences between network structures. The structure of internal flows is characterized into two types: transactional (tangible) and informational flows (intangible), both with relevant impacts over the network objectives. More recently, many academics such as Contractor and Lorange (2002) give more emphasis on informational than transactional flow. This is due to a greater fluidity of transfer of knowledge and information translating into the increase of interorganizational relationships with substantial gains of innovativeness (Contractor and Lorange, 2002).

The growing emphasis on the informational flows also stresses the importance of the network structure which seems to facilitate the exchange and traffic of knowledge between individuals and organizations. The network structure is formed by ties. These ties can be strong or weak (Granovetter, 1973). Granovetter (1973), a sociologist from Stanford University, emphasised the power or strength of ties (strong and weak) in a network relationship:

> "T*he strength of a tie is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie*" (p.1361).

His argument involves many sociological aspects and from the strategic viewpoint, it seems to be robust. According to him, organizations with many weak ties formed in the context of network, in general, are more likely to turn diverse and non-redundant information to their own benefits; thus, the presence of weak ties creates bridges to access new and updated information from outside; therefore, increasing the possibility of firms to become more innovative. Strong ties, on the other hand, seem to be favourable to stimulate an efficient environment for trustful interactions; although are more likely to create redundant information, which most of the time is not useful to increase a firm's innovativeness (Granovetter, 1973).

According to selected literature above, the great majority of authors emphasize the benefits of networking. The benefits are often related to the achievement of competitive advantages: faster, cheaper and with less risk and disruption to operations (Hunt, Doyle, McDermott and McCormack, 2005). Pressures from the external environment, gains in competitive advantage and access to new sources of innovation can be considered among the main reasons for the existence of business network arrangements. Since the last two decades, many authors such as Rugman and D'Cruz (1996), Ahuja (2000), Minguzzi and Passaro (2000), Porter and Ketels (2003), Pittaway, Robertson, Munir, Denyer and Neely (2004) and Cortrights (2006) have studied business networking and the impact on the improvement of competitiveness and innovativeness. These authors have identified that business networking is emerging as a significant tool to promote the generation and diffusion of knowledge, information and new technologies leading to the improvement of the overall firm's performance. Cortrights (2006) argued that to succeed, firms have to network and collaborate with each other in a way of creating formal and informal mechanism of collaboration. Ahuja (2000) claimed that a firm's innovation activities increases with the number of interaction linkages that firms maintain; so, as a consequence, new collaborative network arrangements have effectively emerged.

For Cooke (1996), 'business network' is considered a formal or informal non-hierarchical organizational arrangement in which firms make relational contracts with each other through a set of linkages to facilitate the exchange of information and

technologies. These relational contracts among actors within business networks can be in two forms: formal and informal. According to the same author, the difference between them relies on the structure of interactions. Formal business networks lead to a contractual dimension of relationships and informal networks do not demand any formality, allow casual relationships among various different actors with common purposes and most of the time are characterized by trustful linkages. According to Balestrin and Verschoore (2008), in an informal network there is no need for contractual terms because the relationships are structured on mutual trust and perception of benefits. These features allow transfer of tacit knowledge promoting learning with significant benefits for innovation (Unido, 2001).

The advantages and benefits of belonging to a business network are well known and crucial for the improvement of firm's learning and innovation capabilities. According to Mohannak (2007), business networks also improve the

> *"(....) efficiency (or innovative capability) by reducing uncertainty through information access, sharing, screening, and by establishing a longer term focus on relationship building for the development of organizational competencies"* (p. 240).

The selected literature, in general, suggests that a successful business network is not only a simple case of agglomeration or association of firms and/or other economic agents, but collaborative interactions with common objectives able to facilitate constant flows of knowledge, information, resources and competencies, improving competitiveness collectively.

Although it is recognized that networking is of relevant importance for firms in the search of sources of new knowledge and competencies focusing on gains in competitiveness and innovativeness, it does not happen by itself. An important pre-requisite is needed: Collaboration. Even though it seems to be relatively easy, most of the time it is not so easy to practice it.

There is no doubt that any form of collaboration or cooperation, whether at personal, social or organizational levels (e.g. coalitions, strategic alliances, joint venture, consortia, business network) is of immeasurable importance and is at the heart of any discussion about networking. According to Gray (1996), specifically in the business context, collaboration *"(...) offers an antidote to turbulence by building a collective capacity to respond to turbulent conditions"* (p. 58).

Many scholars have defined collaboration in many forms. For example, according to Himmelman (1996), it is the process of

> *"(...) exchanging information, altering activities, sharing resources and enhancing the capacity of another for mutual benefit and to achieve a common purpose"* (p. 28).

According to Cropper (1996), collaboration

> *"(...) is a distinct mode of organizing and implies a positive, purposive relationship between organizations that retain autonomy, integrity and distinct identity, and thus, the potential to withdraw from the relationship….it ranges from wide networks through loose alliances and tight federations to the creation of novel organizational entities…."* (p. 82).

Miles, Miles and Snow (2005) summarized collaboration as *"(...) a process whereby two or more parties work with each other to achieve mutually beneficial outcomes"* (p. 40). Thus, in a simple way, collaboration may be said to be individuals or organizations working together for a common purpose (Miles, Miles and Snow, 2005). In the business field, collaboration is manifested through collaborative arrangements. Those arrangements may be structured from a wide range of typologies such as coalitions, alliances, joint-ventures, consortia, sub-contracting, cross-licensing and business network (Tidd, Bessant and Pavitt, 2001). Inter-enterprise cooperation arrangements encourages enterprises to learn from each other, exchange experience and ideas and help firms to individually and collectively achieve economies of scale improving their competitive position (Unido, 2001). These benefits are materialized through the improvement of the capacity of those firms to become more innovative. So, undoubtedly, collaboration brings immense benefits to those involved, but

unfortunately, it does not seem to be a natural-born characteristic and to engage in collaboration activities demands some kind of stimulus. Child and Faulkner (1998) stated that one of the principal stimuli to collaboration, particularly in the business field, comes from the changing and dynamic external environment.

Porter and Fuller (1996) suggested that the main external motives for companies to collaborate are reduction of risk, the search for economies of scale, response to government or market pressures or the need for technology or market access. To Contractor and Lorange (1988) there are seven general motives for firms to be engaged in collaborative arrangements. These include risk reduction, co-opting or blocking competition, achievement of economies of scale and / or rationalization, overcoming government-mandated trade or investment barriers, facilitating initial international expansion of inexperienced firms, vertical quasi-integration advantages of linking the complementary contributions of the partners in the 'value chain' and technology exchange.

Huxham (1996) argued that the key motive in any firm's engagement in collaborative activities is the focus on outputs of collaboration that could not have been achieved individually. The outputs are materialized into "'collaborative advantages', which is the result of the synergy between collaborating partners. Collaborative advantages are in fact gains and benefits which reflect the possibility of firms to achieve competitive advantages through collaborative arrangements rather than by individual efforts. Among many benefits, working in collaboration with others enables them to achieve competitive advantages faster, cheaper and with less risk and disruption to operations (Hunt, et al., 2005).

These literatures suggest that the benefits of collaborative activities with specific benefits to the improvement of competitiveness are numerous. Many cases of success show that firms have improved competitiveness through engagement in collaborative arrangements. Thus, the main advantage of belonging to collaborative business arrangements with specific benefits to competitiveness is that those networked

arrangements seem to stimulate firms to interact with each other with regards to innovation (Malecki, 1991). Whereas there are a lot of differences in aims, language, procedures, culture and perceived power, collaboration between organizations happens due to the perception of mutual gains and it is highly motivated by self-interest, even though, it does not imply that self-interest is at the expense of others (Huxham, 1996).

This environment of collaboration and networking where innovation seems to be embedded creates the idea of structures in which actors seem to interact with each other in a systemic way. Therefore, it is important to explore some concepts related to the idea of systems of innovation.

To develop this systemic approach, it is necessary to define "system". There are many definitions for the word "*system"*. To the Merriam-Webster's online Dictionary (2010), "s*ystem"* may be defined as: i) *"...a regularly interacting or interdependent group of items forming a unifying whole*"; ii) *"... a group of interacting bodies under the influence of related forces";* iii) "*...a form of social, economic and political organization or practice" or iv) "...an organization forming a network especially for distributing something or serving a common purpose"*. To Carlson, Jacobson, Holmen and Rickne (2002), *system* is *"(...) a set of interrelated components, working toward a common objective. Systems are made up of components, relationships, and attributes"* (p.234).

These definitions for the word "system" set up the foundation of the concept of "system of innovation" which is the main focus of this section. In the next paragraphs, the idea of the "system approach" particularly in the innovation phenomenon is explored in more detail.

> *"...innovation systems approach stresses that the flows of technology and information among people, enterprises and institutions are key to the innovative process. Innovation and technology development are the result of a complex set of relationships among actors in the system, which includes enterprises, universities and government research institutes."* (OECD, 2007, p. 1)

The idea of the networking approach as seen in the previous section only makes sense in the context of systems. Following the Rothwell's framework, it is possible to identify that the fourth generation of innovation theories (1980's – 1990's) was marked by emergence of the concept of systems of innovation.

This model identified strong linkages or alliances between firms and specific institutions such as universities, government agencies and research centres and appeared as opposition to the linear model of innovation characterized in Rothwell's phases I (technology-push) and II (market-pull). In the late 1980's the notion that innovation did not seem to be a sort of phenomenon that originates from a solitary action has been consolidated. In fact, most of innovation initiatives seemed to happen due to collaborative interactions among various actors inside and external to the organization (Abrunhosa, 2003; OECD, 2007). The set of agents inside the organization constitutes the internal innovation system and external partners such as university, suppliers and clients among others constitute the basis of the external innovation system. In most of the cases, the external innovation system complements the set of internal sources of innovation; in others, the external innovation system is the main and only source of innovation. To Svetina and Prodan (2008) "*firms need to acquire new knowledge from numerous internal and external sources in order to constantly generate innovations and maintain their competitive edge"* (p.279).

In late 1980's and early 1990's, a group of scholars such as Freeman (1987) and Lundvall (1992) appeared with the idea of the "system approach" in these studies on innovation. This approach emphasized the relationships between the firms and institutions (e.g. universities, R& D centres and government). Since then, this approach became popular and many scholars have adopted this conceptual framework to study the innovation phenomenon on organizations, regions and countries.

According to Lundvall (1992), a system of innovation is constituted by "*elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge"* (p.2). To Cooke, Uranga and Etxebarria (1997), a system of innovation consists of a set of interactions among users and producers and of

knowledge for practical use. Considering Carlson, et al.'s definition, an innovation system may be made up of components (economic agents), relationships (interactions or linkages among agents) and attributes (flexibility to facilitate the access to different innovation sources, the ability to learn from these sources and the capacity to change and respond to changes in the environment). To Nelson (1993), the system of innovation determines the level of innovation performance of firms. In summary, according to this researcher, a system of innovation may be defined as a set of relationships between economic agents (firms and public or private institutions) focused on promoting the exchange of knowledge, information and competencies leading to the increase of firm's innovativeness

In the early 21st century, even though the idea of systems of innovation is the same as ten years ago, this conceptual framework evolved to a more integrated model in which, due to the complexity of the innovation process, firms are placed in different systems of innovation with various actors and sophisticated interconnections to produce positive innovative outputs. Moreover, the complexity of these systems has demanded from firms the capacity to manage a network of external relationships with different actors at the same time as well as to create flexible business models, able to capture knowledge and information transforming them into successful innovation (OECD, 2007).

Due to the increasing use of systems approaches and the economic impact of the systems of innovation on regions and countries as far as the generation of economically useful knowledge and innovation is concerned, institutions such as the OECD recognized the importance of the national system of innovation approach. To the OECD (2007), the increasing attention on national innovation systems approach reflects the importance of the economic role of knowledge as economic activities are becoming more and more knowledge-intensive and investments in new knowledge are considered key to economic growth.

With the increasing importance of the national innovation system approach, some authors have drawn attention to specific actors inside innovation systems such as

Freeman (1988) and Lundvall (1992). They, for instance, called attention to the role of universities and research centres in the knowledge generation, transfer and diffusion processes. Both authors also emphasized the important participation of the government in the innovation system through policies which incentivise innovation through knowledge transfer and financing mechanisms. So, while universities become important knowledge generators, government policies stimulate knowledge transfer and through financing mechanisms with subsidized interest rates, government agencies facilitate innovation initiatives. This perspective reinforces and amplifies the understanding of the OECD (2007) that in contemporary economies, innovation is not a scientific or technological phenomenon alone, but definitively also a social process in which different actors interact through a network of relationships with constant flows of exchanging knowledge and information.

These premises are the base of the "triple helix" model. This model proposed by Etzkowitz and Leydesdorff (2000) suggests that the successful innovation system consists of perfect and harmonic interactions between university, government and firms. They called it "triple helix model" (see Figure 2.2).

The "triple helix" model originated from observations of the influence and relationships between the Massachusetts Institute of Technology (MIT) and the technology pole nearby. In that environment, innovation was seen as a result of a complex and continuous exchange process of experience, ideas, information and knowledge between university, government and technology-based firms. In summary, the "triple helix" model describes the innovative environment consisting of strategic alliances among firms, government agencies and academic research groups.

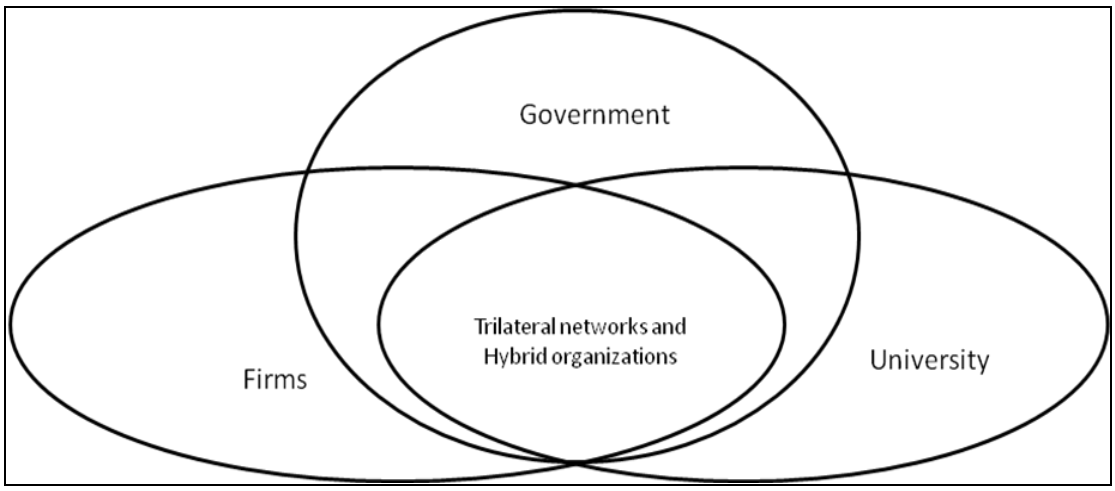

Figure 2.2 Triple Helix Model [Source: Based on Etzkowitz and Leydesdorff (2000, p. 111)]

In this model, even though university, firms and government are independent actors, they work in cooperation with each other through a continuous flow of knowledge and information. The formation of this ideal environment to promote innovation initiatives through strategic alliances is usually encouraged by the government, but according to Etzkowitz and Leydesdorff (2000), the government does not control it. In fact, these alliances suggest the formation of a network in which firms are the main "helix" and determine the speed and direction of the technological changes. The synergy between knowledge generators, business sector and government tends to create an appropriate environment able to promote conditions to increase firm's innovativeness.

Even though firms seem to be the cradle of innovation, they are strongly influenced by external factors such as access to innovation sources, infrastructure or specific government policies. Many of these factors come from the location where firms are located and others from different localities where geographic distance is not relevant.

In the next section, the innovation phenomenon is discussed considering disciplines such as business management and entrepreneurship.

2.3 Innovation from the perspective of the business management and entrepreneurship disciplines

Innovation and entrepreneurship are at the heart of any discussion about competitiveness and economic development. In previous sections of this chapter, this researcher has focused on the discussion about innovation and related issues such as location, economic geography and networking; now, this section aims on the relationship between business management discipline and innovation; in particular, issues related to entrepreneurship, creativity and the role of entrepreneurs for the development of innovation initiatives as well as the importance of micro and small enterprises as economic agents in creating progress and wealth through innovation.

2.3.1 Innovation studies and the business management approach

From the modern business management perspective, few authors have translated so effectively the Austrian vision of innovation as Peter Drucker. To Drucker (1986), innovation is a systematic phenomenon motivated by many factors, such as: R&D, unexpected external (e.g. customer preferences) or internal events or changes in the marketplace (e.g. new competitors), demography, perceptions or the appearance of new knowledge or technology. He also claimed that innovation is highly motivated and driven by the entrepreneur. In this context, innovation is essentially a business strategy in which the leadership position is more than a temporary advantage, but also a sustainable competitive advantage. However, for the purpose of this researcher innovation is

> "(…) the *implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" (OECD/EUROSTAT, 2005, p.46).

This definition categorizes innovation into four specific groups: product/service, process, marketing or organizational methods. This set of categorization leads to a more descriptive, tangible, measurable and manageable approach of the innovation phenomenon, facilitating the investigation and examination of the innovation performance of firms surveyed.

One of the most important publications on innovation as a business strategy is the book by Eisenhardt and Brown (1998) "Competing on the edge". This book presented the investigation of several technology-based firms in one of the most dynamic industries in the world: computing. The firms were located in Europe, Asia and North America. Their interest in this sector was to understand how entrepreneurs could manage their businesses in this so fast-paced and highly competitive industry. To them, the managerial problems were unprecedented. This study concluded that the key driver to successful innovations is the ability to change, the ability to reinvent the firm constantly over time. An important outcome was that the authors established a relationship between the firm's capacities to innovate and firm's organizational structures. Firms with simple and flat organizational structures are more likely to be innovative. They claimed that successful innovative firms are those in which the management strategy is focused on interactions and an extensive and efficient communication between the firm and the external environment. This book showed that the computer industry is ideal for studying strategy, interaction behaviours and organizations in situations where the ability to innovate is central to superior performance.

On the other hand, to Holmen, Magnunsson and McKelvey (2007), innovation is a phenomenon which is characterized by the exploitation of new opportunities, whether firms use high technology or not. In fact, innovation is not always associated with technologies; new opportunities may be new combinations of resources and market needs, emerging from changes in the knowledge base and customer preferences, or interrelationships of economic actors. To Christensen (2001), technology, in general, is any set of processes in which organizations transform resources (capital, labour, raw materials and information) into products and services with aggregate value. According to Porter (1998b) innovation is believed to sustain competitive advantage and is a thin

line that can divide both sides: the side of the survivors and the side of those which struggle to survive.

The discussion of innovation in management literature suggests that the majority of authors in this area have focused on the microeconomics side of innovation as they explore the firm-level determinants of competitiveness. In this sense, innovation is merely a means of achieving competitive advantages able to meet clients' needs with new products and services. Even though, they often explore innovation from the organizational perspective, the understanding of the spatial systems of innovation and models of business agglomerations may yield some important insights of the impact on firm's competitive performance through innovation.

2.3.2 Innovation and entrepreneurship

The discussion about entrepreneurship and innovation historically started in France in the seventeenth century, where the term "*entrepreneur"* was first used. At that time, the term was in reference to people who led military expeditions. Then, in the eighteenth century, for the first time, an Irish economist, Richard Cantillon, used the term "*entrepreneur"* in the business context. Later, in the nineteenth century, Jean-Batiste Say associated the entrepreneur as somebody who innovates and acts as a change agent. But, it was only in the twentieth century, the direct link between entrepreneurship, business and innovation was popularized. . This is credited to Joseph Schumpeter.

Even though Schumpeter is best known for his contribution on innovation theory, he was also the first to radically pay attention to the impact of entrepreneurship on the economy through innovation and emphasised the importance of innovation to the capitalist system. He argued that innovation in all its forms is what keep capitalist engines moving and, of course, it is not static but evolutionary (Schumpeter, 1979). His theory about the dynamism of economic cycles popularized the term "creative destruction". "Creative destruction" suggested the replacement of old products or

consumer behaviours to new ones by the implementation of radical innovations which alter the balance of previous economic conditions. To Schumpeter (1979), innovations were from many forms such as the introduction of new product, new methods of production, organization or management, transportation, communication, marketing, new markets, new sources of raw materials or new business models. Finally, he supported the view that innovation was the real manifestation of the entrepreneurship spirit. Not only Schumpeter but more recently authors such as Drucker, Mintzberg and Filion have related innovation to entrepreneurship. To these authors, entrepreneurship combines elements such as creativity, risk taking, new opportunities, leadership, innovation and others. So, in this sense, it seems that there is no innovation where there is no presence of the entrepreneurship "spirit". To illustrate this point, Kornijezuk (2004) in his investigation listed forty nine different factors behind entrepreneurship and found that eighteen out of nineteen authors investigated related innovation to entrepreneurship; so, it seems clear that no serious study about innovation can afford not to mention the importance of entrepreneurship.

So, for the purpose of the current thesis, according to Kornijezuk (2004), this researcher highlighted the top five factors (innovation, new opportunities, risk taker, creativity and leadership) related to entrepreneurship and presented in the Table 2.1 as they are directly related to the main issues discussed in this thesis. Among these factors, two (innovation and creativity) in particular, are very relevant for this study because of the potential relationship between them. This researcher agrees with Conde (2002) who suggested that innovation is a result of a creative process and suggests that there is no innovation if creativity is not stimulated. Creativity has been studied since the eighteenth century. In that century, creativity was always associated to exceptionality. The creator was somebody divine, rare and different. In the following century, 19th century, due to the development of psychology, creativity started to be studied scientifically (Kneller, 1978).

Most recently, cognitive psychology proposed a new approach to creativity. This approach argues that the solution for a certain situation is built upon mental models represented by similarities and specific and abstract knowledge. Thus, creativity, in

general, is built upon entrepreneur's experiences, which create mental models in response to new situations (Souza, 2001).

Authors / Factors	Innovation	New opportunities	Risk taker	Creativity	Leadership
Schumpeter, J.	X	X	X	-	-
McClelland, D.	X	X	X	X	X
Weber, M.	X	-	-	-	X
Filion, L. J.	X	X	X	X	X
McDonald, R. E.	X	X	X	-	X
Degen, R.	X	X	X	X	-
Drucker, P.	X	X	X	-	X
Souza, E.	X	X	-	X	X
Lalkala, R.	X	-	-	X	-
Dutra, I.	X	X	-	X	-
Mintzberg, H.	X	X	X	-	X
Angelo, E.	X	X	X	X	-
Lognecker, Moore and Petty	X	X	-	-	-
Leite, E.	X	X	X	X	-
Carland et al.	X	X	X	X	-
Dolabela, F.	X	X	-	X	-
TOTAL	16	14	10	10	07

Table 2.1 Matrix of Entrepreneurial factors [Source: Based on Kornijezuk, 2004,p.71]

In the business field creativity has also been studied for a long time, but only recently it has been considered a key element to generate innovation inside organization (Dolabela, 1999; Leite, 2001 and Conde, 2002). From the organizational perspective, creativity has many definitions. Stein (1974) argued that creativity is a process in which many people accept new products as useful. To Kneller (1978) the process of creation implies the analysis of past experiences and new ideas to solve a certain situation or problem. To Alencar (1995), creativity is the result of interactions between the individual and the external environment. The remarkable thing is that creative solutions in fact, happen due

to someone's attitude to solve problems or situations and in this context, it is important to consider the important role of entrepreneurs in the development of innovative initiatives.

2.3.2.1 Innovating entrepreneur

The success of an enterprise depends in large part on that firm's entrepreneurial orientations and the implementation of its business strategies. Those strategies are responses to challenges and opportunities posed by economic and social environments. Those challenges impose on the entrepreneurs the need to innovate in order to survive. However, this challenge-push type of innovation behaviour depends directly on the entrepreneurial profile of the main leader of the organization. Thus a firm's innovative behaviour is directly influenced by the entrepreneur (Chell, 2001).

The theme entrepreneurship is normally associated with risk taking, opportunity seeking and proactive decision making catalyzed by someone, the entrepreneur. His/her profile reflects the firm's propensity to engage in innovative, proactive and risk-seeking behaviours to achieve strategic objectives (Miles, Miles and Snow, 1978). According to Schumpeter (1979), the entrepreneur is the main element to the development of the process of innovation and the main agent of the process of "creative destruction". From a Schumpeterian perspective, the entrepreneur is naturally innovative and essential to the dynamism of the economic system and socioeconomic growth. He has the function to innovate, combining different forms of production factors creatively and more efficiently. To Dolabela (1999), the entrepreneur is the bridge between creativity and innovation. To him, the entrepreneur is someone with great vision and creativity, able to transform ideas into new opportunities. Moreover, according to Schumpeter (1979), the entrepreneur's role is not only to create new things but to get things done.

Other academics such as Drucker (1986) agree with Schumpeter's ideas. Drucker (1986), in his book Innovation and Entrepreneurship, emphasized that

> *"(...) Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service"* (p. 33).

Drucker (1986) stated that the main function of the entrepreneur is to create new and different values as well as to modify existing products and services. He was the first to use the expression "innovating entrepreneurs" to indicate the innovating characteristic of the entrepreneur's profile. He followed stating that innovating entrepreneurs are those who assume risks, when transforming the current use of resources to new ones, creating new capacities to generate wealth. According to Drucker (1986), in general, entrepreneurs are risk takers, and usually concentrate on opportunities not on risks.

Other scholars such as Carland, Carland and Koiranem (1997) also researched the entrepreneur's characteristics and linked them to innovating enterprises. They described the main characteristics of entrepreneurs based on empirical evidence collected from their study of the American entrepreneurship model. This model suggests three basic characteristics for a successful entrepreneur: innovative and creative, risk taker and must have the capability to accomplish new tasks. Even though these entrepreneurial characteristics are important to explain innovating behaviour; at the same time, any of them separately can explain the success of individual entrepreneurs. Successful entrepreneurs are a result of joint efforts of internal and external forces to the organization.

The report "Entrepreneurship in Ireland" elaborated by Goodbody Economic Consultants (2002) demonstrates that strong entrepreneurial skills together with market vision and new opportunities give entrepreneurs much more confidence and increases their chances to create a successful enterprise. According to Goodbody Economic Consultants (2002), successful entrepreneurs are those who have strong entrepreneurial skills such as a risk taker, someone who wants to get things done, work for themselves, has a can-do mentality, drive, family background/support, tolerance of ambiguity, absolute belief in their idea and able to convince others as well as understand the external forces driving entrepreneurship such as public policies, economic issues, access

to finance and advice, have an ability to exploit new market opportunities and identify competitive advantages.

2.3.3 Micro and small sized enterprises, the main research target

> *"Small and medium-sized enterprises (SMEs) account for over 95% of firms and 60%-70% of employment and generate a large share of new jobs in OECD economies" (OECD, 2000).*

The most important element in the discussion of innovation is the enterprise itself. For the purpose of the current research, this researcher focused attention on the micro and small enterprises (MSE) solely as they are important players in the economic and social fields (Fowler, 2001). Also, relatively little is known about how they operate and perform as researchers often investigate large firms and overlook innovation within small enterprises (Laforet, 2008). As regards innovation, according to Timmons (1990), half of innovation introduced into the market after World War II, was generated by small firms.

The European Commission (2003) defines enterprise as

> "(…) *any entity engaged in an economic activity, irrespective of its legal form. This includes, in particular, self-employed persons and family businesses engaged in craft or other activities and partnerships or associations regularly engaged in an economic activity"* (p. 39).

As regards the size of the firms, small firms are generally those with fewer than fifty employees and micro enterprises have at most ten (OECD, 2000), but the financial criteria may also be adopted to classify enterprises by size in specific cases such as fiscal incentives or tax reduction programs.

From the economic perspective, micro and small sized enterprises (MSE) account for 95% of firms in the OECD area. According to OECD (2000), MSEs are increasingly

present in technology-intensive industries such as information and communications technology (ICT) and biotechnology as well as in the business services sectors, including computer software and information processing to human resource development. As far as innovation is concerned, MSEs are less likely to conduct R&D than large firms, but they may be more likely to innovate in other ways such as new techniques to enhance productivity, creating or re-engineering products or services and introducing new organizational approaches (OECD, 2000).

Despite the many positive aspects, MSEs face many problems and difficulties such as the difficulty to access new knowledge and technologies, low level of formation of its labor force, difficulties to access credit and new markets as well as economy of scale (Sachs, 2001). Additionally, Sachs (2001) argued that micro and small firms are much more vulnerable to adverse external economic conditions and foreign crisis than large companies. On the other hand, other studies are much more optimistic in relation to the position of small businesses in the local and global contexts. Sponsored by the International Institute for Labour Studies (autonomous facility of the International Labour Organization), two researchers (Sengenberger and Pyke) organized a research programme called the New Industrial Organization Programme. This programme developed a research network to investigate the trends in the industrial districts in many countries. One of the findings is that small firms can compete efficiently when organized in the appropriate way. To Sengenberger and Pyke (1991), one of the strategies for micro and small enterprises to face and overcome size disadvantage, business uncertainties and global competitiveness, reducing risks and taking advantage of new opportunities, is to break the barrier of isolation. They stated that the main problem faced by MSEs is not their size but being isolated.

Finally, the next section explores the close relationship between innovation and space; in particular, the emphasis on the important role of location and territorial business agglomeration models that are based on the premise that the geographic proximity of actors stimulates interactions and therefore may have a significant impact on firm's innovation performance.

2.4 Innovation and the geographic perspective (the role of location, geographic proximity and territorial business agglomeration models)

Spatial models of innovation are not alternatives to theories based on economics or sociology, but instead, they are attempts to reconsider those models in the context of location. One consequence of this is that there is considerable overlap and blurring of the boundaries between non spatial and spatial models of innovation.

So, over the past decade, there has been an interest in studies of different models of business agglomeration and the impact on firm's performance. Considering the networking and the systemic approaches of innovation, their principles suggest that interactions between actors are very relevant to the success of any innovation strategy and they use to happen on a systemic structure which may or may not be spatially determined. However, as firms are embedded in spatial territories, it is important to explore the nature of different territorial innovation models. So, to explore this theme which is directly linked to the main research themes, this section investigates some literature on spatial systems of innovation and particular mechanisms of production structures on a geographic concentration basis such as cluster models and the impact on the firm's interaction behaviour.

Even though, locational factors, territoriality, regional innovativeness and economics of agglomeration are not, individually, the central points of discussion of this research, these themes are important to connect the central issues as well as the aims of this work to the theoretical foundations.

In this section, the author presents some academic references of economics of agglomeration and territorial innovation models in which the local dynamics of actors plays a significant role not only for the improvement of firm's innovation performance but also for the regional level of innovativeness.

2.4.1 The role of location and geographic proximity in innovation

> *"The innovative process is not spaceless; on the contrary, innovation seems to be an intrinsically territorial and localised phenomenon....it is highly dependent on resources which are linked to specific places and impossible to reproduce elsewhere"* (Longhi and Keeble, 2000, p. 27).

According to Dicken (1999), every firm, every component in the production chain is literally 'grounded' in a specific location; so the role of location is critically relevant to any organizational strategy. So, the main discussion in this Sub-Section is to present some theories about the relationship between location, geographic proximity and competitiveness through innovation.

Within this context, both modern economic geography and business management disciplines agree that business competitiveness relies to a large extent upon the impact location has on firms' performance. Authors such as Davenport (1998) argued that physical space is believed to influence knowledge creation and diffusion, therefore impacting innovation and firms' competitiveness. He suspected that there was a strong causal relationship between location and innovation. To some authors, this relationship is so close that in the first phase of the innovation process firms try to detect signals in the environment about potential for changes (Tidd, et al., 2001). Many have emphasized the importance of location to innovation and most local and regional development policies implemented in different countries have been influenced by this view which suggests that location has an important role in the increase of firm's innovation activities. Therefore fostering regional development through the establishment of local supply chains and collaborative networks that result in sustainable competitive advantage is necessary (Mcdonald, Huang, Tsagdis and Tuselmann, 2007).

From the economics of "business strategy" perspective, some determinants of competitiveness are seen closely related to locational factors. One of the authors who emphasises the importance of location to the improvement of firms' competitiveness through innovation is Michael Porter. Porter's studies, back to 1990's, related issues on

business management, competitiveness and local economy. His studies concluded that the 'home base' of an enterprise is the locus of the firm's innovation activities. So, to Porter (1998a), there is a direct relationship between location and firms' innovation activities which in essence affect the economic development of the region. Also, he understands that location provides conditions to amplify competition through the creation of a flow of information which allows firms to increase innovation activities.

According to Porter (1998a), there are three aspects of the importance of location to the process of enhancing firm competitiveness through innovation: i) the magnetism of certain locations to attract important input factors (skilled and educated labour, financial resources, scientific and technological resources); ii) the quality of the business environment and, iii) the intensity of local rivalry. He explained that particularly local rivalry stimulates competition; therefore firms tend to be more innovative. On the other hand, he also accepted that both cooperation and competition can coexist, but in different dimensions. In this case, since most firms in the same location share common needs and opportunities, they are more likely to cooperate and compete at the same time.

This kind of thought is also shared by other authors such as O'Donnell and O'Connell (1997) who defended that internal domestic rivalry is relevant because it stimulates pressure to innovate due to the beneficial effects of visibility and personal pride. Based on a sample of about 2, 100 East German firms, Eickelpasch, Lejpras and Stephan (2007) found the opposite effect: the stronger the competition a firm faces, the worse the performance of these firms.

Moreover, Eickelpasch, Lejpras and Stephan (2007) proposed that suitable locational factors have a significantly positive impact on both firm performance and innovativeness. In this context, they divided locational factors into two categories: hard and soft. Hard locational factors such as infra-structure (e.g. road and the telecommunication systems) and the proximity of important innovation agents (e.g. universities and research centres) and soft locational factors (e.g. legal and fiscal environments, local tax incentive policies, regional image and good reputation of certain

places) benefit innovative firms and may be used as a means for regional policies (Eickelpasch, et al., 2007).

This "soft factors" effect creates meaning and value to specific places able to transform intangible gains (e.g. Silicon Valley in the USA is perceived as a niche of excellence in the information and technology sector) into trade and marketing advantages. The economic implication of this geographical association for businesses and regional development is being explored in some places as components of territorial development strategies (Pike, 2010). The combination of all these factors in a particular location creates value and improves efficiency, quality and specialization, resulting in the increasing of firms' competitiveness

The analysis of the investigated literature suggests that it is undeniable that firms' innovation strategies are directly influenced by location factors under social, cultural and economic circumstances. This premise highlights the importance of location for the efficiency of the innovation process. Human interactions, information and learning are also shaped by geographical environment and may impact directly on a firm's decision to innovate (Howells, 2002). So, location with appropriate infra-structure of access to knowledge sources, legal maturity, financing mechanisms, availability of educated and skilled labour plays an important role pushing firms to innovate. Presumably, location promotes the formation of an appropriate environment where all firms involved get some benefits, enhancing their ability to innovate.

Not only location itself, but being spatially close to other economic agents also influences the innovation process positively (Porter, 1998a). He stated that the high concentration in the same location of specialized skilled workers, institutions, rivals, related businesses and customers tend to facilitate business innovativeness through the increases of the frequency and the impact of interactions. This is the central issue of my research: the importance of geographic proximity to the increase of firm's interaction which may or may not have an impact on firm's innovation performance.

Other authors such as To Rosenfeld (1997) argued that

> *"Firms find it advantageous to be close to their suppliers, customers, services and competitors. Close proximity allows them to transact business more cheaply and easily, resolve their problems more quickly and efficiently, and learn earlier and more directly about new and innovative technologies and practices"* (p.3).

Moreover, Lundvall (1992), Cooke, Uranga and Etxebarria G. (1997), Cooke and Morgan (1998), Lundvall, Johnson, Andersen and Dalum (2002),) and Cooke and Leydesdorff (2006) understood that localised interactions between actors have served as an efficient tool to increase the knowledge flows and consequently to the level of innovativeness of firms in a region. According to these authors, this network which involves different economic actors helps to invigorate the systems of innovation.

While this researcher considers that the innovation process is highly depended on the interactions between various actors within a system of innovation regardless of the geographic perspective or extent of this system are precise or determined; other authors such as Porter (1998a) believe that geographic proximity and the way these firms are organized in a geographic context have a significant importance to the level of interactions within these spatial business agglomerations and consequently have an impact on firms' competitiveness.

2.4.2 Territorial business agglomeration models

Most of the territorial business agglomeration models, despite that they are different concepts of dynamic regional economies (Shearmur, 2011), have the main characteristic of keeping the advantages of spatial and geographic proximity between actors and it is believed to have influence on the development of firm's innovation process.

Historically, one of the first economists to study geographic business agglomerations was Alfred Marshall. Marshall's dominant idea about agglomerations of industries was that similar businesses geographically clustered are more likely to promote supplier specialization, to benefit from a pool of workers with similar skills and to facilitate the knowledge flows as the geographic proximity creates a sort of "knowledge is in the air" environment; therefore firms near one another would become more competitive (Cortrights, 2006).

Another scholar, a non-economist Jane Jacobs (1969) also believed that the increase of competitiveness and the geographic proximity of economic actors was the main source of region's economic development. However, from her point of view, the creation of new knowledge, technologies and products are results of the interactions between different economic actors. Different from Marshall's idea, Jacobs believed that knowledge spillovers increase between complementary rather than similar industries (Marshallian specialization). To her a diversified local production structure leads to the increase of innovation initiatives (Panne, 2004).

So, in this context, what is important to highlight is that both the Marshallian specialization (based on studies in industrial districts in England) and the Jacobian diversification (based on a geographically larger area such as cities) arguments have positive impacts on the firm's innovation performance as in both cases, the economic relationships between actors emphasize strongly the use of the network approach as a key element, even though most of the time this is not clearly mentioned in their work.

In this sense, the way firms network and organize themselves to efficiently explore and get benefits from location seems to have impact on their innovation performance. More recently, Moulaert and Sekia (2003) presented an analysis of the literature on the development of territorial business agglomeration models on innovation. They described six distinguished models of spatial innovation systems as follows: local production system, regional innovation systems, learning region, innovative milieux,

new industrial spaces and spatial clusters of innovation, all linked to subjacent theories which give support to the existence of those models (Figure 2.3).

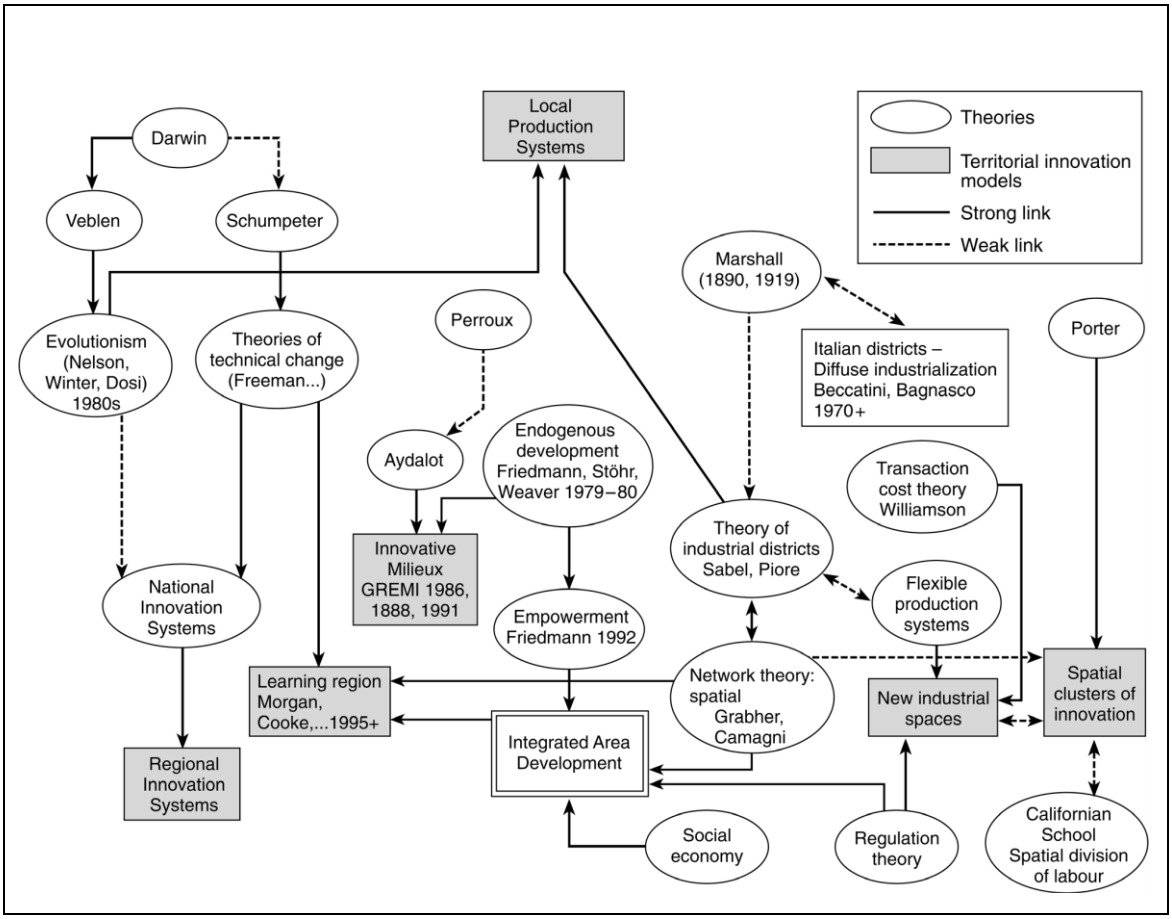

Figure 2.3 Territorial innovation models: theoretical roots and challenges. [Source: Moulaert and Sekia (2003, p.295)]

According to Figure 2.3, the authors show that there are links between various theories of innovation and the respective development of apparently different territorial models able to foster innovation initiatives. Each of the models has its own characteristics and logic and highlights different mechanisms *"whereby regions provide or generate the conditions necessary for innovation and growth*" (Shearmur, 2011).

The significance of the distinction between those models lies on what angle or perspective scholars from different academic backgrounds explore it. Different theories lead to different models and characteristics. However, the aim of this Sub- Section is not to discuss the pros and cons of each spatial innovation model individually, but to present an overview of the diversification of these models and to show that even though

there are different types of territorial business agglomeration, they all emphasise the importance of spatial externalities to the overall improvement of firm's performance and local and regional competitiveness.

As far as the innovative milieux model is concerned, over the last few years, a number of scholars such as Shearmur (2011) have been investigating the "milieux effect" on the development of regions. To Shearmur (2001) innovating milieux stress the important role of local culture, trust and the social network which leads to the increase of knowledge exchange and collaboration between firms. The "innovative milieux" approach seems to propose a new perspective of the traditional regional development theories as it moves from a perspective of regional development focused on the industry to a more holistic approach based on social, cultural, administrative, political, environmental, and economic factors (Proulx, 1992).

On the other hand, other models such as the regional innovation systems places more emphasis on institutions and the traditional industrial district model emphasises the supplier and client relationship and labour specialization. In the early 1990's, however, a new theory emerged from this idea of labour specialization and industry agglomeration: the new industry space theory. This theory is based on the social division of labour and the proliferation of new high-technology small and medium sized firms that make extensive use of information technology, employ large numbers of high skilled staff and is highly active in inter-firm networks (Gatfield and Yang, 2006). At last, the regional cluster model puts forward the idea of competitive advantages through inter-firm interactions and collaboration.

Even though all these models are relevant to any study which aims to investigate the impact of location and spatial externalities, specifically to the current study, this researcher focused attention on the regional cluster model, in particular, Porter's cluster innovation model. One of the reasons is that this model explains firms' gains in competitiveness through improvement in firms' productivity and innovation which is clearly a proposition framed in terms of business strategy and the second reason is that he considered his theory based on the advantages of externalities which arises from the way firms organize themselves (especially in spatial agglomerations such as clusters)

and the important role of geographic proximity and location and those are the main issues discussed in this thesis. His theory combines two important elements: i) innovation as a business strategy and ii) the idea of the geographic proximity to enhance the level of firm's interactions able to lead to the increase of innovation activities and improvement of competitiveness.

2.4.2.1 Spatial Cluster Model

Historically, prior to Porter's studies, Piore and Sabel's case studies of Italian districts showed, in the early 1980's, that networks of small firms spatially organized was rapidly responding to changes in market demand offering customized and high quality products where large corporations could not fill these market niches. In this way, these clusters of small enterprises, organized geographically and supported by institutions represented an important alternative to large-scale capitalism (Cortrights, 2006). This concept seemed to inspire Porter's clusters of innovation model. Even though Porter's model seemed to prioritize market and competition elements rather than the networking and social interactions within the clusters (Moulaert and Sekia, 2003), his model seems to be an important mechanism for exploring geographic proximity advantages and suggests that interactions are the means to overcome competitive disadvantages and to promote innovation initiatives.

Simmie (2004), based on Porter's studies, suggested that there are five hypotheses that relate to the reasons why clusters deliver innovation: i) they allow rapid perception of new buyer needs; ii) they concentrate knowledge and information (knowledge resources are localised); iii) they facilitate on-going relationships with other institutions including universities; iv) they allow the rapid assimilation of new technological possibilities and v) they provide richer insights into new management practices. Overall, they are seen as very beneficial to the increase of innovativeness and a sign of new opportunities.

Porter (1998b) defined cluster as

> *"geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agency, and trade associations) in a particular field that compete but also cooperate and are linked by commonalities and complementarities"* (p.198-199).

Porter's definition of cluster is a spatial agglomeration of firms characterized by a geographical concentration of economic actors. Porter (1998b) argued that these business arrangements facilitate access to external sources of knowledge, information and competencies through a network of interactions contributing to the increase of firms' competitiveness. Therefore, clusters promote a higher level of integration, increasing efficiencies and specialization, facilitating mechanisms of interchange (knowledge and information flows) and creating trust by diminishing perceived differences among firms. From this point of view, cluster is also seen as

> *"(...) a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions"* (Porter 1998b, p.227).

Those interactions are transactional and informational and indicate the type of cooperativeness within business arrangements strengthening competitive advantage. According to Porter (1998b), as a consequence of the intensification of interactions, the actors create synergy and generate an innovation environment which results in gains of competitiveness for companies, regions and country.

Others scholars, such as Rosenfeld (1997) defined cluster as *"a concentration of firms that are able to produce synergy because of their geographic proximity and interdependence"* (p.4). He suggested that clusters have the social infrastructure that keeps information flowing continuously, spark new ideas and generate the networks. He concluded that the greatest advantage of clustering is the ability of their members to learn quickly from each other, accelerating the process of innovation. Synergy suggests

collaborative interactions among participants, which leads to another approach: cluster as a business network. Malmberg and Power (2005) defined cluster as a phenomenon in which similar or related firms and industries tend to assemble (concentrate, agglomerate, co-locate, cluster) in a particular place, facilitating more rapidly the access to new components, services, machinery, and other elements needed to implement innovation. This happens mainly due to geographic proximity of economic actors and specialized institutions, facilitated by frequent face-to-face contacts. Frequent contacts are believed to promote great pressure over firms, and consequently, force them to innovate and distinguish themselves creatively (Porter, 1998a). Nauwelaers, Tom Martin Association and Vision (2004) in the report "Innovation Networks" prepared for Forfás gave a contribution to the discussion of conceptualizing clusters. They defined cluster as:

> *"Mode of organization of the productive system, characterized by a geographical concentration of economic actors and other organizations, specialized in a common field of activity, developing inter-relations of a market and non-market nature, and contributing to innovation and competitiveness of its members and the territory."* (p. 10).

Hunt, Doyle, McDermott and McCormack (2005) in the report "Business networks on the island of Ireland", prepared for InterTradeIreland, also defined cluster as:

> *"….geographically concentrated groups of interconnected companies, educational institutions, local authorities, local economic development agencies, national government agencies and related institutions that arise out of linkages or externalities across sectors. Clusters share a common regional location, where 'region' is defined as a geographic area, labor market, or other functional economic unit…."* (p. 5).

It is worth highlighting that these definitions intrinsically suggest that clusters can also be seen from a social and not only geographic and economic dimension. Porter (1998b), for instance, considered cluster as a sort of network where spatial concept and geographic proximity of members are strategic factors aiming at the implementation of cooperative practices focused on the improvement of competitiveness and are crucial to

the game of innovation. They became not merely an economic phenomenon, but also a social mechanism in which particular firms can benefit from geographic proximity to increase interactions, creating sustainable competitive advantages.

Malmberg and Power (2005) and Malmberg and Maskell (2002) suggested that spatial agglomeration of firms such as clusters facilitates innovation by enhancing learning processes and promoting the ideal environment where many actors (e.g. government, universities, institutions, firms, etc.) act together in a collaborative manner. To them, this happens due to some factors such as: face-to-face interaction, short cognitive distance, common language, trustful relationships between various actors, easy observation and immediate comparison. These factors suggest that innovation is not only an economic phenomenon, but it is equally conditioned to cultural, political, institutional and social factors.

Under geographic circumstances, cluster may be considered a type of network where the intensity of interactions and the institutionalization of relationship-building mechanisms are essential to the continuous development of innovative clusters and their advantages rely heavily on linkages and connections among individuals and firms (Porter, 1998a). Though, clusters demand not only physical proximity of several agents but also efficient formal and informal mechanisms of interactions between members. These mechanisms of interactions and co-operations are necessary to consolidate the competitive advantage, unless clusters are just simple agglomerations of firms (Schmitz, 1995 and 1997). So, in spite of the complexity of those business arrangements, they, per se, do not seem to be sufficient to promote an increase of innovation activities. They also need to promote a wide involvement of cluster participants and associated institutions as well as pay close attention to personal relationships (Porter, 1998a). According to Porter *"The mere presence of firms, suppliers, and institutions in a location creates the potential for economic value, but it does not necessarily ensure the realization of this potential"* (Porter, 1998a, p. 225).

To properly promote the coordination and management of those mechanisms able to foster innovativeness, clusters may demand an efficient governance structure. Rugman and D'cruz (1996) were among the first scholars to introduce this new element: governance, to the discussion about clusters. To them, any form of business arrangement such as business networks or clusters needed a governance structure to provide strategic directions to its members. This governance structure has the main role to stimulate collaborative interactions to make the network worthwhile for all its members.

As clusters rely on autonomous units operating in a setting of demand uncertainty with high interdependence, governance carries with it some problems of adapting, safeguarding and coordinating exchange. To overcome these problems, governance can use social mechanisms rather than authority, bureaucratic rules, standardization, or legal recourse (Jones, Hesterly and Borgatti 1997). Thus, governance bodies organize competition and cooperation fostering the improvement of innovation performance of firms in certain business arrangements, leveraging the potential of benefits by facilitating the exchange of information, know-how, and experiences. Collectively, firms gain competitive advantages that are impossible if they use their own resources individually. To Porter (1998a), associations or collective bodies should institutionalize cluster linkages. The role of these institutions should be to continuously promote cluster upgrading and an appropriate interface with a cluster's stakeholders (government, agencies, universities), as well as fostering open communication channels and building trust among members on an individual or corporate levels.

According to the Global Cluster Initiative Survey (2003), 89% of all clusters surveyed had a dedicated facilitator. This survey has shown that individual companies can independently influence cluster initiatives and development, but associations or collective bodies provide a neutral forum for identifying common needs, constraints and opportunities which enhance cluster competitiveness, acting also as a networking facilitator (Solvell, Lindqvist and Ketels, 2003). Any attempt of clusters to foster regional progress must take into consideration the existence of an efficient governance

structure the main goal of which is to coordinate a network of business interactions which can lead to individual or collective improvement of innovation performance of the firms involved. Finally, the challenge for the cluster model, however, is not to induce innovation locally, but to help firms to keep innovating. According to Porter (1998a), if they neglect do this, they are susceptible to decline.

From the point of view of some economic geographers such as Martin and Sunley (2001), this theory in terms of economic geography has many problems and it is not as unanimous among academics as it seemed to be among policy-makers, institutions and national governments. One of the main problems is the lack of geographical precision in some definitions such as "geographic proximity" and the ambiguity in the use of the term "cluster". On the other hand, Martin and Sunley (2001) recognized that Porter's spatial cluster model was very successful and the most influential among policy-makers around the world, mostly because of the efficient use of branding strategies and the way it has been marketed by Porter rather than a relevant piece of intellectual production.

The apparent conflict of ideas arising from the different views about territorial business agglomeration models, especially those related to the various concepts of cluster can be interpreted as windows of opportunity for new studies on organizational strategies such as innovation and the effective impact of local interactions on firm's innovation performance, in particular under the globalization context where the generation of knowledge is not restricted geographically.

In this sense, the merit of Porter's model, according to this researcher, is that it considers the innovation phenomenon from two perspectives: the perspective of innovation as a business strategy, therefore considering the firm's internal dynamics and at the same time, the important role of the external environment to mould this strategy. The importance of the external environment is detailed in his concept of spatial cluster which reflects much more a policy tool than an analytical concept of territorial business agglomeration models (Martin and Sunley, 2001). Despite that there are many controversies about Porter's cluster model, some points of his studies agree with some

authors from the economic geography field such as Lundvall (1992), Freeman (1995) and Edquist (1997) who emphasised the importance of location and geographic proximity as a relevant factor to stimulate innovation initiatives. Although these issues of innovation have been accepted and studied intensively worldwide in the past years, some aspects need to be discussed in detail and constantly revised. One of these aspects is the role of geographic proximity to the increase of interactions able to impact a firm's innovation performance. Thus, the central research aims of this study are focused on the investigation of relationships between economic actors within clustered structures of production and the impact on the firm's innovation process.

However, it is important to highlight that this sub-section is not focused on defending the advantages of one spatial business agglomeration model over the other nor Porter's cluster model as the most appropriate model to explain local and regional economic growth or firm's improving of innovativeness; but to investigate whether there is enough literature able to support and test these determinants of competitiveness under different conditions as it was proposed in early 1990's. These new conditions are mainly related to the advance of new communication technologies and relative importance of geographic proximity in this new trend of global pipelines.

2.4.3 Strategic issues on innovation: the different types of proximity, the geographic scope of types of knowledge (codified and tacit), local buzz and local and global pipelines.

The first question which may come up is what is the potential relationship between these issues and the research problem? The study of location, geographic proximity and clusters, in part, is justified by the notion that innovation initiatives are embedded spatially in territorial structures such as local business agglomerations and depend on the efficiency of knowledge exchange mechanisms and on information and competences from the external environment for the clusters to succeed. Many of these territorial structures use the network concept as a key element to provide constant internal and external knowledge exchange flows and other inputs able to stimulate the development

of new innovation activities (Moulaert and Sekia, 2003). So, as the research problem involves issues related to local and distant interactions in a context of clustered firms and the impact on the development of innovation, these issues are of relevant importance to the central question of this study.

As a point of departure, this researcher invokes the discussion about the important role of knowledge exchange and the networking approach to the development of innovation activities. Unquestionably, generation and transmission of knowledge are essential to the development of innovation; therefore, the analysis of how it flows among firms plays a central role in this discussion. In this sense, this section discusses the geographic scope of the interaction process considering the flows of knowledge (tacit and codified) and the impact on innovation activities. Some authors such as Lundval (1985 and 1992), Lundvall, Johnson, Andersen and Dalum (2002) and Bathelt, Malmberg and Maskell (2004) argued that the transmission of both types of knowledge may be explained geographically. They claimed that codified knowledge, represented by written codes, is "less space-sensitive" and therefore when available, they can be accessed regardless of their location. On the other hand, tacit knowledge is much more dependent on geographical proximity of actors involved and concentrated territorially. In a simplistic view, "tacit = local" and "codified = global" model provides the best alternative to combine local and global knowledge providing a great potential for dynamic interactions. This logic is followed by Gertler and Levitte (2005) who suggested that there is a tendency for the flows of knowledge and capital to be strongly induced by local relational linkages.

The important role of territoriality on innovation then is justified by the dynamic of localized generation and transmission of innovation inputs, usually associated with tacit knowledge. The level, speed and quality of this process within a certain cluster determine the intensity and relevance of the local buzz with significant impact on the development of innovation. As "buzz", Bathelt, Malmberg and Maskell (2004) defined as

> *"... the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region. This buzz consists of specific information and continuous updates of this information, intended and unanticipated learning processes in organized and accidental meetings, the application of the same interpretative schemes and mutual understanding of new knowledge and technologies, as well as shared cultural traditions and habits within a particular technology field, which stimulate the establishment of conventions and other institutional arrangements* (p. 38)

The other argument suggests that even with the existence of an intense, vibrant and dynamic local buzz there is always a need of extra sources of knowledge. According to Bathelt et al. (2004), external sources are important triggers to stimulate the growth of new innovation initiatives and to maintain the innovative level of firms already established within those territorial innovation structures such as clusters. These new sources can be accessed through a system of pipelines connecting the firms to other actors outside the cluster (distant interactions) with significant impact on the development of firm's innovation activities. This "pipeline" model was first suggested by Owen-Smith and Powell (2002) to characterize the channels used in distant interactions to access new networks which were not defined geographically as local. The advantages of accessing distant sources of innovation through this "pipeline" model rely on the fact that firms need to go beyond the borders of the clusters to reach new innovation sources able to maintain sustainable long-term flows of knowledge, information and competences and therefore firm's competitive advantage.

The analysis so far are related to the geographic dimension of the firm's interaction process, knowledge transfer and sources of innovation; however, despite the strong emphasis many economic geographers have given to the importance of geographic proximity to the development of innovation; it is neither a prerequisite nor a sufficient condition for innovation to take place. Other forms of proximity (e.g. cognitive, organizational, social and institutional) besides geographical proximity are key in understanding the impact of interactions on innovation (Boschma, 2005). In this sense,

other forms of proximity may function as substitutes to establish the links between different economic agents. This explains why even between firms from different regions, long distance type of interactions can be established with effective results in the firm's innovativeness.

In this line of reasoning, the emphasis on the "pipeline" model stimulated by the advance and development of new information and communication technologies, associated with the concept of other forms of proximity seemed to accelerate a relative decline of the importance of territoriality on innovation, especially related to the importance of local networking as sufficient mechanism to maintain firm's level of innovativeness. So, while firms in this new century recognizes that the local buzz is important to the development of a clustered firm's innovation activities, no one believes that it is sufficiently enough to provide all inputs necessary to the development of innovation activities. In this sense, new channels opened through global pipelines are built to establish new relations with distant partners providing access to important external innovation sources and with significant impact on a firm's innovation activities (Bathelt, Malmberg and Maskell, 2004). All these arguments have direct impact on the discussion about the advantages related to the interactions within clusters versus the benefits and gains of external sources of knowledge to the development of innovation activities, the central focus of the current study. Many authors such as Dicken (1999) and Martin and Sunley (2002) have adopted a "global-local" perspective on spatial development and critically discuss Porter's theory of clusters.

2.5 Chapter summary

The literature review presented in this chapter, reflects the investigation performed by this author to cover the theoretical base upon which this research was built. Overall, this researcher approached the innovation phenomenon as a systemic phenomenon driven by the entrepreneur, highly influenced by the changes in the economic scenario and by firm's interaction behaviour within a spatial business agglomeration.

Although innovation has been studied intensively, some aspects still need to be discussed in greater depth and some concepts reviewed constantly. One of these aspects is the discussion about Porter's clusters model and the relative importance of geographic proximity on the increase of interactions between firms and the potential impact it may have on the firm's innovation performance.

The analysis of the selected literature revealed that with the growing emphasis on the globalization of markets and the advance of new communication technologies, the relevance of geographic proximity to the interaction process seemed to be relatively declining and therefore, the emphasis now is to invest in building new global pipelines able to access new innovation sources outside the cluster's borders to support the growing demand for innovative products and services.

Another point reflected by the analysis of the literature review that is unanimous among the authors is that innovation is key to competitiveness and that the capacity of firms to innovate varies considerably. One of the reasons may be the impact of externalities on firm's innovation performance, in particular, the result of its engagement in business networks able to provide the necessary inputs to innovate. The main hypothesis in the literature suggests that geographic proximity enables networking with a direct impact on innovation. Case studies and research have supported this idea, but now, with the increasing advance of new communication technologies, specifically in the ICT sector and the popularity of the global pipeline approach, this may reduce the importance of the local buzz and local networking, reducing the relative importance of geographic proximity to facilitate the flows of new knowledge and information able to effectively have an impact on firm's innovativeness. So, the analysis of the literature on innovation revealed that there seem to be a gap that needs to be fulfilled: the evaluation of the significance of the geographic proximity to promote the increase of local networking and the effective impact on firm's innovativeness considering this new environment of extensive use of new communication technologies and globalization. In this context, this literature review facilitated the identification of factors and stakeholders able to influence directly this research and created the context for the planning and the elaboration of the main research question of "In agglomeration of technology-based

micro and small sized firms, is innovation associated mainly with local or non-local interactions?".

Overall, this literature review demonstrates that while arguments exist on many points of detail, there is general support for the argument that the innovation phenomenon is produced by a combination of distinct forces (e.g. internal and external competencies) acting together or separately impacting the development of new innovation initiatives at a firm's level (see Figure 2.4). However, according to Svetina and Prodan (2008), with globalization and advances in information and communication technologies, the geographic scope of these interactions is widening and the use of local knowledge sources may be insufficient in terms of innovation.

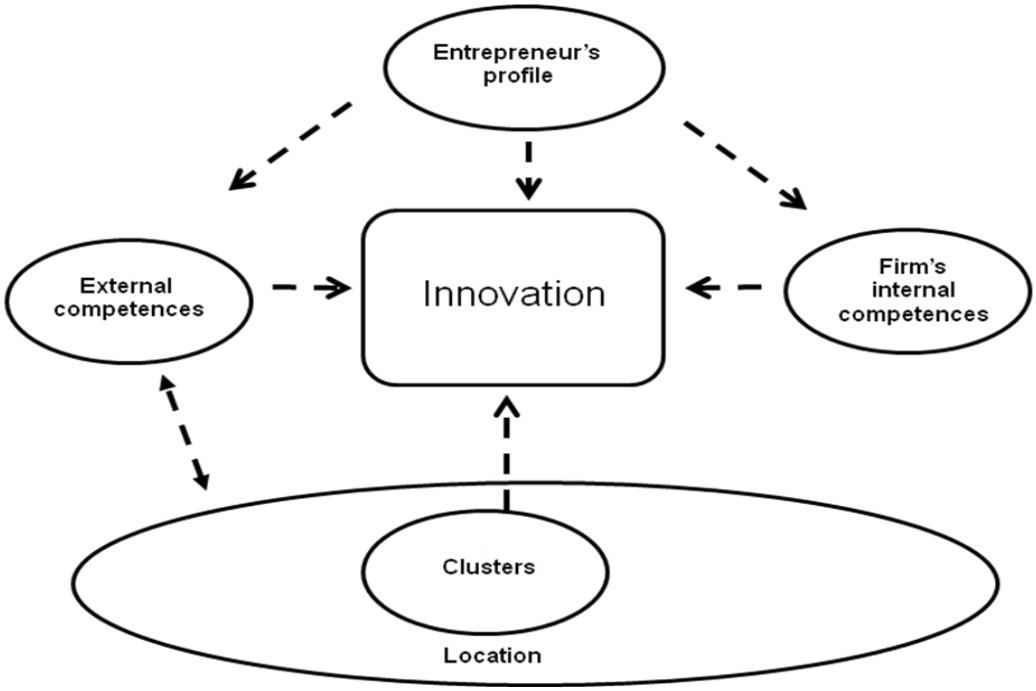

Figure 2.4 Diagram of the main forces driving innovation [Source: the current study]

So, for the current study, the theoretical references in which this thesis is founded and the links between the literature review and the research questions are explained by authors from three different knowledge fields mainly: business management, economic geography and sociology. Overall, authors such as Schumpeter (1979) recognized the

importance of innovation to keep the dynamic of the capitalist system and to the development of economies. To Schumpeter (1979) innovation is what keeps capitalist engines moving and the concepts of creative destruction and entrepreneurs are dependent on one another.

Other authors tried to explain innovation from different perspectives. Authors such as Lundvall (1992), Freeman (1995), Edquist (1997), Rosenfeld (1997), Porter (1998a, 1998b), Longhi and Keeble (2000), Malmberg and Maskell, (2002), Simmie (2004) and Malmberg and Power (2005) explained innovation from the territorial perspective. They defended that business agglomerations especially those on a geographic concentration basis, provide the ideal environment able to foster innovation due to the increase of interactions favoured by the geographic proximity of the business arrangement members. However, they did not effectively explain how the local production structure on a geographic concentration basis facilitated these interactions or how these interactions had impacted the firm's innovation performance, especially with focus on micro and small sized enterprises. From the business management perspective, authors such as Drucker (1986) established the bridge between Schumpeterian arguments and business management theories. For him, the entrepreneur is the key element in the process of introducing innovations. From the corporate point of view, Eisenhardt and Brown (1998) argued that successful innovative firms are those which are able to change rapidly and this ability to change is intrinsically linked to the organizational structure. Small sized firms and flat organizations are more likely to be innovative.

At last, in this global, informational and networked economy, firms which do not create linkages able to facilitate the process of exchange of knowledge, information and new technologies reduce their ability to get sustainable competitive advantages (Castell, 1999). In this sense, authors such as Svetina and Prodan (2008) argued that firms need to nurture relationships able to increase their ability to get competitive gains individually and collectively. This is the case of the importance of local and non-local interactions for the development of firm's innovation activities. With the growing emphasis on the globalization of markets and the advance of new communication technologies, the relevance of geographic proximity to the interaction process is

relatively declining and therefore, the emphasis now is to invest in building new global connections or "pipelines" through which firms can access new innovation sources outside the cluster's borders to support the growing demand for innovative products and services. However, even though there is an emphasis on non-local interactions, local relational linkages are still considered important to the development of the process of innovation, particularly in some specific aspects related to the flows of knowledge and capital (Gertler and Levitte, 2005).

Finally, the current chapter aimed to contribute to the general understanding of this thesis and the growing debate about the extent to which interactions under geographic proximity have an impact (or not) on firm's innovativeness. In the next chapter, the researcher presents the methodology and how the methods used to perform this study contributed to the overall project.

CHAPTER 3

CONCEPTUAL FRAMEWORK AND APPROACH TO METHODOLOGY

From the review of literature presented in the previous chapter, this researcher concluded that innovation is a complex, multidisciplinary phenomenon that is difficult to explain satisfactorily with reference to a single family of authors or even within a single knowledge field. Therefore, as a basis for this investigation, the review drew on theories from four different perspectives: economic, social, spatial and business management.

Despite this diversity of perspectives, there are some key commonalities in the literature. Authors from many disciplines agree, for instance that innovation seems to be key to competitiveness at the level of the individual firm (particularly for small sized firms), locality, region and country. Following this analysis, another aspect is the capacity of firms to innovate. It also seemed to be unanimous that firms' capacity to innovate varies considerably depending on their capacity to interact in a way to acquire the inputs they need to innovate. This in turn depends to some extent on the spatial dimension of innovation which includes the important role of location, geographic proximity and the ways firms organize themselves in territorial agglomeration models.

Some of these spatial agglomeration models suggest that geographic proximity enables local networking which has a potential impact on firm's innovation performance. One of these models is the regional spatial cluster model of innovation. Using ideas derived from several other disciplines, many authors such as Michael Porter popularized the idea that the fact that firms are physically close to each other, it potentially increases the flow of local tacit knowledge (which is an important innovation input) which, he argued, has direct impact on the improvement of firm's competitiveness through innovation.

More recently, the important role of geographic proximity of actors, the local "buzz" and the local interactions within those spatial agglomerations to the development of firm's innovation process have been challenged by the rapid advances of new communication technologies, the globalization and integration of national economies and the popularity of new approaches on innovation such as the global pipeline approach, seem to make geographic distances less relevant. However, this argument does not mean that local knowledge and local networking are irrelevant or can be disregarded; in fact, firms need to manage effectively both local and global mechanisms in order to be effective in exploiting new knowledge and technology.

To this researcher, in such circumstances, the geographic proximity-oriented approach to spatial business agglomerations with impact on firm's innovation performance needs to be revised and re-evaluated. The analysis of the selected literature has suggested that local interactions (local buzz) need to be re-interpreted considering the new dynamic of the economic factors such as the globalization phenomenon and the growing number of new technologies, in particular, in the communication sector which facilitates long distance interactions and shorter physical distances.

So, in a broader perspective, the purpose of this chapter is to outline the conceptual framework and consider the methodological principles and methods that are appropriate to this investigation of the role of local tacit knowledge and local interactions for innovation. The reason for the choice of technology-based firms for this investigation is mainly the fact that it is expected that they are much more inclined to use new technologies than traditional industries; therefore, this investigation can evaluate whether it is true that local interactions within spatial business agglomerations of technology-based micro and small firms is less important to innovation.

The Chapter is structured around the following four themes: i) framing the research in terms of conceptual framework, research question and objectives; ii) determining the methodology and methods necessary to the research question; iii) designing the research

to collect and analyse those data and iv) using the data to answer the question (Punch, 2003).

3.1 Research question and research objectives

To address a certain phenomenon, the starting point is to elaborate properly the research question or problem to be researched. The research question is a statement that clearly identifies the phenomenon to be studied and is the most important step before starting the research itself. However, the way a researcher goes through to elaborate the research question, depends on how he/she thinks about the development of knowledge (Saunders, Lewis and Thornhill, 2003).

So, the elaboration of an appropriate research question is crucial to conducting the research process. Johnson and Harris (2002) argued that *"it is the nature of a research question that will guide many of the significant choices throughout the duration of a research project" (p.100).* Thus, it is important to recognize that how the research question is formulated, influences directly the way the research is conceived, designed and conducted. Thus, to approach the research problem, the researcher posed the following research question: "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?"

Next, the general objective of the current research is to investigate whether innovation is associated mainly with local or non-local interactions within agglomerations of technology-based micro and small sized firms. In other words, the aim is to examine whether interactions in that particular context (clustered micro and small technology-based firms) effectively impact or influence the development of innovation initiatives.

Besides the establishment of the general objective, this research also aimed to achieve some specific objectives as follow:

1. To investigate entrepreneurs' perceptions of the importance of interactions for innovation activities;
2. To investigate entrepreneurs' perceptions of the importance of location for innovation activities;
3. To investigate entrepreneurs' perceptions of importance of different innovation agents for innovation activities;
4. To examine firm's interaction process and barriers to interactions;
5. To examine firm's internal innovation process and factors hampering innovation activities;

3.2 Conceptual framework

To writers such as Curran and Blackburn (2001), the design of a conceptual framework is the first step in carrying out any research. Overall, the conceptual framework is the basis of thinking about why and how the researcher undertakes a research. It describes the choice of the researcher which in essence is based on his/her understanding and perceptions of the problem. So, in this particular context, this researcher decided to approach the research problem by describing the firm's interaction and innovation behaviours in order to trace a route able to answer the research question.

The macro argument which drives the current research comes from the Austrian School of thoughts represented by Schumpeter's ideas: the capitalist system is by nature dynamic and innovation is what keeps the system moving forward. This premise induced the development of other theories on innovation such as innovation as a business strategy of differentiation which enables firms to generate a sustainable competitive advantage (Porter, 1998a).

In the 21st century capitalist-based economy, the dynamism of the economy has accelerated and there are intensified demands on firms to adopt new strategies to innovate. In this context, other elements are introduced such as the special attention on the sociological aspect of innovation and its relationship with spatial factors. This combination suggests that spatial factors have an important role in promoting interactivity between innovation agents and therefore raising the discussion of the significance of local and non-local interactions to the development of firm's innovation activities.

The logic is that as firms are embedded in specific locations, this competitive advantage-based approach on innovation is therefore not spaceless. On the contrary, it is very influenced by the location where the organization is grounded and the way they spatially organize themselves. This argument is defended by many scholars such as Tidd, Besssant and Pavitt (2001) and other authors from various paradigms within the economic geography. To Malmberg and Maskell (2002) and Malmberg and Power (2005), the way firms spatially organize themselves has an influence on firm's innovation activities. From the sociological perspective, Cortrights (2006) argued that locational factors have an influence on firms' innovation performance and for firms to succeed they must network and collaborate with each other. This interaction process considers both local and non-local interaction as significant for the development of the process of innovation. Scholars such as Granovetter (1973) suggested that non-local interactions (weak ties) are more likely to create bridges to access new knowledge and updated information; therefore, increasing the possibilities of becoming more innovative. On the other hand, other scholars such as Gertler and Levitte (2005) suggested that local relational linkages (strong ties) are also of importance for innovation, particularly when related to specific aspects such as the local flows of knowledge and capital. These arguments provide a focus for this research's theoretical foundation as shown in Figure 3.1.

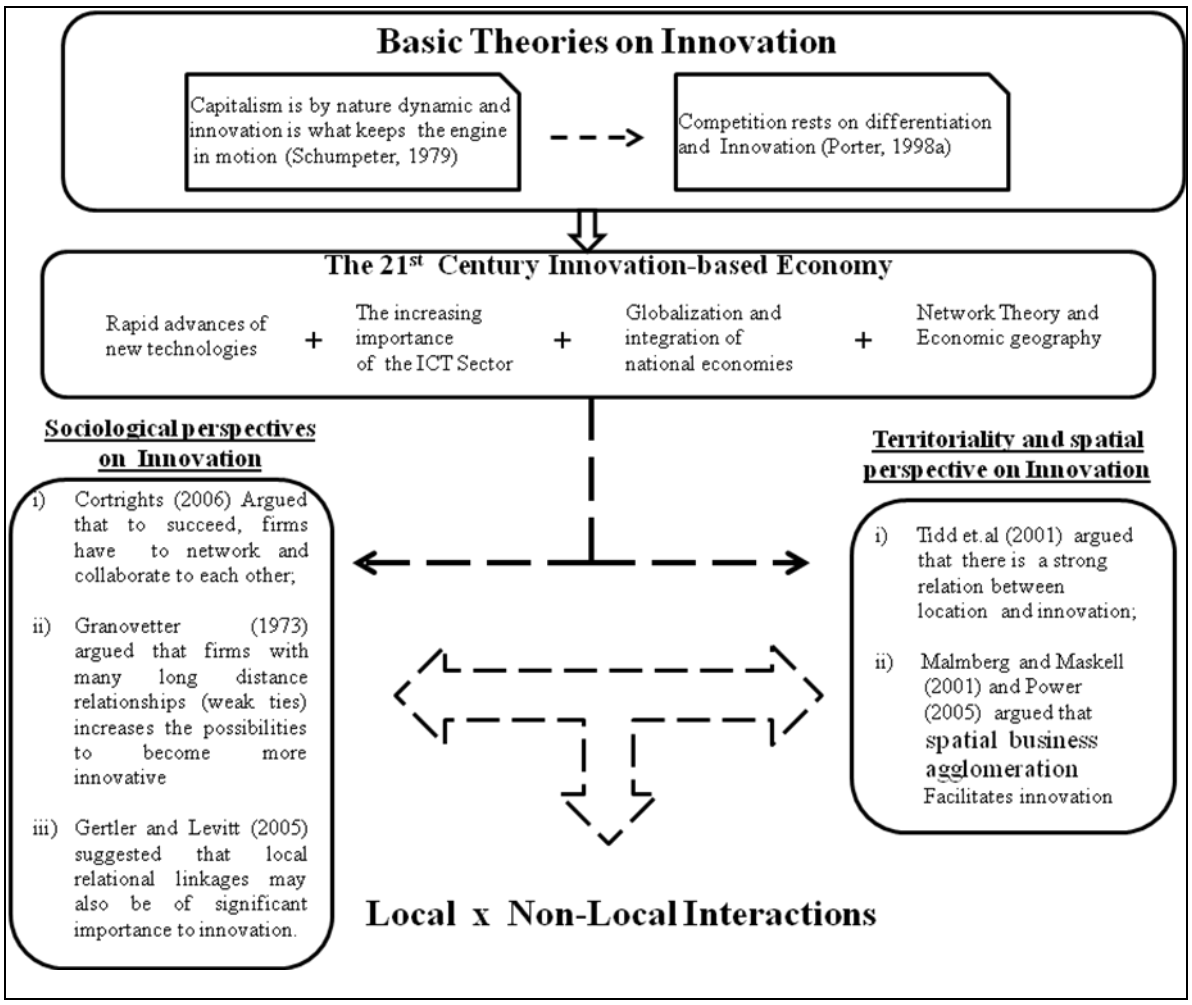

Figure 3.1 Research Conceptual Framework [Source: current research]

Following the reasoning of the conceptual framework, some concepts may appear to be abstract notions allowing different interpretations, which can lead to unexpected results; so, it is important to clarify and to identify the meanings of each key concept in order to establish a common understanding, avoiding misinterpretations.

Thus, in Table 3.1, this researcher lists and defines the three key concepts (innovation, local interactions and spatial business agglomeration) pertaining to this study. Each key concept also needs to be observable and measurable in ways which make them clearly identifiable in the data-collection process (Curran and Blackburn, 2001).

Concept	Definition
1. Innovation	Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations (OECD/EUROSTAT, 2005).
2. Interaction	Interaction is a relationship between two or more individuals and/or organizations in a process of exchanging information, skills, equipment, knowledge and competencies. Local interactions – any interaction with partners within the spatial business agglomeration. Non-Local interaction – any interaction with partners outside the spatial agglomeration borders. (Definitions by the author of the current study).
3.Spatial Business Agglomeration	Spatial business agglomeration is a form of business agglomeration (formal or informal recognized grouping) that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions (Definition by the author of the current study, based on Porter (1998b)).

Table 3.1 Key concepts and definitions [Source: current research]

Another aspect related to the conceptual framework is the identification of *hypotheses*, also called *propositions*. According to Curran and Blackburn (2001) hypotheses or propositions are *"…statements which assert a relationship between two or more concepts."* (p. 41). As this research is positioned in the field of social science, the term *proposition* is the most suitable and appropriate. So, Table 3.2 shows the main theoretical and specific propositions pertaining to the current research.

Main Theoretical Proposition	Specific Propositions
Within agglomerations of technology-based firms, innovation is much more likely to be associated with non-local interactions than with local interactions.	○ Interactions in general are important to innovation; ○ Interactions depend on the entrepreneurs' attitudes and perceptions; ○ Interactions focused on innovation outputs are likely to be associated with non-local interactions and inputs into innovation processes are more likely to be associated with local interactions; ○ The accesses to local and global sources of innovation need to be combined effectively.

Table 3.2 Propositions related to the current research [Source: current research]

The last aspect involves the "theory". Theory is simply the hypothesis or propositions together with additional statements which collectively suggest why something occurs. It is also associated with the 'explanation' or 'interpretation' of a certain phenomenon. So, considering that the key concepts have been clearly defined the theory would suggest why such a relationship exists (Curran and Blackburn, 2001).

The existing theories of economic geography perspective on innovation have suggested that the spatial business arrangement models promote the formation of an appropriate environment where all firms involved get some benefits from geographic proximity, knowledge spill-overs and interactions, enhancing firm's capability to innovate.

However, the review of literature seemed to suggest that there is a gap to be fulfilled: the evaluation of the importance of geographic proximity under a new scenario of extensive use of communication technologies and globalization of economy. Few studies have investigated the evidence of the relative significance of proximity,

considering the population of small sized firms, specifically in the technology sector; therefore the debate of this theme is still disputed. So, this reflection constitutes the "theory" that guided this research and from which those propositions were derived.

3.3 Methodology (philosophical approach) and Methods (research design)

At this point it is important to draw a distinction between methodology and method. Methodology is more philosophical and refers to the approach that underpins the research and method is related to the tools of data collecting and analysing (Blaxter, Hughes and Tight, 2001). Thus, once a research problem has been identified, the researcher needs to select the appropriate research design to approach that problem.

Every research is based on premises and assumptions about how the world is perceived and understood (Trochim, 2006), the central role of any researcher is to define, identify and analyse those assumptions in order to describe the process adequately. Therefore, the research process is the materialization of the format of the inquiry. It is the step by step process of any research and it depends on the way the researcher thinks about the development of knowledge (Saunders, et al., 2003). So, among the five major philosophical assumptions involved in a research (ontology, epistemology, axiology, rhetorical and methodological), the choice of stances on each assumption leads to practical implications for conducting and designing the research. In this sense, the strategic planning and definitions concerning the research process is an important step to the completion of the study.

3.3.1 Research Philosophy

The understanding of the researcher's philosophical position is the basis of any research process and neglecting to discuss it, may seriously compromise the quality of the research itself. So, this section briefly explains the predominant philosophical stance

driving the current study, considering the three major philosophical schools of thoughts: positivism, interpretivism and realism.

Even though this discussion is much more abstract than objectively focused on the research process, it is important to understand the philosophical stance associated with the research process. Theoretically, the process of the choice of the philosophical paradigm should be based on the curiosity and understanding of certain phenomenon as well as the improvement of knowledge every researcher pursues. This is not an argument about which philosophical paradigm (e.g. positivism, interpretivism or realism) is the most relevant in general, as they all have strengths and weaknesses; but, in particular, to determine which is the most suitable to answer the research question.

So, considering that the real role of any researcher, it is not only to collect and measure data and facts, but to appreciate the different constructions and meanings that people place upon their experience (Easterby-Smith, et al. 1994); considering also the research question and objectives, this researcher positioned the current research within the phenomenological paradigm solely. The phenomenological approach provides mechanisms to understand how ideas are acquired and acted upon within a business environment and allows the understanding of how human interactions affect the firm's capability to innovate. These are phenomena that are not easy to "measure" statistically and much depends on the interpretations placed upon events by business owners and managers. It lends itself to a methodology that seeks to understand influences on human behaviour in particular social interactions placed within a spatial dimension (See Table 3.3).

	Phenomenological paradigm
Basic beliefs:	➢ Innovation phenomenon is socially constructed through interactive process; ➢ Interaction is driven by human interest;
Researcher shall:	➢ Focus on meanings: the importance of interactions to innovation initiatives through the investigation of perceptions of entrepreneurs; ➢ Try to understand what impact interactions within cluster have (or have not) on firms' innovativeness;
Preferred methods include:	➢ Using multiple methods to establish different views of phenomena: interview and bibliographic investigation mainly;

Table 3.3 Overall current research philosophy [Source: current research (based on Easterby-Smith, et al., 1994, p. 27)]

3.3.2 Research design

To Hayter (2004), Research design is the way "in which empirical information is collected and analysed..." (p. 15); however, according to the same author, information and data analysis do not speak for themselves; they need to be evaluated from a particular conceptual perspective.

In the current study, the conceptual perspective in which this research design model was founded considered the following premise: innovation is not only an economic phenomenon but also a result of social mechanisms driven by human actions. So, while recognizing that innovation is a strategic business decision and a product of interaction between individual and organizations with impact on firm's innovation process, this author directs attention to innovation as an organizational strategy but with interference of other related subjects (e.g. corporate sociology, economics of innovation and economic geography).

Overall, this research's conceptual framework derived from the Austrian School of Economics which recognizes innovation as product of economic factors as well as social pressures and cannot be explained by mathematical or statistical methods only,

but also by interpretation of qualitative data. The focus is not on location decisions or how locations affect their performance but to investigate their interaction behaviours as regards the quantity and quality of local and non-local interactions and the effect of those interactions on the firm's innovation performance. So, any attempt to propose any research design approach must take these premises into consideration.

In this context, considering that it has been argued that a phenomenological approach is the best suited to the types of issues under investigation in this thesis, one consequence is that the research design needs to focus on the understanding of some specific situations which social aspects are operated within spatial circumstances in a relatively small number of cases. Also, considering the complexity of this theme forced the researcher to limit the geographical extension and scale of study. In these terms, the study lends itself to an "intensive" form of research design as discussed by Sayer and Morgan (1985) (See Table 3.4). To Sayer and Morgan (1985), intensive research works out in particular cases in which the primary questions are concerned to approach how certain process work, what produces a certain change and what the agents do. It also facilitates substantial relations of connections and normally produces causal explanations of certain events.

Considering the current research positioned within the phenomenological paradigm and the research design based on the intensive approach, the discussion now is about the details of the research design in order to effectively provide consistency to the answer of the research question and objectives.

	Intensive	Extensive
Research question	How does a process work in a particular case or small number of case? What produces a certain change? What did the agents actually do?	What are the regularities, common patterns, distinguishing features of a population? How widely are certain characteristics or processes distributed or represented?
Relations	Substantial relations of connection	Formal relation of similarity
Type of groups studied	Causal groups	Taxonomic groups
Type of account produced	Causal explanations of events, through not necessary a representative one	Descriptive "representative" generalizations, lacking in explanatory penetration
Typical methods	Study of individual agents in their causal contexts, interactive interviews, ethnography, qualitative analysis	Large scale survey of population or representative sample, formal questionnaires. Standardized interviews and statistical analysis
Are the results generalizable?	Actual concrete patterns and contingent relations are unlikely to be 'representative', 'average' or 'generalizable'. Necessary relations discovered will exist wherever their data are present,	Although representative of a whole population, they are unlikely to be generalizable to other population at different times and places.
Disadvantages	Problems of representativeness	Lack of explanatory power.

Table 3.4 Intensive and Extensive research: a Summary [Source: based on Sayer and Morgan (1985)

3.3.2.1 The Research methodological approach (the qualitative/quantitative distinction) and the research purpose

It would be simplistic to consider that the difference between both: quantitative and qualitative strategies, would reside only on the fact that quantitative research employs measurement and quantification and qualitative does not; actually, it is much more

complex than that. Quantitative research suggests a path of verification, while qualitative involves discovery and descriptions.

The great majority of authors, such as Mason (1996), commonly consider the qualitative approach associated with the social research school. To Mason (1996), qualitative approach is concerned with how the social world is interpreted, experienced, produced or understood. In this sense, the qualitative approach is grounded in a philosophical position which in general is related to interpretivism as opposed to the quantitative approach which is related to positivism. Thus, apparently, there are significant differences between both, qualitative and quantitative approaches in many dimensions (see Table 3.5).

Requisites	Quantitative	Qualitative
1. Principal orientation to the role of theory in relation to research	Deductive; testing of theory	Inductive, generation of theory
2. Epistemological orientation	Natural science model, in particular positivism	Interpretivism
3. Ontological orientation	Objectivism	Constructivism

Table 3.5 Fundamental differences between quantitative and qualitative research strategies

[Source: based on Bryman and Bell, 2003, p. 25]

Objectively, considering the research's characteristics of being positioned within the phenomenological paradigm and the research design based on the intensive approach (Sayer and Morgan, 1985) which suggests that the research question should consider the understanding of a certain process and the establishment of causal relations between agents through the study of individual stakeholders and qualitative analysis, the choice of which research strategy provides the best approach to answer the current research

question (“In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?”) seems to be the qualitative approach.

This choice also considered the general context in which the study was founded: a relatively small sample population (two locations with four clusters and population of not more than two hundred and fifty firms) and the format of information able to explain the complexity of the phenomenon investigated. Under these circumstances, it seemed clear that primarily the emphasis was less on numbers and much more on words perceptions, contextualization and the meaning respondents give to the events they experienced.

Regarding the research purpose, theoretically, it involves three main different approaches: exploratory, descriptive or explanatory. Independently to the adoption of one approach or the other, the choice is closely linked to the research question and research objectives as well as the way the researcher perceives the complexity of the phenomenon. However, it does not mean necessarily a researcher should adopt only one approach; on the contrary, a research may adopt a combination of two or three approaches, as they are not mutually exclusive.

On the face of qualitative aspect of the current research and the phenomenological stance using an intensive research design approach and considering the research question and objectives, the current research purpose is predominantly explanatory. The explanatory approach is crucial to understanding the core issue of this research (the relationship (not causality) between interactions (local and non-local) and innovation), therefore fundamental to the formulation of the answer to the research question. However, it may combine some characteristics of the other two approaches: the exploratory approach is useful to gain more information and insights about the nature of the relationship (causality or not) between interactions and innovation activities under the specific conditions of clustered firms. This approach allows the researcher to formulate propositions and to decide the best techniques to approach the research

problem. The descriptive approach is helpful in identifying the profiles, characteristics and behaviour patterns of entrepreneurs and firms surveyed, necessary to perform a good explanatory research.

3.3.2.2 Research Approach (Deductive and Inductive)

Another important issue regarding the methodological issues involving any research is the definition of its method of reasoning: inductive and deductive approaches. They have a direct impact in the design and structure of the research, influencing particularly its empirical findings (the result of observations made in order to check out the assertion) (Jankowicz, 2000) (see Figure 3.2).

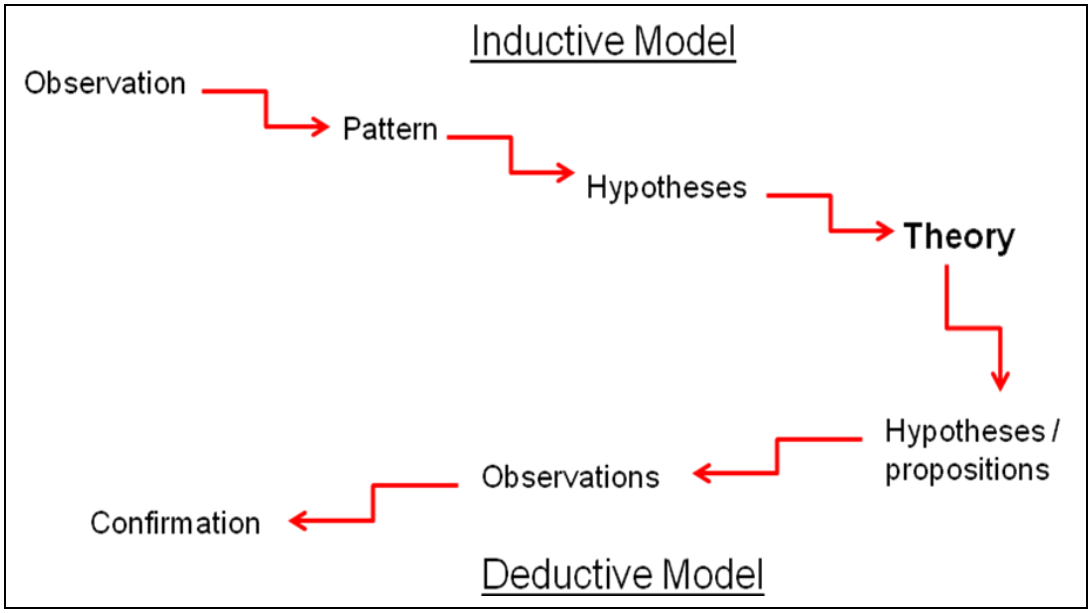

Figure 3.2 Inductive and Deductive Models [Source: based on Trochim, 2006]

The choice of one of these two approaches, however, depends on the nature of the research, research question, answers the researcher expects to get, time and audience (Saunders, et al. 2007).

In general, there are many differences between both approaches (see Table 3.6); however, Saunders, et al. (2007) supported and recommended whenever possible, the use of more than one reasoning approach in the same study,

> *"…So far we have conveyed the impression that there are rigid divisions between deduction and induction. This would be misleading. Not only is it perfectly possible to combine deduction and induction within the same piece of research, but also in our experience it is often advantageous to do so"* (Saunders, et al. 2007, p. 119).

Deductive approach	**Inductive Approach**
• Scientific principles • Moving from theory to data • The need to explain causal relationships between variables • The collection of quantitative data • The application of controls to ensure validity of data • The operationalisation of concepts to ensure clarity of definition • A high structured approach • Researcher independence of what is being researched • The necessity to select samples of sufficient size in order to generalize conclusions	• Gaining an understanding of the meanings humans attach to events • A lose understanding of the research context • The collection of qualitative data • A more flexible structure to permit changes of research emphasis as the research progresses • A realization that the researcher is part of the research process • Less concern with the need to generalize

Table 3.6 Deductive and inductive approaches [Source: based on Saunders, et al., 2007, p. 120]

So, as regards the reasoning method, the current study was basically framed considering the inductive approach method, but with some stances of the deductive one as well (see Table 3.7). The inductive approach allowed the researcher to focus on the core context of this thesis: the investigation of whether interactions within clusters have (have not) an impact on the firm's innovation process and therefore, gaining more substantial information and insights about the research problem through the collection of qualitative data. Also, it allowed the researcher to identify the perceptions people have about key issues concerned with both processes (interaction and innovation processes).

Deductive Approach	Explanation
• Moving from theory to data • Researcher independence of what is being researched	• Existing theory: as clustered firms are close to each other (geographic proximity), they are more likely to interact, therefore become more innovative; interactions then, have an impact on firms' innovativeness.
Inductive approach	**Explanation**
• A close understanding of the research context • The collection of qualitative data • Gaining an understanding of the meanings humans attach to events	• To understand the context of cluster strategy to firm's innovation process; • To investigate whether interaction impacts innovation; • To capture entrepreneurs' perceptions about interaction and other issues concerned with innovation activities;

Table 3.7 Current research's reasoning approach [Source: current research (based on Saunders et al., 2007, p. 120)]

The application of the deductive reasoning approach involved the relationship between the existing theories about economic geography and innovation and the research problem. As shown in the literature review chapter, there are numbers of studies examining the importance of clusters and interactions within those spatial arrangements for the improvement of firms' competitiveness through the increase of firms' innovation initiatives. In general, most of the existing theories seem to argue that as clustered firms are close to each other (geographic proximity), they are more likely to interact, therefore becomes more innovative due to the increase of the information flow among them. So, according to these theories, interactions within clusters have a great impact on firms' innovativeness. However, as presented in the section 3.4, there are good grounds for thinking that this may not be effectively true nowadays. So, this researcher suggested an investigation process whereby propositions were deduced from existing theories and these propositions guided the methods of data collection so that they can be investigated (see Table 3.2).

3.3.2.3 Research Strategy

This section is concerned basically with the structure of data-collection that neatly addresses the research question. Saunders, et al. (2007) argued that in spite of there being many tools of research strategy, such as: experiment, survey, case study, action research, grounded theory, ethnography and archival research, the choice the researcher makes should be guided by:

i) The research question and objectives

ii) The extent of existing knowledge

iii) Time and resources available

iv) Researcher's own philosophical beliefs.

This view of the research strategy stresses the importance of the research question and objectives as the starting point of any decision. The decision process is driven by the choice for the more suitable tool to answer the research question begins with two other questions: i) what is the researcher trying to find out and ii) how will he do this.

As regards this study, the answer to the first question is: this researcher is investigating whether interactions within spatial business agglomerations have (or have not) an impact on the development of firms' innovation activities and this is translated basically into the research question (In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?). To answer the second question, the argument of what is the most suitable tool that matches with the need to give the most appropriate answer to the research question, considers the tools (e.g. experiment, ground theory, action research, case study and survey) listed by Saunders, et al. (2003).

So, the choice of the appropriate tool should be the one which promotes the best conditions to give that answer. Moreover, the suitable tool should also be compatible with the intensive research design approach, research purpose, main methodological strategy (qualitative), research philosophy (phenomenology) and research reasoning approach (inductive /deductive).Under these circumstances, this researcher considered that the "survey" tool was the most suitable to answer the research question and the research objectives. Aspects such as: to capture of people's perceptions, possibility to administer structured questionnaires and to collect data faster and economically, were the main reasons which led the researcher to decide to adopt the survey strategy to approach this investigation.

3.3.2.4 Time horizon

Time horizon is another important part of any research project and depends on how you are planning to carry out your research. As many decisions over your study, it depends basically on the research question and how you are going to gather data to answer it. Generally, gathering data can be done just once (snapshot) or in several points in time. This may seem simple, but it is what distinguishes a 'cross-sectional' and a 'longitudinal' study respectively:

> *"A study can be done in which data are gathered just once, perhaps over a period of days or weeks or months, in order to answer a research question. Such studies are called one-shot or cross-sectional studies…in some cases, however, the researcher might want to study people or phenomena at several points in time…such studies are called longitudinal studies"* (Sekaran, 1992, p. 109 and 110)

In this particular study, due to the characteristics and nature of the phenomenon researched (innovation), the research question and objectives and the fact that this academic project was time and resource constrained, this researcher decided to adopt the cross sectional approach as the most appropriate time perspective for data collection.

3.3.2.5 Research Criteria and the Data Collection Methods

The research criteria provides the framework and the boundaries of the investigation as well as determines what the investigator aims to achieve. It is based on the research question and depends on the objectives that the researcher is pursuing.

Considering the current research question context, there are indications of three key elements which are inexorably linked to the research criteria: i) the research question indicates that firms must be located within a spatial business agglomeration; ii) must be micro or small sized firms (firms must have less than 10 and not more than 50 employees) and iii) firms must be in the technology sector.

The Data collection method is another important part of any type of research. Data collection means gathering data and information to address certain problems or questions. The data collected is the evidence to answer the research question; therefore, it must come from reliable sources and through trustworthy methods. For data collection method, a researcher has available a wide range of means, techniques and sources which can be used to answer the research question. He / She can employ techniques from primary and secondary sources, for instance, such as i) primary sources: observation, interview, questionnaire, case study and ii) secondary sources: business analysis, government publications, books and articles.

However, the key point is how to select the appropriate technique to get the right information to answer the research question. The choice of the method of data collecting is a complex matter and depends on the research question, the choice of the research strategy tool (survey), the data analysis process, how the data is going to be interpreted and reported and costs and resources associated with the process as well as the choice of the research design approach. In this case, the intensive research design approach (Sayer and Morgan, 1985) suggests the use of interactive interviews which are

able to capture agents' perceptions, explaining and establishing substantial relations between the events.

In the current research, this researcher adopted the interviewing strategy as the primary source of data collection. Interviewing is a useful technique of data collection, especially in an intensive-based research design approach and qualitative research, to obtain information when the researcher is unsure of the nature of the phenomenon (exploratory approach) and the size of the sample population is relatively small. Theoretically, interviewing may be in two ways: unstructured or structured and can be conducted face-to-face, by telephone or computer-assisted (Sekaran and Bougie, 2010).

This researcher decided to administer interactive (face-to-face) interviews conducted by the researcher himself and based on a structured questionnaire (closed-ended questions), which allowed a logical sequence of conversation. Face-to-face interviews ensure that the answers are properly understood, it is more flexible, it is easier to clarify any doubts, establish credibility between interviewer and interviewee, it is possible to manage the time so any discomfort can be detected and finally can be administered in relatively small samples.

In this particular data collection process, the interviews were administered following ethical issues such as confidentiality, privacy and anonymity. It was agreed that for this specific research, respondents are not going to be identified with their own names, but with codes.

The interviews were conducted based on a questionnaire, which according to Sekaran (1992), is the most suitable technique to approach a survey research. The questionnaire technique allows the investigator to obtain data more efficiently in terms of time, energy and cost. The questionnaire administered in the current investigation was designed in line with the recommendations of the Oslo Manual (OECD/EUROSTAT, 2005)

methodology for innovation surveys. The structure of the questionnaire and logical construction of the set of questions were based on two internationally recognized innovation surveys: the Community Innovation Survey (CIS) and the Brazilian Innovation Survey (PINTEC). The questionnaire is structured according to the following dimensions and respective variables as shown in Table 3.8.

Dimensions	**Variables**
Firm's characteristics	• Year started the operation • Number of employees • Main activity
Respondent's characteristics	• Respondent's position • Level of education • Age
Firm's innovation performance	• Product, process and organizational/marketing innovations implemented during the period of 2007 and 2008 • Responsibility for innovation • Types of innovation • Factors hampering innovation activities • Importance of innovation agents
Networking and co-operation for innovation activities	• Perception of belonging to a business arrangement • Perception of advantage in belonging to a business arrangement • Types of interaction experienced • Nature of interactions experienced within business arrangement • Types of partners and location • Factors hampering interactions

Table 3.8 Research Questionnaire - dimensions and variables [Source: current research]

3.3.2.6 Summary of the research design section

This topic outlined the methodological principles and methods of this research process. Figure 3.3 presents the visualization of the research methodological framework which stressed the key points pertaining to this research such as i) this research is framed

within the phenomenological paradigm; ii) research design – intensive approach; iii) it is a qualitative research; iv) explanatory study mainly; v) an inductive method of reasoning is used; vi) regarding time perspective, it is a cross-sectional study and vii) the main data collection strategy was the use of survey interviews with administration of interactive interviews based on structured closed-ended questionnaires. All issues approached throughout this chapter, from selection of locations, research question to research design and data collected methods constituted the methodological backbone of this study.

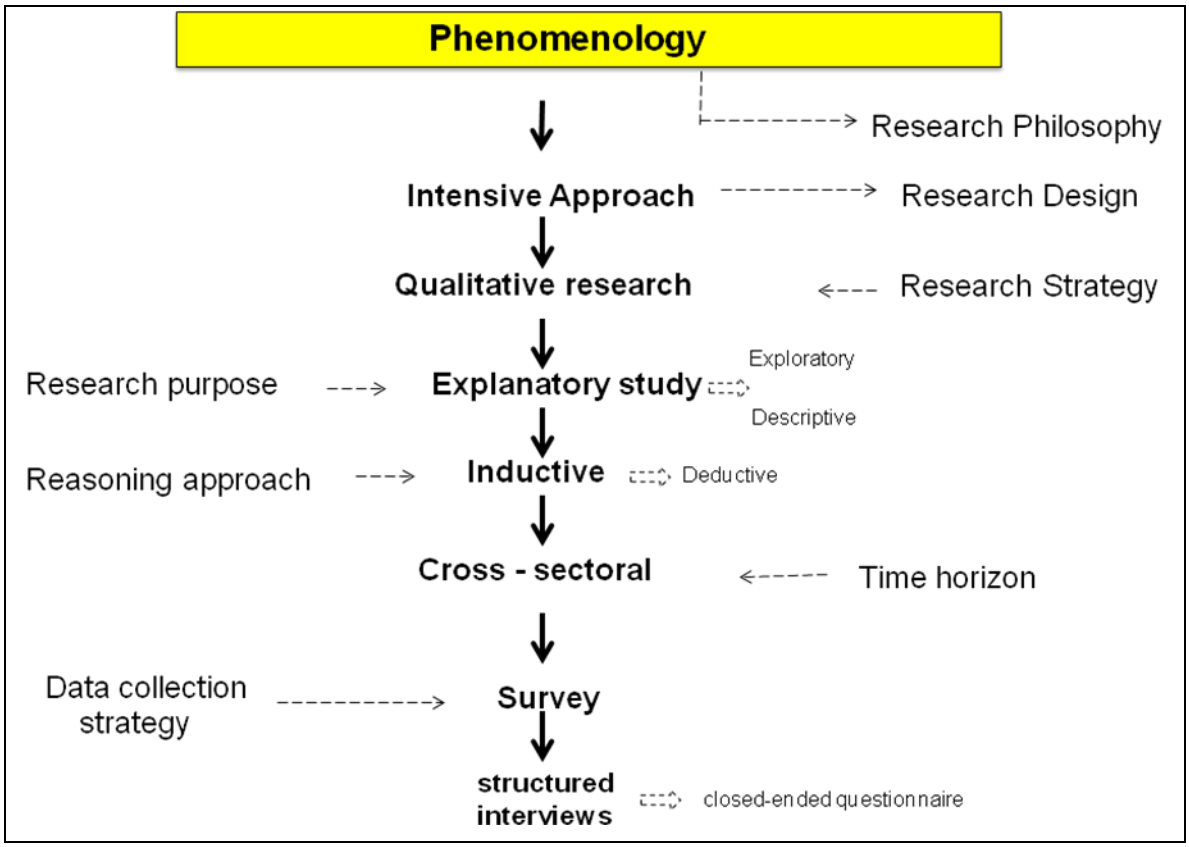

Figure 3.3 Research Methodological Framework [Source: current research]

It is therefore important to understand that different business research may employ a variety of different research designs. The same happens with studies in other areas such as economic geography or industrial geography, for instance. Moreover, the choice of one research design model over the other is not associated to the dichotomy between intensive or extensive research design approach (Sayer and Morgan, 1985), quantitative

or qualitative strategies and between inductive or deductive approaches, but to the perception and reflection on the nature of the research's theoretical and methodological dimensions. In most of the case, successful research considers the combination of various research models as the most appropriate and suitable approach to address the research problem.

Considering the current research the combination of the intensive research design model (Sayer and Morgan, 1985), qualitative, explanatory, inductive, cross sectional and survey offered a unique type of research design able to answer the research question of "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?".

From the intensive research design model, the current investigation adopted the study of a relatively small group of individual firms through interviews conducted in an interactive way. The information generated by this sort of interview is basically qualitative. Some may say that this model has problems of representativeness and generalization; however, the sampling firms surveyed were representative of the whole population as well as they revealed important insights into complex processes which could not be clarified by other models. Even though this research is eminently an intensive-based research design, from the extensive research design, the current study explored the standardized interviews approach through a structured questionnaire. This approach provided a crucial mechanism to keep the focus on the main research problem. In the end, the empirical strength of the current research lied on the combination of positive points from different research models to obtain a more complete knowledge and understanding of the problem under study.

3.3.3 The investigation period (time span)

As Regards the investigation period, some considerations needed to be made: i) this researcher recognizes that innovation is a continuous process and therefore sometimes it is difficult, if not impossible, to isolate and to measure it; ii) some theoretical considerations indicate that innovation occurs in waves in a certain period of time; thus, short or longer investigation periods may compromise the accuracy of the results. Thus, this researcher, considering that the current study refers basically to the examination of the innovation phenomenon under the specific angle of the interactivity within clusters, decided to adopt the suggestion recommended by the Oslo Manual (OECD/EUROSTAT, 2005) which argued that *"...the length of the observation period for innovation surveys should not exceed three years nor be less than one year"* (p. 130). On the face of it, the investigation period for this study was the last two years (2007-2008) prior to the period of interviews in 2009.

3.3.4 Data analysis

One of the most important stages of any research is the data analysis. It is the process of interpreting gathered data, highlighting important information which leads to consistent conclusion, supporting ideas, propositions and theories. This topic provides an overview of how data were treated and analysed, considering the complexity of the phenomenon researched, the research question and the methodological premises that underpinned this research.

The way the researcher organizes, analyses, interprets and reports the findings is much more than simply a compilation of data. In fact, the data analysis stage is the more complex and sensitive part of any thesis because the researcher compiles the raw data so that it can be presented to answer the research question. In the data analysis process, the data can be analysed, interpreted and reported considering three basic formats: numerical, non-numerical or using both forms. The choice of the appropriate format is

directly related to the type of research (qualitative or quantitative), the research question and the way the researcher wants to present the findings.

Regarding the methods data can be analysed, according to Easterby-Smith, Thorpe and Jackson (2008), there are five different methods as follows: content, grounded, discourse, narrative, conversation and argument analysis. According to these authors i) the content analysis is more deductive and has been used successfully in the examination of historical artefacts; ii) the grounded analysis is more inductive, searching for the understanding of the context and time. This approach is the more 'open', allowing empirical data to be used from many sources such as from interviews or surveys; iii) the discourse analysis is more appropriate to the examination of psychological issues and takes into account the complexity of the social context in which the conversation takes place; iv) the narrative analysis is based on the analysis of people's stories and is related to the interpretation of those stories; v) the conversation analysis can be used when the data is in the form of transcripts of conversation between two or more people and finally, vi) in the argument analysis, the respondents are completely involved in the situation as they are asked to write stories of events at work and then asked to critically reflect about them. The argument analysis can lead to a change in the respondent's behaviour. So, considering the study's variables and characteristics, this researcher adopted the grounded analysis method.

The data analysis process involved many steps. The first step was to develop an Excel spreadsheet in which all questions from the structured questionnaire were displayed. Such a spreadsheet facilitated the entry of the responses directly into the computer. Every question from the structured questionnaire was codified using numbers (i.e. question #1, question # 2 and so on) in order to facilitate the manual process of entering the raw data in the Excel spreadsheet and therefore future analysis. Other data, such as comments and perceptions obtained through the interviews, were reported literally or through researcher's perceptions in order to support or emphasize the evidences. Those comments and perceptions were sorted into five categories, each of them according to each research objective. So, every comment and perception could be easily identified according to each research objective. The procedure adopted to sort the comments into

different categories according to each of the five research objectives took into consideration the context in which the comments were placed and the interpretation of the researcher. It is important to highlight that for each objective there is a specific question or a group of questions related to this objective, so that it is relatively easy to identify in what context these comments were placed.

The data entry process in the spreadsheet was performed manually firm by firm, organized by business arrangement and then grouped by location: Recife and Campinas separately. Despite that this is not a comparative study, the categorization by location helped the researcher to analyse interaction and innovation behaviours individually in each location. Moreover, the data were treated considering three basic aspects: data concerned with both the interaction behaviour and innovation performance and the perceptions and comments entrepreneurs had about issues affecting both processes.

The interaction behaviour analysis involved information about interactions only focused on the development of innovation activities within and outside the clusters. In this stage, the data analysis aimed to verify to what extent those interactions influenced and impacted the development of the firm's innovation initiatives. The second aspect involved the innovation performance. The empirical evidence should demonstrate whether firms were (or were not) innovative and draw a general picture of the firm's innovation performance. The last aspect investigated how the entrepreneurs perceived issues such as networking, business arrangement strategy and external agents influencing innovation activities.

The final step was to present the data available in a way that could explore the best understanding of the data and to lead to a conclusive answer to the research question. In the current research, most of the data, even though this is a qualitative research, were quantified and presented in numerical format and tables, in order to emphasize percentages, proportions, frequency and distributions of the empirical evidences. In summary, this topic aimed to present a detailed description of the data analysis process

which in essence, formed the basis of the findings chapter. Finally, Figure 3.4 below presents a diagram of the data analysis process.

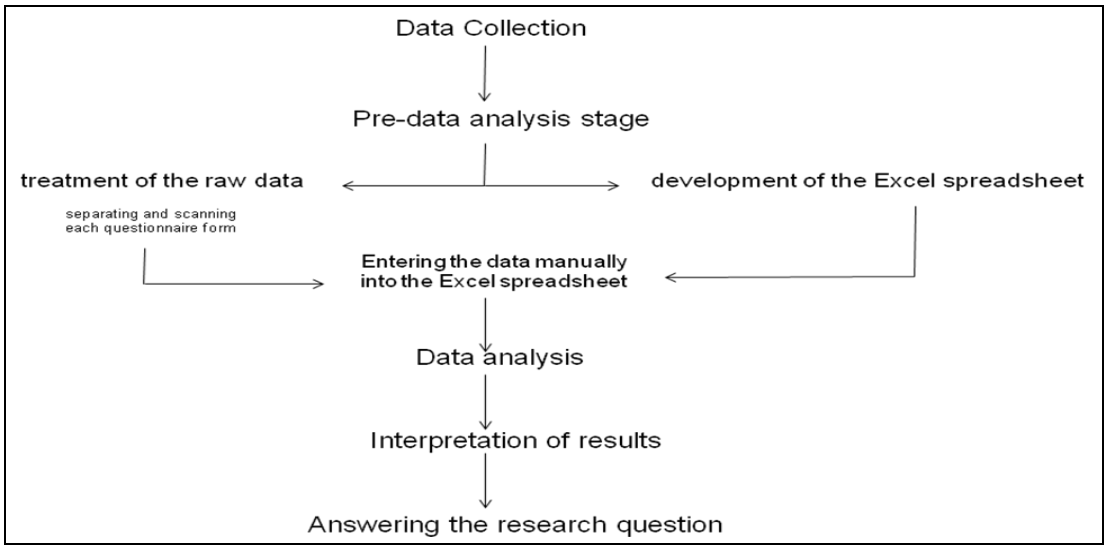

Figure 3.4 Diagram of the data analysis process [Source: current research]

3.4 Research validity and reliability

Scientific research is seen as the ideal means of disclosing certain phenomenon. Thus, it is necessary to include control and to insure both credibility of research findings and whether it is done correctly. To prevent mistakes occurring, researchers should always be concerned with: research validity and reliability. In general, a clear explanation of the data collection process facilitates the assessment of research validity and reliability.

As regards research validity, it refers basically to the gathered data and reflects the degree to which a research guarantees it is measuring what it claims to be measuring. Through the research question of "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?", this study investigated the geographic scope of interactions impacting the firm's innovation activities.

Thus, to ensure validity and to reduce the possibility of getting wrong answers, this researcher conducted interactive (face-to-face) interviews (Sayer and Morgan, 1985) based on a structured questionnaire. To avoid misunderstanding, the instrument of data collection (questionnaire) contained the definitions of the concepts pertaining to this investigation and the choice of interviewees was based on the people who really run the business and main decision-makers such as the entrepreneurs and managers.

As regards internal validity, this researcher was concerned to give confidence that the measure included a representative set of items that could cover all concepts, address key issues pertaining to this study and ensure the quality and accuracy of the measurement instrument. The method used ensured that: i) the measurement instrument was adapted to the audience; ii) it answered the research question and iii) there was transparency in the concepts and definitions pertaining to this investigation.

Externally, this researcher was concerned to what extent the methodology used in the current research could equally be applicable to other research settings and at other times, so that the results found could be comparable. In this case, the methods used seemed to guarantee the validity of the data gathered as in both locations, this researcher also interviewed cluster managers with the clear purpose of triangulation, assuring that the interviewees were honest and sincere in their responses.

The other aspect this researcher was concerned with was the research reliability. This is associated with the quality (accuracy) of measurement and the consistency and repeatability of research measures. Reliability is the extent to which a research can yield the same results under the same conditions and similar observations can be reached by other researchers. One of the most important choices of this investigation regarding reliability was about the data collection process, more specifically about the decision of which measurement tool should be adopted.

To decide what was the most suitable measurement tool to answer the research question and objectives, this researcher considered that: i) even though this study was not purely an innovation investigation in the sense of describing analytically the innovation process, innovative firm was one of the research criteria, therefore, it was important to evaluate the firm's innovation performance and ii) the measurement instrument should contemplate questions which measured the research objectives (general and specific). The questionnaire therefore was designed considering the two main dimensions pertaining to this study: interaction and innovation. Each question was related to one of the subjects investigated. The first group of questions addressed the innovation process and the second the interaction process.

Furthermore, to ensure comparability, this researcher adapted the measurement tool to the same methodology (Oslo Manual (OECD/EUROSTAT, 2005)) used by the Organization for Economic Co-operation and Development (OECD) to measure and evaluate innovation performance in various countries. This is an internationally tested and recognized methodology to measure innovation and has inspired many initiatives for standardizing survey methodology and technological innovation indicators ensuring comparability at regional, national and international levels. Additionally, this researcher also administered the structured questionnaire in four other firms outside the selected business arrangements in order to test the instrument and to verify if it effectively provided consistent results under different circumstances of those it was designed for.

Finally, the application of the structured questionnaire during the interviews based on the Oslo Manual (OECD/EUROSTAT, 2005) methodology, the use of the same measurement instrument in all groups of firms surveyed ,the discussion of findings with some respondents and the application of this instrument with firms under different circumstances assured the scientific rigor of the current research. Also, considering that the design of the instrument (questionnaire) used to collect the data and the formulation of the set of questions was closely based on the recommendations of the Oslo Manual (OECD/EUROSTAT, 2005) methodology for innovation surveys, this researcher assumes that the results are consistent therefore leading to legitimate and conclusive conclusions and reliable outcome.

3.5 Chapter Summary

This chapter explored the main methodological issues and methods used to approach the investigation of firms' strategy regarding innovation initiatives from the aspect of interactivity and the specific circumstance of locating in a spatial business agglomerations. The final outcome should answer the research question of "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?"

To ensure scientific rigor, consistency, credibility, accuracy and comparability, this researcher followed certain methods as described in this chapter, so that the findings can lead to satisfactory conclusions. The robustness of the methodology and results produced are substantially consistent to provide a basis and techniques to other researchers to perform similar studies in other business arrangements and thus this research results may be legitimized.

Finally, academic research may develop or test theory and when applied with good methodological basis, normally yields the desired outcome. So, considering the methodology and methods applied, this academic piece of work which was derived from the excitement of exploring the innovation and interaction phenomenon under the specific circumstance of business arrangements based on geographic limitations, produced satisfactory results, contributing to the theory and good practices of innovation, especially for micro and small sized firms.

CHAPTER 4

TECHNOLOGY-BASED FIRMS WITHIN SPATIAL AGGLOMERATIONS IN BRAZIL, THE MAIN RESEARCH TARGET

This Chapter presents an overview of the economic and innovation landscape in Brazil as well as introducing the main study areas, the choices of the sampling population and a descriptive approach of the selected areas for investigation.

4.1 Contextualization

To perform the current investigation, this researcher decided to select Brazil as the main target. In the past twenty years, Brazil has experienced many transformations in the economic scenario. The implementation of an aggressive stabilization plan in early 1994 to control inflation (Plano REAL) and a relative modest approach towards opening the economy through trade liberalization and foreign exchange policy were among the most important measures adopted by the government to re-organize the country's economy and to prepare it to face the challenges of the new century.

Also, the choice of Brazil relies on the fact that the country is one of the biggest economies in the world, but internally, the innovation rate is growing slowly which means that Brazilian firms have not been so successful in improving the level of innovativeness. According to PINTEC 2000 (IBGE, 2002), 31.5% of the firms surveyed implemented product and/or process innovations. Almost ten years later, according to the same survey, PINTEC 2008 (IBGE, 2010), this figure has grown to 38.6%. This means that in the past ten years, the innovation rate grew only 7% points (see Table 4.1). Considering the innovation rate among small sized enterprises, the result demonstrates that the innovation performance of small enterprises is lower if compared to the national average (see Table 4.2).

Period	Firms surveyed	Firms which implemented innovation in products and/or processes	% Innovation rate
1998-2000	72, 005	22, 698	31.5%
2001 – 2003	84, 262	28, 036	33.3%
2003-2005	95, 301	32, 796	34.4%
2006-2008	106, 862	41, 262	38.6%

Table 4.1 Overall Innovation rate in Brazil (1998-2008) [Source: IBGE (2000, 2003, 2005 and 2008)]

Since the first Brazilian innovation survey (PINTEC) was undertaken by the Brazilian Institute of Statistics (IBGE), back in 2000, PINTEC is becoming much more representative and therefore reflecting a much closer picture of the Brazilian innovation performance. According to Table 4.1, the population surveyed increased from 72,005 firms in 2000 to 106,862 firms in 2008. This increase of almost 35,000 new firms surveyed, also included changes in the methodology. One of the most significant changes in the past years was that at the beginning only industrial firms were surveyed. Now, Firms from the service/technology and research & development sectors are also part of the survey population.

Period	Firms surveyed	Firms which implemented innovation in products and processes	% Innovation rate Small firms	% innovation rate National average
1998-2000	56, 611	15, 086	27%	31.5%
2001 – 2003	67, 165	20, 894	31%	33.3%
2003-2005	75, 904	22, 926	30%	34.4%
2006-2008	85, 361	31, 663	37%	38.6%

Table 4.2 Innovation rate in Brazil – Small firms [Source: IBGE (2000, 2003, 2005 and 2008)]

From the domestic point of view solely, some may argue that the situation is not so bad as the innovation performance of Brazilian firms is growing even slowly. Yet, when compared with other countries, the innovation performance of Brazilian firms reflects a significant loss of competitiveness in the international scenario. With the acceleration of the speed of technological changes and the frequent movement of product and services

across nations, countries must be worried about the level of firms' innovation performances as it defines the level of a country's competitiveness. The integration of national economies through trade, direct foreign investments, capital flows and flows of technologies, is inevitable and irreversible.

So, when considered in the international context, the Brazilian innovation picture is even worse. The country's innovation performance is behind many European countries such as Denmark, Ireland and Germany (see Table 4.3). This comparison is possible due to the use of the Oslo Manual (OECD/EUROSTAT, 2005) methodology in both innovation surveys (Community Innovation Survey (CIS) and PINTEC). In this sense, the present picture emphasizes the importance of mapping closely Brazil's innovation performance, in order to understand what causes the apparent weaknesses and bottlenecks hampering the acceleration of the innovation initiatives in the country.

Countries	**Innovation surveys**	**Innovation rate (%) 2002-2004**	**Innovation rate (%) 2004-2006**
Germany	CIS	65%	62%
Austria	CIS	53%	50%
Ireland	CIS	52%	47%
Denmark	CIS	52%	47%
Brazil	PINTEC	33% (2001-2003)	34% (2003-2005) 38% (2006-2008)

Table 4.3 Innovation rate among selected countries **[**Source: IBGE (2003, 2005 and 2008); Eurostat (2007) and CSI (2009)]

The level of a country's innovativeness sets the sustainable level of its economic prosperity. Competitive economies tend to be more prosperous as they have the ability to sustain a higher level of innovativeness. This discussion is the main contribution of the current research in which the increasing importance of the role of innovation on country's competitiveness leads to urgent measures to stimulate new innovation initiatives.

4.1.1 Innovation performance of Brazilian firms– an overview

The overall innovation rate in Brazil has increased modestly since PINTEC survey was first performed by IBGE (Brazilian Institute of Statistics) in 2000. The first PINTEC survey, version 2000, covered the period between 1998 and 2000 and revealed that, on average, three (31.5%) out of ten firms were involved in product or process innovation. The latest PINTEC survey, version 2008, showed that this scenario has changed slightly. Now, almost four (38.6%) out of ten firms were involved in innovation activities (see Table 4.2).

There are many explanations for this modest growth in the country's innovation rate. One of the explanations is the fact that there is a quite unbalanced relation between innovation rate of firms in the manufacturing and service sectors. During the period of 1998 to 2008, the PINTEC surveys showed that the innovation rate between firms in the manufacturing and service sectors was quite unbalanced. According to PINTEC 2008, firms in the service sector (i.e. telecommunication, computing and R&D firms) presented an innovation rate of 46.5% against 38.1% of firms in the manufacturing sector (see Table 4.4). Other factors such as innovation expenditure also may explain the modest growth of innovation rates in Brazil in the past ten years. The amount of money invested in innovation activities (innovation expenditure) is an important conditioning factor which impacts directly the development of innovation activities. Innovation expenditure is used to invest in intramural and extramural R&D, to access new innovation sources (external knowledge) and to acquire new machinery, equipment and software (OECD/EUROSTAT, 2005).

Sectors	**1998-2000 IR**	**2001-2003 IR**	**2003-2005 IR**	**2006-2008 IR**
Manufacturing	31.5%	33.3%	33.4%	38.1%
Service (telecommunication, computing and R&D)	-	-	56.9%	46.5%

Table 4.4 Innovation rate (%) by sector – Brazil **[**Source: IBGE 2002, 2005, 2007 and 2010]

Table 4.5 shows that the overall innovation expenditure in Brazil almost doubled in ten years, from R$ 22, 3 bi in 2000 to R$ 43,6 bi in 2008. This is not only because firms are investing more in innovation, but because there was an increase of the absolute number of firms surveyed.

Sectors	PINTEC 2000	PINTEC 2003	PINTEC 2005	PINTEC 2008
Manufacturing				
Overall innovation expenditure – R$ Billion	$ 22,3	$ 23,4	$ 34,4	$ 43,7
Innovation expenditure in small sized firm segment – R$ Billion	$ 1,9	$ 1,9	$ 4,8	$ 5,0
% small sized firms / overall innovation expenditure	8,5%	8.1%	14.0%	11.4%
Average of innovation expenditure / firm (R$ 1,000)	$ 1,1	$ 1,1	$ 1,7	$ 1,4
Service (telecommunication, Computing and R&D)				
Overall innovation expenditure – R$ Billion	-	-	$ 6,9	$ 10,4
Innovation expenditure in small sized firm segment – R$ Billion	-	-	$ 0,47	$ 0,61
% small sized firms' innovation expenditure / overall innovation expenditure	-	-	6.8%	5.9%
Average of innovation expenditure / firm (R$ 1,000)	-	-	$ 3,4	$ 4,3
Total				
Overall innovation expenditure – R$ Billion	$ 22,3	$ 23,4	$ 41,3	$54,1
Innovation expenditure in small sized firm segment – R$ Billion	$ 1,9	$ 1,9	$ 5.3	$ 5,6
% small sized firms' innovation expenditure / overall innovation expenditure	8,5%	8.1%	12.8%	10.4%
Number of firms engaged in innovation activities (a)	22,698	28,036	32,796	41,262
Number of firms which invested ($) in innovation activities (b)	19,165	20,599	21,966	33,034
Relation between (b) / (a)	84%	74%	67%	80%
Average of innovation expenditure / firm (R$ 1,000)	$ 0,99	$ 1,1	$ 1,9	$ 1,6

Table 4.5 Innovation expenditure in Brazil [Source: IBGE (2002, 2005, 2007 and 2010)]

According to PINTEC 2000, 72,000 firms were surveyed and in 2008, over 106,000. Besides that, the number of firms engaged in innovation activities which invested ($) in innovation jumped from 19,000 to 33,000 firms in 2008. Moreover, the overall average of investment in innovation by firms individually grew 62% since the first PINTEC survey was published in 2000. In absolute figures, it grew from R$ 990.00 according to PINTEC 2000 to R$ 1,600.00 in 2008. Considering the average of innovation expenditure in the manufacturing and service sectors, PINTEC 2008 showed that while firms in the service sector invested R$ 4,300.00, firms in the manufacturing sector invested only R$ 1,400.00. PINTEC surveys have confirmed that firms in the service sector, especially technology-based firms, traditionally use to invest more in innovation activities therefore present higher innovation rates than firms in the manufacturing sector. In the same period, according to the PINTEC surveys, the innovation expenditure in the group of small firms increased substantially from R$ 1, 9 bi in 2000 to R$ 5, 6 bi in 2008 (see Table 4.5).

Small firms in the manufacturing sector were mainly responsible for this expansion on the innovation expenditure figures suggesting that after the aggressive trade liberalization policies in middle 1990s, small industrial firms invested in new equipment and modern machinery. In spite of all these figures regarding innovation expenditure suggesting that the country is "flying" in the right direction, the country's innovation rate did not take off satisfactorily. The explanation may be the quality of the expenditure.

According to PINTEC version 2008 (IBGE, 2010), the first priority as far as innovation is concerned among firms in the manufacturing sector is the acquisition of new machinery and equipment. 77.7% of firms considered it of high importance for the development of innovation. The second most important innovation expenditure is "training courses" as a complement to the first priority. Among firms in the technology service, the acquisition of software is the most relevant form of maintaining the level of innovation. This evidence suggests that Brazilian firms, on average, embody new technologies through acquisition of new equipment and software and not through the investment in new knowledge and technologies.

Other information presented by PINTEC surveys such as the main agent responsible for implementation of product/service innovation, the perception of the respondents about some sources of innovation (i.e. R&D department, third level institutions, clients, suppliers, and so on) and the level of co-operation also caught this researcher's attention. This set of information in general refers to the interaction behaviour of firms. So, as regards the main agent responsible for implementation of innovation, PINTEC surveys present information sorted by type of innovation (i.e. product/service and process innovation) as well as by economic sector. In the context of this study, while in the product/service innovation, 85% of firms were the main agent responsible for the development of innovation, in the process innovation, this figure was only 18%. As far as the economic sector is concerned, in the manufacturing and services sector, 84% and 86% of firms were the main agent responsible for the development of product/service innovation respectively. Regarding process innovation, only 17% and 35% of firms, in the manufacturing and service sector respectively, were the main agent responsible for that type of innovation.

As far as co-operation is concerned, the PINTEC survey version 2008 (IBGE, 2010) showed that only a few firms experienced some sort of co-operation arrangement for the development of innovation activities; therefore, the level of co-operation of Brazilian firms may be characterized as relatively low. When sorted by economic sectors in general, PINTEC survey version 2008 (IBGE, 2010) showed that only 10% of firms in the manufacturing sector were engaged in co-operation arrangements for the development of innovation as against 13.1% in the service sector. However, one particular group of firms caught this researcher's attention: the group of firms in the research & development (R&D) segment. PINTEC survey version 2008 (IBGE, 2010) showed that, on average, among R&D firms the level of co-operation was astronomically high.

Almost 93% of firms surveyed were engaged in co-operation arrangements for the development of innovation. In general, for firms in the manufacturing and service sectors, the most important co-operation partners were clients/customers and suppliers

(see Table 4.6); but for R&D firms the most important co-operation partners were universities and research institutes.

Sources of innovation	High importance to innovation
Virtual information network	50%
Client/customer	46%
Suppliers	39%
Competitors	23%
Consultants	11%
University	7%
Research institutes in general	5%

Table 4.6 Sources of innovation to the development of innovation [Source: IBGE (2010)]

Considering the size of firms, the group of small sized enterprises presented levels of co-operation lower than the national average: 8.4% and 11.8% of small firms in the manufacturing and service sector respectively were engaged in co-operation arrangements.

PINTEC surveys also present some information about respondents' perceptions of the importance (high, medium or low/not relevant) of some external sources of innovation (i.e. suppliers, clients, competitors, universities, consultants and research institutes). The PINTEC survey version 2008 (IBGE, 2010) showed that among the most important sources of innovation are clients/customers and suppliers. 46% and 39% of firms surveyed answered that clients/customers and suppliers respectively are of high importance for the development of innovation activities (see Table 4.6). However, in general, the most important source of innovation, according to the same survey, was "virtual information networks". Exactly 50% of firms identified "virtual information networks" as of high importance for the development of innovation.

Furthermore, PINTEC surveys also presented some information about the number of firms supported by government programs (i.e. financial aid or fiscal and incentive

policies mainly). According to PINTEC survey version 2005(IBGE, 2007), almost 19% of firms engaged in innovation activities benefited from some of the government programs to promote innovation initiatives. In 2008, this figure grew to 22.3% which means that more firms are supported by government schemes. Among the firms supported by the government to invest in innovation, medium and large enterprises were the ones that benefited the most. On average, 36.8% of large corporations (over 500 employees) were beneficiaries of some of government programs.

The most important government program in the manufacturing sector was the financing program for acquisition of new machinery and equipment. This program usually offers lower interest rates if compared with regular market rates. According to PINTEC survey version 2008 (IBGE, 2010), 14.2% of firms applied for this financial benefit; on the contrary, programs less requested are those which finance R&D projects in co-operation with universities and research institutes. Only 0.8% of firms applied for this type of benefit.

Two government institutions are the main financing agents which support innovation initiatives in the country: Research and Projects Financing Agency (FINEP) also known as the Brazilian Innovation Agency and the Brazilian development bank (BNDES). FINEP was created in 1967, as a public agency linked to the Brazilian Ministry of Science and Technology. FINEP's mission is to promote innovation among private companies, third level institutions, research centres and other public or private institutions as well as to finance and fund innovation projects and R&D activities. The Brazilian development bank (BNDES) is a public financial institution established in 1952. It is linked to the Ministry of Development, Industry and Foreign Trade and plays a fundamental role in financing national enterprises of all sizes. Its mission is to provide long-term financing mechanisms at competitive interest rates able to foster sustainable economic and social development and to improve the competitiveness of the Brazilian economy. However, as regards fiscal and incentive policies, only 1.1% of firms engaged in innovation activities get some benefits from this kind of policy. Among large corporations, this figure grows up to 16.2%.

Other efforts such as the legal environment are also essential to provide conditions to the improvement of a country's innovation performance. In Brazil, as far as legislation is concerned, there is a new group of laws implemented since 2000 to incentivise firms to innovate. This new set of laws is especially focused on small sized firms. The main laws are as follows:

i) Lei da Inovacao, 2004 (Law of innovation)

ii) Lei do Bem, 2005 (Law of good)

iii) Lei geral da micro e pequena empresa, 2006 (General Law for micro and small enterprises)

"Lei da Inovacao" or Law of innovation (2004) is focused on building an appropriate environment (co-operative environment) for the development of innovation through the creation of incentives for R&D activities in the productive sector (industrial and service). "Lei da inovacao" was inspired by the French law (Loi sur l'innovation et la recherché) from 1999, and it was based on four pillars:

1. Companies need to innovate to survive in the global market;
2. The important role of universities and research centres, as knowledge generators;
3. The responsibility to promote conditions to approach universities, research centres and companies is assumed by the government;
4. The legal instrument needs to be efficient to create a new and dynamic relationship between universities, research centres and firms (co-operation).

Another legal instrument to stimulate innovation initiatives in Brazil is the "Lei do Bem" or Law of good, which offers a package of incentives (fiscal and non-fiscal) to firms to innovate. As fiscal incentives, firms are able to deduct the innovation expenditure in the corporate income tax; as non-fiscal incentive, the new law allows the government to subsidize the researchers' salaries involved in technological innovation activities.

Finally, the "Lei geral da micro e pequena empresa" (2006) or General Law for micro and small enterprises has given a differential legal treatment to innovative micro and small companies. According to this law, all government levels (i.e. federal, state or local) as well as all public institutions are responsible to promote and create specific programs able to foster innovation initiatives among micro and small sized enterprises. Also, according to this law, 20% of the government's budget must be allocated to the development of R&D activities and technological training courses.

From the legal point of view, the Brazilian legislation seems to be favourable to the development and improvement of innovation initiatives; however, innovation apparently is not only about good laws, it is much more complex and depends on several other aspects (i.e. infrastructure, knowledge creation and diffusion mechanisms, skilled labour and favourable market conditions). Thus, to understand a country's innovation landscape it is also important to examine why some firms do not innovate and which factors are hampering innovation activities in the country. This is fundamental to the formulation of public policies able to stimulate the increase of innovation initiatives in Brazil. In this sense, PINTEC surveys also suggest some clues about the main problems blocking or hampering innovation in Brazil. According to PINTEC survey version 2008 (IBGE, 2010), almost half of firms (49.8%) affirmed that the problems they faced were of relevant importance (high or medium importance) and among the four main barriers; three are economic problems (innovation costs are too high, lack of funding and financing and excessive perceived risks) and one is internal to the organization (lack of skilled labour). These problems have affected not only small enterprises, but large corporations in the whole country.

Despite that the overall number of firms supported by government programs has increased in the past years as well the variety of mechanisms to stimulate firms to innovate, the government efforts do not seem to be sufficient to meet the huge challenge to increase the innovation rate in Brazil. This challenge is even higher among micro and small enterprises. According to Corder (2004), neither government nor financial institutions are properly engaged with Brazil's needs to improve and support innovation activities in the industrial or services sectors. The immediate consequence of this

insufficient capacity of the government to stimulate efficiently the improvement of innovation performance of Brazilian firms is the slow growth of the country's innovation rate during the past years.

In summary, this section presented an overview of the economic scenario and a review of the innovation landscape in Brazil. During the past twenty years many factors have influenced the decision to invest in innovation. The positive perspective in the economic context was one of these factors. Inflation was under control, there was a relative aggressive trade liberalization policy which allowed the country to expand its presence in the world markets and to import new technologies and new laws were implemented to stimulate and to incentivise new innovation initiatives. This new legal environment has reflected government's concerns about the low level of competitiveness and poor innovation performance of Brazilian firms. Many new and specific laws are providing special treatment for firms engaged in innovative initiatives. According to PINTEC survey version 2008 (IBGE, 2010), during the period between 2006 and 2008, over 9,000 firms were supported by government programs to improve their capacity to innovate. This represented an increase of 50% if compared with previous periods such as 2003-2005.

However, In spite of this favourable economic and legal scenario as well as efforts undertaken by the Brazilian government at all levels (federal, state and local) to support and to stimulate firms to increase innovation activities, it was not enough to leverage the country's innovation rate satisfactorily.

The overall understanding is that innovation seems to be a very complex phenomenon and has demanded actions in many directions: from funding and financing to new legislation framework, from good infrastructure to positive entrepreneurs' attitudes to innovate. None of these aspects separately seems to provide necessary and sufficient inputs to effectively support sustainable improvement of the country's innovation performance. Country's successful innovation performance then seems to be a combination of the efficiency of the national innovation system to provide basic innovation inputs able to stimulate new innovation initiatives and the entrepreneurs'

ability to identify internal innovation competencies and to interact with external agents when these competencies are not found internally.

4.1.2 The changes in the economic scenario in Brazil since the early 1990s

Giving the development of innovation initiatives is strongly influenced by global and country's economic contexts, the examination of economic transformations during the past twenty years in Brazil is essentially relevant for the understanding of the innovation performance of Brazilian firms.

Since the early 1990s, Brazil has faced many changes in the political, social and economic fields. In the past twenty years, the Brazilian democratic regime was re-established, the country's presence in world markets was expanded with a relative liberalization of the economy, inflation was under control and poverty reduction policies were seriously implemented. However, such political, social and economic measures were not enough to place the country comfortably in the world scenario. The acceleration of the process of globalization during those years has demanded from countries faster and more efficient decisions. This view has nothing to do with anti-capitalism or anti-globalization arguments, but with a realistic view that much has to be done in order to guarantee a sustainable integration of the national economy into the international scenario.

Even though important measures were taken, some of them were relatively modest and the impact on the level of innovativeness of firms is growing gradually. Before 1990, past governments insisted firmly to prioritize the domestic market as opposed to an export oriented strategy (closed economy).

For over fifty years, Brazilian governments decided to create a strong and self-sustained domestic market through the implementation of strategies which prioritized investments in the development of national industries with national technology as opposed to what

other countries were doing (i.e. Chile and Korea). This strategy was implemented with strong import controls, including not only foreign product/service but new knowledge and technologies. This context created an environment relatively averse to new technologies and the country's industries became obsolete which reflected directly in the low level of innovativeness of Brazilian firms. This technological and trade isolation reflected in the loss of competitiveness in the international scenario and it was only in early 1990s when the first democratic government elected after years of dictatorship decided to gradually open the economy.

However, the combination of economic measures, especially those related to the control of inflation and trade liberalization, even relatively modest, created an optimistic scenario able to stimulate entrepreneurs to heavily invest in innovation otherwise they could not survive in these new domestic and global markets.

4.1.3 Brazilian economy after economic reforms in the middle 1990s

The most important challenge faced by the Brazilian government in middle 1990s was the control of inflation. The inflation accumulated in the period between 1986 and 1994 reached 842.5%, according to the Brazilian Central Bank (2010) (see Table 4.7). International experiences have demonstrated that inflation under control is sine qua non to sustainable economic growth (Brazilian Central Bank, 2010).

Period	Annual Inflation rate (%)
1980 - 1985	147.1%
1986 - 1994	842.5%
1995 - 2003	9.1%
2004 - 2006	5.5%

Table 4.7 Annual inflation rate in Brazil [Source: Brazilian Central Bank, 2010]

Since the 1980s, Brazilian governments have been fighting against inflation through many economic plans. It was only in 1994, the Minister of Finance, Fernando Henrique Cardoso (he became the Brazilian president during the period 1995-2003) finally implemented an economic plan capable of addressing the fundamental problem of the Brazilian economy: inflation. The "Plano REAL" was primarily focused to control inflation and was based on three key pillars: i) fiscal strategy, ii) monetary reform and iii) opening of the economy. The "Plano REAL" was very successful and reduced the annual inflation from stratospheric levels to rates less than two digits in a few years. Low inflation rates insure long term and sustainable economic progress, reducing uncertainties and facilitating the increase of investments in the country. As far as innovation is concerned, low inflation rates stimulates competition increasing the level of innovation initiatives.

Also, with "Plano REAL", Brazil redefined the macroeconomics of the external sector in Brazil (Franco, 1996). He stated that with "Plano REAL" the country offered a valuable opportunity to redefine the country's trade orientation. Thus, the stabilization plan proceeded impressively with aggressive reductions in import tariffs which exposed the majority of Brazilian industries to foreign competition forcing them to invest in innovation.

So, with inflation under control and a more open economy, Brazilian firms gradually perceived the importance to establish innovation strategies to compete in the domestic and international markets. Even though this study does not aim to suggest any relation between inflation and innovation rates, this researcher noticed that during the past ten years, the increase in the country's innovation rate is inversely proportional to the decrease of inflation rate (see Table 4.8).

Period	Average of annual inflation rate (%)	Innovation rate (%)
1998 - 2000	5.5%	31.5%
2001 - 2003	9.8%	33.3%
2004 - 2006	5.5%	34.4%
2007 - 2009	3.89%	38.6%

Table 4.8 Annual inflation and innovation rates in Brazil [Source: IBGE, 2010 and PINTEC 2008]

Overall, these figures showed that the country has improved the general conditions to do business in Brazil, but as regards the country's competitiveness position, Brazil is still very far from developed countries such as USA and European countries. In spite of Brazil being one of the most important developing countries and one of the biggest economies in the world by nominal gross domestic product (GDP), according to the Global Competitiveness Report 2008-2009 (Schwab and Porter, 2008), the country is ranked in 64th position among 134 countries surveyed, behind countries such as Ireland, China, Chile and Spain. The uncomfortable position of Brazil in terms of global competitiveness is the main motivation behind this study as the innovation performance is considered a key condition that determines productivity growth which, in turn, is a key factor underlying competitiveness (Porter, 1998b).

The Global Competitiveness Report (GCR) 2008-2009 defined competitiveness as a *"set of institutions, policies, and factors that determine the level of productivity of a country"* (Schwab and Porter, 2008, p.3); thus, it reflects to what extent the country is able to provide rising prosperity to its citizens. The GCR is a result of joint efforts of many institutions around the world coordinated by the World Economic Forum, which for the past several years has been using the Global Competitiveness Index (GCI) to rank the most competitive countries. This report provides a realistic picture of the competitiveness landscape around the world and can help countries ensure long-term competitiveness, highlighting the strengths and weakness of each country, making it possible to identify priorities for implementation of new policies able to leverage the overall competitiveness of the countries.

The GCR (2008) examined several factors or determinants enabling national economies to achieve sustained economic growth and long-term prosperity. It is formulated considering 12 basic determinants of competitiveness as follows: institutions, infrastructure, macroeconomic stability, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market sophistication, technological readiness, market size, business sophistication and innovation. Of course, all twelve pillars together are important drivers to determine a country's level of prosperity; however, for this study, innovation is the only focus. So, to approach this subject, this author concentrated particularly on the evaluation of the innovation phenomenon in the group of micro and small sized firms in the technology-based sector only.

4.2 Justifying the selection of the economic sector, the main population surveyed and the localities

The past twenty years have seen a tremendous rise of innovation in many economic sectors. However, no other economic segment has experienced so many changes as the technology-based sector, especially the computing and information, communication and technology (ICT) segments. In the current study, the term "technology" is narrowly used to specify the practical use of knowledge to generate value in certain areas such as: information and communication, telecommunication, computing, software development, biotechnology, engineering, electronics, optical and laser, biotechnology and chemistry. These new technologies have been pushed forward by a series of advances in the generation of new knowledge and this new wave of technological changes is the result of faster diffusion of technologies. These changes are driven by the increase of competition between firms and countries in the world markets.

There are three arguments to justify the choice of the technology-based sector as the central object of the study. Firstly what called this researcher's attention was the study of Robert Solow in the late 1950's when he identified that technological changes were responsible by the economic growth in the US during the first half of the 20th century.

Secondly, the fact that the technology-based sector is the most competitive sector in the economy and at last, the enormous amount of managerial challenges generated by the introduction of new technologies inside the organizations.

Technology-based firms are developing new competitive strategies to respond more rapidly to the customer needs and to changing market conditions (Chamanski and Waag, 2001). The computing and ICT segments, for instance, are the most dynamic, competitive and fast-paced industry sector in the world and the challenges, especially as far as the managerial problems are concerned are unprecedented (Eisenhardt and Brown, 1998). Simultaneously with these changes in the technology-based sector, a major change has taken place inside the organizations: the challenge to cope with the increasing of managerial problems caused by this so dynamic momentum.

The increase of competitiveness happened mainly due to the general pressure to innovate and to be at the forefront of competition, firms must continually develop innovative products and services and be able to reinvent the firm constantly. But to develop these abilities, firms must also be able to acquire knowledge and technologies from the external environment and adapt it to the organizational conditions and culture (Eisenhardt and Brown, 1998).

In this new environment, products become obsolete very fast (shorter product life cycles) which forces firms to develop new products and services with new technologies. These technological changes imposed many changes inside the organizations and lead to enormous managerial challenges. Firms must implement new strategies to adapt organizational systems and production methods to this new and dynamic reality and finally, this natural vocation of the technology-based sector to innovate has an impact on other sectors of the economy with substantial relevance to the improvement of countries' competitiveness.

The main result is that it is expected that the lessons learnt from the efforts developed by the firms in the technology-based sector to adapt to this new environment where the rapid growth of new technologies has forced them to promote the implementation of internal strategies based on innovation has influenced the decision of traditional industries and services to also invest in the development of innovative initiatives with positive results to the overall picture of competitiveness of any economy.

Thus, the relevance of the investigation on technology-based firms is to learn from firms which had to promote rapid changes internally in order to survive. According to Eisenhardt and Brown (1998), the main challenge to investigate firms in the computing and ICT segments was to search for new models to replace the mature paradigms that dominate strategy and organizational thinking.

Regarding the choice of micro and small sized firms, this researcher calls attention to three aspects to justify this segmentation: firstly, according to the Brazilian Institute of Geography and Statistics – IBGE, in the study "The demography of firms in Brazil-2006", 92.2% of Brazilian firms are micro and 6.7% are small; therefore, they are largely the great majority of economic actors and generators of jobs; thus, there is no way to deny the importance of those economic actors to the overall improvement of the Brazilian economy. Secondly, according to PINTEC surveys, small firms usually present innovation rates lower than large organizations and thirdly, firms in the technology sector are naturally perceived as innovative. The perceived vocation to innovation of technology-based firms was suggested by Chamanski and Waag (2001), who argued that those firms are distinguished from the others by the immediate need to innovate. The natural vocation of the technology-based firms to develop innovation initiatives seems to have a direct impact on other sectors of the economy, such as the traditional industries and services sectors.

In general, for traditional industries and services to become innovative, therefore competitive and efficient, seem to demand technological solutions (operational or/and managerial) mostly generated and transferred by technology-based firms. Hence,

technology-based firms produce new technologies; those technologies are then transferred to traditional industries and services which consequently become more innovative. Finally, firms with modern technologies are more likely to be competitive and this cycle may provoke a typical chain reaction with gains for every chain member individually and collectively: the transfer of new technologies from technology-based firms to firms in the traditional industry and service sectors, improves the overall picture of competitiveness of any country; thus, the importance of any study related to innovation phenomenon seems to be substantially relevant to the improvement of firms' and countries' competitiveness.

4.2.1 Explaining the choices for the selection of the localities surveyed

To Longhi and Keeble (2000), innovation is intrinsically a territorial phenomenon, therefore locational factors (including the way firms organize their production structures in business arrangements on a geographic concentration basis) has an impact on a firm's innovation process. So, it was *sine qua non* that firms to be considered eligible for this study must be located in some type of spatial agglomeration.

In the previous sections, this researcher has presented the motivations for the selection of Brazil as the chief aim of this investigation. The country is undertaking many efforts to increase the innovativeness of Brazilian firms; however, it is not doing enough to leverage the overall country's innovation performance either in the speed able to compete efficiently in the international field nor to bring economic and social benefits to the Brazilian society. So, based on this context, the first step then was to select the appropriate locations. Based on investigations using different sources such as specialized magazines, internet, books and academics, two locations were selected: Campinas and Recife (see Figure 4.1).

The reason for the choices of Campinas and Recife was the fact that two of the most advanced technology-based business arrangements in Brazil are based in these two

cities: Porto Digital in Recife and the Technology Pole in Campinas, including three distinct clusters as follows: INCAMP / INOVA, CIATEC and SOFTEX (see Figure 4.3) and these two locations are recognized internationally as niches of excellence in technology-based enterprises. However, it is important to highlight that even though firms within these two business arrangements were from the technology-based sector, there was no previous knowledge whether they were innovative or not.

In fact, the main goal of this study was to investigate whether they were innovative and to learn how their interaction behaviour had influence on firm's innovation process so the lessons learnt could be multiplied to other firms in different economic sectors. In fact, this is not a comparison study between high and low innovation performers, but the development of a pragmatical understanding of how firms responded to the challenge of innovating in a rapidly changing and highly competitive market.

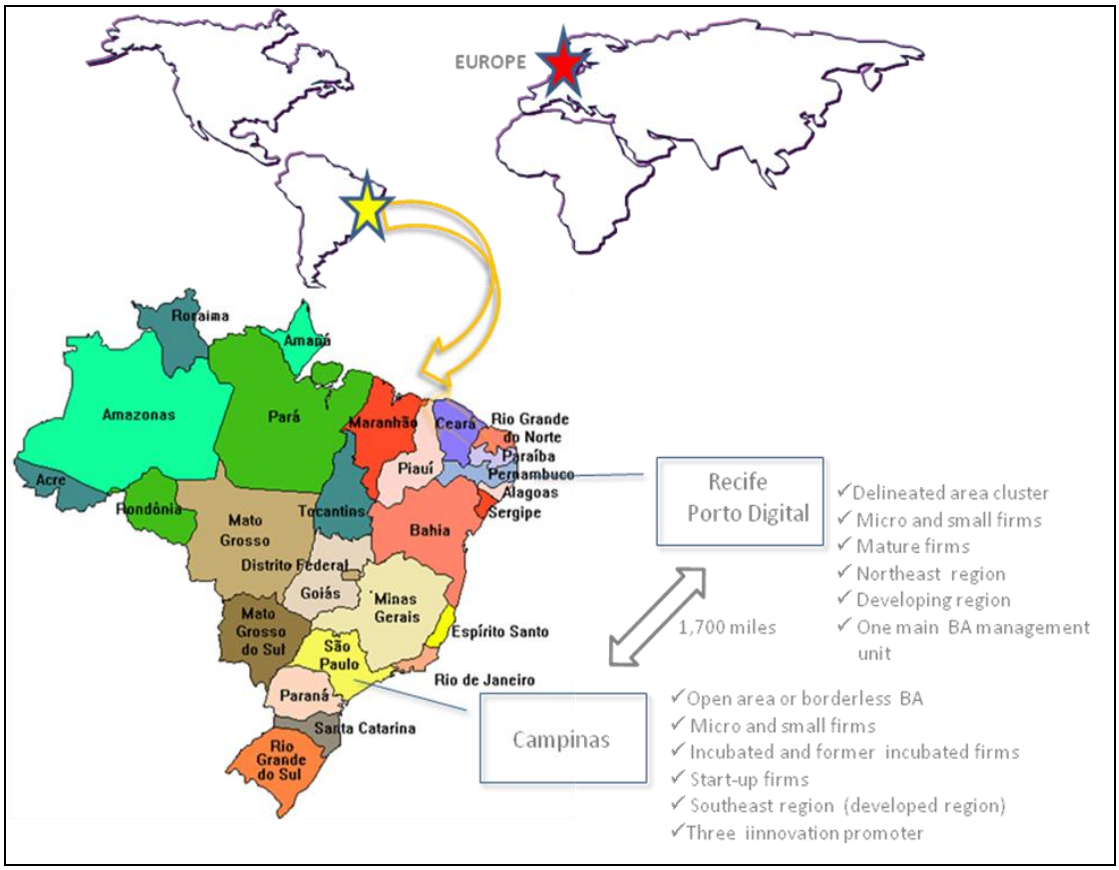

Figure 4.1 Selected business arrangements [Source: current research]

The first challenge after selecting the clusters was the establishment of geographic boundaries for each business arrangement selected for this study. In the case of Recife, this city is the capital of the state of Pernambuco and it is located in the northeast region of Brazil. Porto Digital Information, Communication and Technology (ICT) cluster is located in Recife (see Figure 4.2).

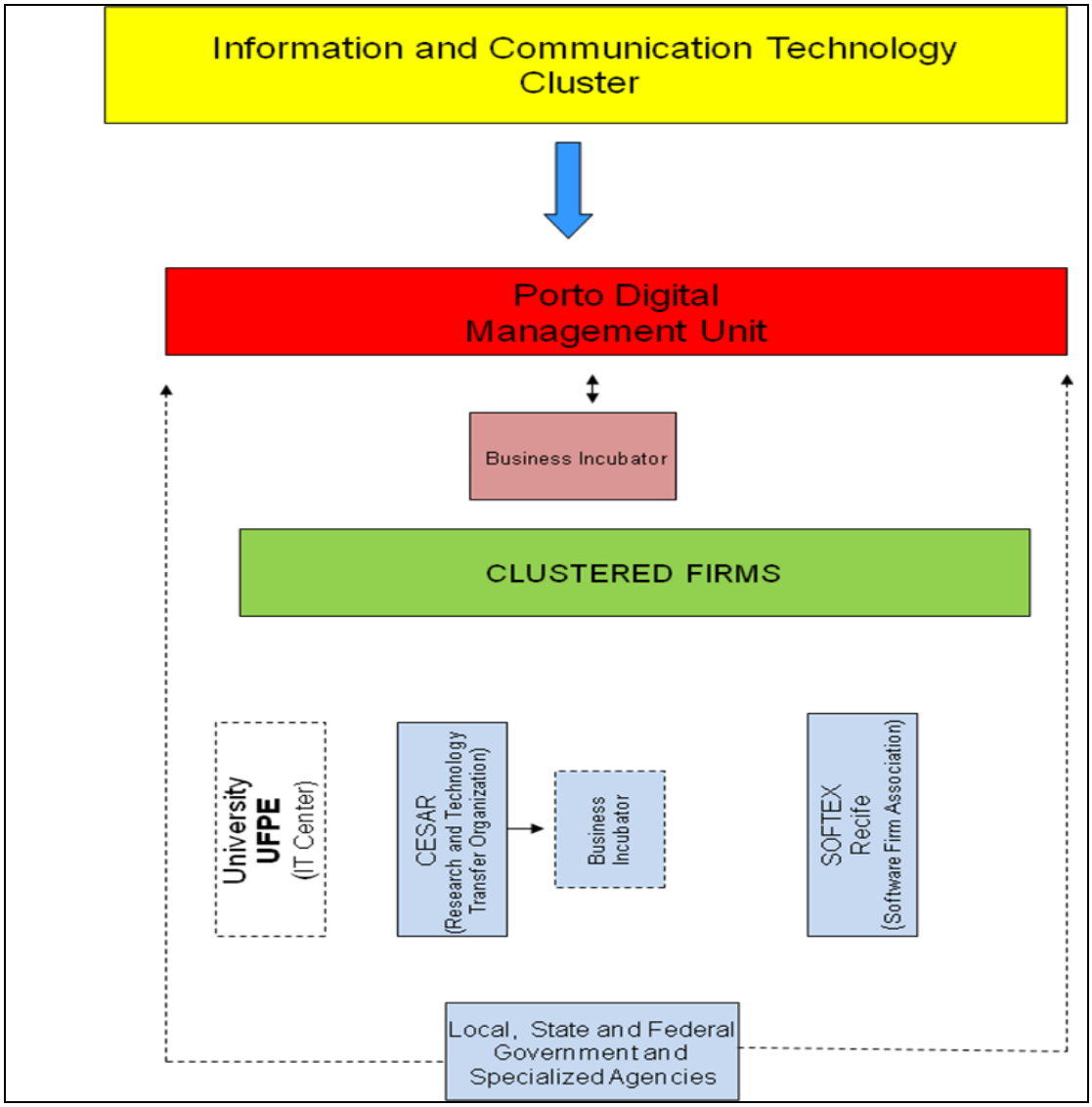

Figure 4.2 Porto Digital ITC Cluster Framework [Source: current research]

The Porto Digital ICT cluster is one of the most advanced poles of software development and has attracted the presence of high tech and digital enterprises, because of the excellent telecommunication infrastructure with an extensive network of optic

cables guaranteeing companies with high connectivity and wireless internet access; also because of the availability of a skilled labour force and the presence of innovation support agencies, research centres and government incentives in the three levels: local, state and federal. So, in Recife, it was relatively easy to define the geographic boundaries of the business arrangement to be investigated: only companies located in approximately 100 hectares-island in the old part of Recife downtown.

Campinas, on the other hand, is located in the southeast region of the country, almost 1,700 miles away from Recife. It is the most industrialized and developed region in the country. It is considered the Brazilian "Silicon Valley", especially because of some special features, such as: the presence of a high-tech university (UNICAMP), good infrastructure, availability of skilled labour force and a high number of technology-based industries. Mainly because of the presence of UNICAMP, many innovative enterprises and organizations were attracted to the region. In 2003, UNICAMP established INOVA (Unicamp Innovation Agency). INOVA is responsible to create a network of relationships between the university and companies, government and other economic agents in the region.

INOVA also runs an incubation program through the UNICAMP Technology-based Incubation Program (INCAMP). Besides INOVA, there are two other organizations which work to enhance the level of innovative initiatives in the same location: the local government agency (CIATEC) and SOFTEX, a private business association (see Figure 4.3). All three organizations run incubation programs which was the base for this investigation in that area. In this case, this researcher investigated firms from all three business arrangements (INOVA, CIATED AND SOFTEX).

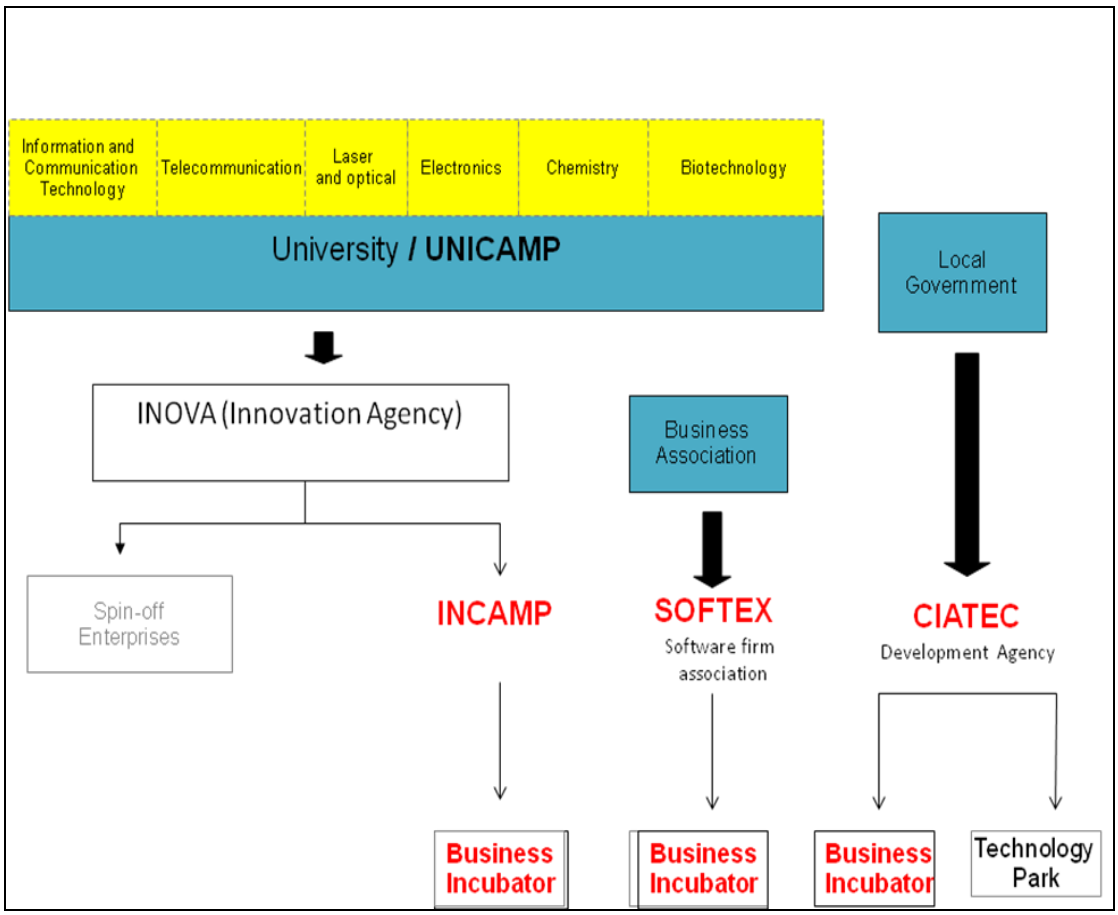

Figure 4.3 Campinas' technology-based BAs framework [Source: current research]

Because of the specific characteristics of this location and also because Campinas is a broader area if compared with Recife, the establishment of geographic limitations was a huge challenge. The study could focus on the region of Campinas, the city of Campinas or on micro sites where the clusters are located. So, in this case, this researcher decided to adopt the following methodology to establish the geographic limits for the study: two of the business arrangements investigated: INOVA/INCAMP and SOFTEX are located in the same geographic area. They are both located in the main campus site of UNICAMP, the local university. As regards CIATEC, there were two options: i) to investigate firms located in the technology park site or ii) to consider only firms located in the main buildings where the incubated and former incubated firms are located. The choice then was made for the second option: to investigate only incubated and former incubated firms located in the incubation area. The choice was due to the fact that most of the firms located in the technology park site are medium or large sized firms;

therefore they do not meet one of the main research criteria: to investigate only micro and small sized firms.

Another challenge was to examine what are the procedures to set up a business in those business arrangements. This researcher realized that there were different procedures, depending on where the firms decide to locate. The first step is to identify the organization responsible which manages and runs the clusters. They can be from different types and characteristics, therefore demand different approaches. In Recife, there is the PORTO DIGITAL management unit and in Campinas, there are three distinct organizations: INOVA/INCAMP, CIATEC and SOFTEX. These three organizations in Campinas have different functions and characteristics. INOVA is linked to the local university (UNICAMP) and runs an incubation program through the UNICAMP Technology-based Incubation Program (INCAMP); CIATEC is the local government development agency and finally, SOFTEX is a private business organization which represents firms from the ICT sector, especially software companies. It is important to highlight that these cluster management units were not perceived to be the owners of the cluster; on the contrary, they are seen as facilitators between the firms and the external environment as regards the elaboration of marketing strategies (the good image and reputation of the business arrangements), the attraction of new cluster members and the intermediation between the firms' interests and government benefits such as fiscal incentives and tax reductions programs.

So, as regards the process to join or set up a business in these clusters, firms have to follow different paths. In Recife, the first step is to contact the PORTO DIGITAL management unit (NGPD). This unit can help firms to search for available spaces (i.e. building or just a room in a building) and give orientations about the local infrastructure, legislation and other issues related to the area. According to the NGPD there are no subscription fees involved nor does it requests any formal project from firms in order to set up a business in that site.

In Campinas, start-up and mature firms may follow different paths. Start-ups are usually incubated firms selected according to the project they submit to each incubation management program (INOVA/INCAMP, CIATEC or SOFTEX) and the selection of firms depends on the internal criteria of each incubation program. As far as mature and established firms are concerned, if they decide to locate the firm in the technology park site, for instance, it is necessary to submit a project to CIATEC. CIATEC helps to search for space and gives support to the firms as regards the fiscal benefits involved in locating the business in that area. In any other location, firms do not need to submit any project. However, it was noticed that independently where they are located or if they are start-up or mature firms, firms can join the SOFTEX organization and in this case, a membership fee is charged. In Campinas, the investigation was based on incubated and former incubated firms established in one of the three clusters selected

4.2.2 The selection of the sampling population among firms within both selected spatial agglomerations

As regards the method of selecting the firms for the interviews, there are two distinct methods: census and sampling. Due to restrictions of time and resources as well as access constraints, this researcher used the sampling method. Sapsford (2001) stated that the sampling method is a relevant aspect of any survey:

> *"....The sampling pattern is not a simple random one, but a complex stratified design which aims to produce as good as possible a representation of the population, including people in rare but important categories"* (Sapsford, 2001, p. 7)

So, the selection of firms to participate in this study was not a random choice in essence. This researcher followed some steps: the first step was to approach the business arrangement management unit in each location to explain in detail to the respective managers, the survey objectives, the importance of the research to the discussion of the

innovation phenomenon in general and in particular the importance of the findings to the business arrangement itself. This approach was important to get the necessary support to contact the firms. In Campinas, for instance, the INCAMP manager facilitated the process by suggesting some firms to be contacted. Those firms were contacted and interviews were arranged. These steps ensured the maximization of time and credibility of the research project. Among the population of thirty one firms, eleven were interviewed (see Table 4.9). The firms interviewed were in general, those in which the entrepreneurs were much more open and participative in studies like this and also had a closer relationship with the cluster manager. In Recife, there was not any personal involvement of the cluster manager to suggest or to help to contact the firms. The cluster manager was aware of the research and the interviewing process, but he did not get involved in the selection of the firms for interview. Through the cluster website (www.portodigital.org), this researcher had access to the list of all cluster members. The next step was to contact each firm individually, trying to arrange an appointment. This stage was very time consuming and the interviews were arranged according to the positive responsiveness of the entrepreneurs. Among the population of one hundred and eleven firms, thirteen firms were interviewed (see Table 4.9).

Business arrangement	**Location**	**Number of interviews**	**Population**	**% population**
INCAMP	Campinas	11	31	35.4%
SOFTEX and CIATEC	Campinas	08	87	9.2%
Sub-total……	Campinas	19	118	16.1%
Outsiders	Campinas	04	-	-
PORTO DIGITAL	Recife	13	111	11.7%
Total of valid interviews	-	32	229	14.0%
Total of interviews	-	36	-	-

Table 4.9 Number of interviews [Source: current research]

Overall, in the current interviewing process, thirty six entrepreneurs and senior executives were interviewed across both locations: thirty two interviews with firms located within the business arrangements (valid interviews) and four others with firms outside the business arrangements (not valid interviews – firms did not meet the research criteria). Each interview was one hour duration on average and every interview was recorded, either on paper or tape. The total number of valid interviews represents 14% of the total population (see Table 4.9). To illustrate, in the PINTEC 2008 (The Brazilian innovation survey), technology-based firms represent only 6% (6,366 firms) of the total population surveyed. Finally, this Chapter described the context in which this research was performed, the selection of the study areas and economic sector under investigation. This research focused the investigation specifically in two locations: Campinas and Recife, respectively in the southeast and northeast of Brazil. The main reason for choosing these two locations is the fact that they are recognized worldwide as highly specialized technology niches of excellence. In both locations there are a significant amount of micro and small sized technology-based firms and a critical mass of technical expertise for high technology services, supposedly innovative.

CHAPTER 5

FIRMS' INTERACTION BEHAVIOUR AND THE INNOVATION ACTIVITIES: THE RESEARCH FINDINGS

The Findings Chapter is one of the most important parts of any research and shows the results and the analysis of data collected during the field research thesis. Overall, in the current chapter, the researcher reports in detail, the empirical findings regarding the investigation of the selected micro and small technology-based firms' interaction behaviour under geographic proximity context and the innovation process in Brazil. The theoretical foundation is based on Rothwell's (1994) evolution of the innovation theories in which after the 1990's, innovation was seen not only as a result of economic factors, but also derived from strategic networking (e.g. technical and social networks). So, the logic behind this Chapter is to develop a methodology showing that i) firms investigated are, first of all, innovative (the first premise of this study); ii) their interaction behaviour has influence on their innovation performance and iii) to show whether local interactions have or have not effective influence on their innovation performance.

In more detail, this chapter describes firms' interaction and innovation processes, problems hampering interactions and innovation, respondents' perceptions about the importance of interactions, spatial agglomerations and innovation agents for innovation activities. Furthermore, this chapter presents an analysis of the potential evidence able to answer the research questions.

It is important to highlight that this is not a comparison study between firms nor is it focused to evaluate the role of clusters to the firm's innovation performance. This is a study of two groups of firms under different economic, social and even cultural circumstances and aims to describe their interaction behaviour to understand whether

local interaction have an effective impact on innovation or, in other words, to understand whether innovation might be associated to local or non-local interactions.

The methodological principles followed by this researcher to develop this Chapter considered that: firstly, this is an intensive research and a survey-based study carried out on clustered firms in two locations in Brazil: Campinas and Recife. The method used to collect the data was face-to-face interviews conducted by the researcher himself, based on a structured questionnaire, which presented a logical sequence of conversation. The questionnaire was based on a development of the internationally tested and recognized methodology suggested by the Oslo Manual (OECD/EUROSTAT 2005) for innovation surveys. Secondly, this research was framed considering predominantly the inductive approach method (see Table 3.7). This method allowed focusing on the core context of this study: the understanding of the relationship between the firm's interaction behaviour under geographic proximity context and the development of innovation activities.

This method allowed this researcher to gain substantial insights through the collection of qualitative data. Finally, the data analysis process involved the analysis and interpretation of the empirical evidence focused on answering the research question (see Figure 3.5). As regards the analysis of the data, this researcher adopted predominately the grounded analysis method, supported by the respondents' comments, to understand the context in which the interaction and innovation phenomenon took place. To present the empirical results, this researcher predominately decided to use Tables.

Even though, most of the empirical evidence is presented in tables with data from both locations (Campinas and Recife), this is not a comparison study and did not aim to establish any relationship between firms' innovation performance of both localities. In fact, the aim was to investigate the firms' interaction behaviour and innovation activities in two different locations, different economic development levels and different institutional environments in order to understand whether they under different

conditions would perform similarly. The complete methodological framework and methods adopted in this study are presented in Chapter 3.

In order to present the findings, this chapter is structured into five sections and the chapter summary. In section 5.1 - Characteristics of firms surveyed, general aspects of the organizations and respondents' profiles are described, such as: corporate maturity stages (startup and mature firms), firm size (micro or small sized firms) and respondent's age, educational level and at last, the respondent's availability of working time for entrepreneurial and managerial activities.

Section 5.2, the researcher presents evidence to approach whether firms surveyed are (or not) innovative, a basic premise of this study. Section 5.3, it is described the firms' interaction behaviour focused on the innovation process. Both sections (5.2 and 5.3) represent the backbone of this Chapter. Next, section 5.4 presents the analysis of how the empirical results of this investigation can provide information able to answer the research question. Section 5.5 presents detailed and general information regarding the interaction and innovation processes and finally, section 5.6 presents the summary of the chapter.

5.1 General characteristics of firms surveyed

First of all, in this section, the researcher outlines the general characteristics of the local spatial agglomerations, firms surveyed and respondents' profiles. These aspects involve description of the spatial agglomerations, size of firms, corporate maturity stages and entrepreneurs' profiles (i.e. age, educational level and working time availability).

Altogether, thirty six business owners and senior executives were interviewed (Recife - 13 and Campinas -23); however, thirty two (Recife 13 and Campinas-19) met the research criteria. Firms in this study are not identified with their own names (see Tables

5.1a and 5.1b). For reasons of confidentiality, it was agreed that for this specific research, respondents are identified with codes, as follows: 1) Firms located in Campinas which met the research criteria:

- CI1 to CI11- firms belonging to Incamp business arrangement

- CSC12 to CSC19 – firms belonging to Softex and Ciatec business arrangements

Codes	Locality	Business arrangements	Business activity
CI1	Campinas	Incamp	Agriculture equipments
CI2	Campinas	Incamp	Medical equipments
CI3	Campinas	Incamp	Genetic test Consultancy
CI4	Campinas	Incamp	Bioenergy
CI5	Campinas	Incamp	Deep water engineering Consultancy
CI6	Campinas	Incamp	Food technology
CI7	Campinas	Incamp	Software development (biometric identification)
CI8	Campinas	Incamp	Biotechnology (agriculture)
CI9	Campinas	Incamp	Biotechnology (food and cosmetics)
CI10	Campinas	Incamp	Software development
CI11	Campinas	Incamp	Software development (voice recognition)
CSC12	Campinas	Softex	Software development (telecommunication)
CSC13	Campinas	Softex	Integrated circuits for digital TV
CSC14	Campinas	Softex	Industrial automation
CSC15	Campinas	Ciatec	Software development
CSC16	Campinas	Softex	Software test consultancy
CSC17	Campinas	Ciatec	Wireless network consultancy
CSC18	Campinas	Softex	Software development (engineering)
CSC19	Campinas	Softex	Software development (education)

Table 5.1a List of firms surveyed – Campinas [Source: current research)

2) Firms located in Recife: RPD24 to RPD36

Codes	Locality	Business arrangements	Business activity
RPD24	Recife	Porto Digital	IT management system and software development
RPD25	Recife	Porto Digital	Software development for games, music and entertainment
RPD26	Recife	Porto Digital	IT management system
RPD27	Recife	Porto Digital	Software development and corporate systems for internet
RPD28	Recife	Porto Digital	IT management system and software development and
RPD29	Recife	Porto Digital	Software and hardware for telecommunication
RPD30	Recife	Porto Digital	IT management system
RPD31	Recife	Porto Digital	Software development for games and entertainment
RPD32	Recife	Porto Digital	Software development for telecommunication
RPD33	Recife	Porto Digital	Software development for data base
RPD34	Recife	Porto Digital	Software test consultancy
RPD35	Recife	Porto Digital	Software development for logistics and distribution
RPD36	Recife	Porto Digital	Software development and Security intelligence Consultancy

Table 5.1b List of firms surveyed – Recife [Source: current research)

5.1.1 Overview of the local business agglomerations

The first topic refers to the description of the main characteristics of the local agglomerations selected for this study: Campinas and Recife. To this author, clusters are considered any form of business agglomeration that occurs within a geographic

location, in which the proximity of firms and institutions increases the frequency and impact of interactions (Porter, 1998b). In this context, both locations present geographic agglomerations of firms and institutions, promoting an environment where firms involved can get some benefits such as infrastructure, government incentives, marketing strategy, availability of skilled and educated labour force and others. In Chapter 4, this researcher presented a complete description of each local agglomeration, including: history, formal structure, governance and infrastructure. Next, an overview of the main characteristics of the selected agglomerations of businesses is provided in order to facilitate the general understanding of the environment where the firms are located.

Campinas is located in the southeast region of Brazil. It is the most industrialized and developed region in the Country. Campinas is a particular location where there is a conjunction of three institutions to establish the framework of the local business arrangement. The local business arrangement is formed by the local university (main innovation driver), Softex (business association) and Ciatec (local government agency). One of the main characteristics of this business arrangement is its broad range of technology-based enterprises. It involves firms from the biotechnology, gas, nanotechnology and hardware to software development sectors.

The whole region of Campinas was directly influenced by the local university, University of Campinas (UNICAMP), one of the most important universities in Brazil, especially in the technology sector. In 2003, UNICAMP established the Unicamp Innovation Agency (INOVA), the main goal of which was to create a link between the university and the market to increase the development of innovative initiatives. Prior to the establishment of INOVA, in 2001 Unicamp created INCAMP. INCAMP is an incubator agent of technology-based enterprises and had the mission to promote interactions between start-up technology-based firms and the business sector. Along with INOVA and INCAMP, two more institutions were also involved in the mission to support technology-based firms in that region. They were SOFTEX Campinas and CIATEC. All four institutions have given great contribution to the strengthening of regional development.

Softex started as a national program to support the internationalization of domestic software firms. It was funded by the federal government, but over the years the government stopped supporting those firms and therefore the program was taken apart and ignored. Then, each SOFTEX unit developed their own mission and objectives. In Campinas, for instance, it became a business association representing software firms located in the region. CIATEC, another organization in the region of Campinas to support innovation, is a public institution at a municipal level. It is responsible for the execution of public innovation and development policies focused on the progress of the region. Through the CIATEC incubator program, it contributes directly to the establishment of new technology-based firms in the region.

Almost 1,700 miles away from Campinas, in the northeast of Brazil, Recife was chosen as another location to be investigated. Together with Campinas, Recife is also internationally recognized as a highly specialized pole and niche of excellence in the technology industry.

Recife is the capital of the state of Pernambuco. Pernambuco is located in the northeast of Brazil. This region is a developing region and not as industrialized if compared with other regions such as: south and southeast regions in Brazil. However, the Porto Digital Information, Communication and Technology cluster, in Recife, has been presented as one of the most advanced software development poles in the country. The idea of the creation of the Porto Digital cluster started in early 1990's. In 1991, the Institute of Technology of the State of Pernambuco (ITEP) was responsible to set up one of the most important internet "POP" (internet point of presence) in Brazil, which demanded specialized workers to manage telecommunication networks. In 1992, the State of Pernambuco had privileged access to fast internet before any other state in the Northeast region of Brazil. Also, in the same year, ITEP set up the first technology-basis incubation programme for new technology-based firms, especially in the information and communication technology (ICT) and computing areas.

During that period, the University of the State of Pernambuco had one of the highest rates of PhDs in Brazil in the computing area; so, it was recognized as one of the most important universities in Brazil, especially in the area of software development. At the same time, some of the researchers with strong entrepreneurial spirit, set up the CESAR, a research centre focused on the development of new ICT and computing technologies and innovation. Finally, in early 2000's, a joint project between government, university and private sectors created the Porto Digital Cluster. One of the main institutions to first move to this new location was the CESAR research centre. CESAR became then the main interface between the academy and the market, transforming knowledge into innovation. The original project involved an urban revitalization of the area and demanded huge investments in modern telecommunication infrastructure as well as fiscal incentives and tax reduction programs in order to attract ICT and computing firms to locate in that region.

The coordination and management of the Porto Digital cluster is performed by the Porto Digital Management Unit (NGPD). This governance body is a not-for-profit civil association and was established to organize innovation initiatives, infrastructure and government support. The NGPD plays an important role in the development of the area and to the firms already established as well as to new enterprises in that cluster.

Differently from Campinas where the term "technology" is much broader and involves firms from various sectors (e.g. biotechnology, nanotechnology, chemistry and ICT), the majority of firms in the Porto Digital cluster was predominantly from the ICT and computing sectors, particularly from the software development sector.

5.1.2 Size of firms surveyed

The classification of firms by size is an important element when dealing with innovation activities. It is believed that firms react differently to economic stimuli and have different needs, when they are in different size classes. To keep international

compatibility, this study followed the recommendation of the Oslo Manual (OECD/EUROSTAT 2005) methodology (2005) which has suggested that the size of firms in any economic segment should be measured on the basis of number of employees as follows:

i) 10-49 (small firms),

ii) 50-249 (medium sized firms) and

iii) 250 and above (large firms).

However, this study adopted a more detailed breakdown by size class and also considered firms with fewer than ten employees (micro firms). So, for this study, the following firm size classes were used:

- Micro firms: 10 or less employees
- Small firms: 11 to 50 employees

Table 5.2 presents the distribution of firms by size classes in each location. In general, this sample was quiet balanced between micro and small sized firms: 56% and 44% respectively.

Regarding locations, Recife and Campinas, were characterized by a specific size of firm: in Campinas, the majority of firms (74%) were micro firms and in Recife, 69% were small firms.

Nr. Employees	Firms' size	Campinas No. of firms	Recife No. of firms	Total No. of firms
10 or less employees	Micro	14 (74%)	04 (31%)	18 (56%)
11 – 50 employees	Small	05 (26%)	09 (69%)	14 (44%)
Total	-	19	13	32

Table 5.2 Size of firms surveyed - by location [Source: current research]

5.1.3 Corporate maturity stages of firms surveyed

Corporate life-cycle is considered by some researchers as a potential variable impacting the development of innovation activities. Factors that may facilitate innovation in early stage may not be so significant in later stages and so on. In each corporate life-cycle stage, firms may manifest different reactions to some factors such as: strategy, environment, decision making and innovation processes (Uhlenbruck and Sarason, 1996).

For this study, corporate maturity stage was restricted to the analysis of start-up and mature firms. A startup firm is considered to be those firms with three years or less of operation and mature firm as those with more than three years of operation. So, in the light of the findings, corporate maturity stages of the population surveyed was quite balanced between start-up and mature firms. From thirty two firms surveyed, sixteen were start-up and sixteen were mature firms (see Table 5.2). Also, Table 5.3 shows that each location was characterized by one type of firm: start-up or mature firms. In Campinas, the majority of firms were classified as start-up (74%) and in Recife by mature firms (85%).

Year firms start the operation	Corporate maturity profile	Campinas No. of firms	Recife No. of firms	Total No. of firms
After 2004	Start-Up	14 (74%)	02 (15%)	16 (50%)
Before 2004	Mature	05 (26%)	11 (85%)	16 (50%)
Total	-	19	13	32

Table 5. 3 Corporate maturity profile by location [Source: current research]

Additionally, Table 5.4 shows that the majority of start-up firms were micro sized firms (12 firms or 67% of the total of startup firms) and the majority of mature firms were small sized firms (11 firms or 61% of the total of mature firms). This reflected the broader perspective of analysis, allowing a better comprehension of the phenomenon researched by examining how firms in different corporate maturity stages, sizes and locations react and behave in relation to innovation and interaction.

Nr. Employees	Firms' size	Campinas No. of firms	Recife No. of firms	Total No. of firms
Start-up firms				
10 or less employees	Micro	10	02	12 (67%)
11 – 50 employees	Small	04	-	04
Sub-total		14	02	16
Mature firms				
10 or less employees	Micro	04	01	05
11 – 50 employees	Small	01	10	11 (61%)
Sub-total	-	05	11	16
Total	-	19	13	32

Table 5.4 Corporate maturity profile versus firm size by location **[**Source: current research]

5.1.4 Respondents' profiles: age and educational level

This section describes the respondents' profiles regarding age and educational levels. Many writers such as Chell (2001) and Drucker (1986) agree that innovation largely depends on the entrepreneur's decision. So, to understand innovation from an organizational point of view, it is crucial to analyze the entrepreneur's profile, specifically regarding age and educational level.

In this survey research, the great majority of respondents (entrepreneurs and managers) were relatively young, with ages between 20 and 40 years (79%) in both locations: Campinas (78%) and Recife (76%) (see Table 5.5). To this author, this generation seems to be much more familiar with new technologies and has developed advanced computing skills compared to the older generations; therefore, innovation is facilitated.

Respondents' age	**Campinas** **No. of firms**	**Recife** **No. of firms**	**Total** **No. of firms**
20 – 30	06 (31%)	05 (38%)	11 (35%)
31 – 40	09 (47%)	05 (38%)	14 (44%)
41 – 50	02 (11%)	03 (24%)	05 (15%)
Over 50	02 (11%)	-	02 (6%)
Total	19	13	32

Table 5.5 Respondents' Age by location [Source: current research]

Regarding educational level, on average, the great majority of entrepreneurs/managers (88%) surveyed completed tertiary level and was very well educated. Twenty two (69%) out of thirty two respondents have higher diploma, masters or PhD degrees. The combination of young and highly specialized and educated entrepreneurs and managers seems to be typical for the development of successful innovation strategies (see Table 5.6).

Respondents' education level	Campinas No. of firms	Recife No. of firms	Total No. of firms
Secondary level	02 (10%)	02(15%)	04(12%)
Tertiary level	05 (26%)	01 (7%)	06(19%)
Higher Diploma	01(6%)	05(39%)	06(19%)
Masters	04 (21%)	05(39%)	09(28%)
PhD	07 (37%)	-	07(22%)
Total	19 (100%)	13(100%)	32(100%)

Table 5.6 Respondents' education level by location [Source: current research]

5.1.5 Working time profile

Drucker (1996), in his book Innovation and Entrepreneurship argued that *"Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or a different service"* (p. 33). So, this part of the study examines how entrepreneurs spend their working time between managerial and entrepreneurial activities.

Entrepreneurial activities are those focused on creativity and new solutions and managerial activities are much more focused on bureaucratic processes which by nature, do not demand much creative efforts. For innovation, entrepreneurial activities are crucial for the development of innovative strategies.

During the interviews, this researcher emphasized the difference between both concepts, in order to assure that the responses would be accurate and would reflect the reality of how the respondents spent their working time. So, according to the findings and in the light of the complexity of the role of entrepreneurs, from the thirty two respondents, the great majority (88%) was entrepreneurs/owners (see Table 5.7).

Respondents	Campinas No. of firms	Recife No. of firms	Total No. of firms
Entrepreneurs /Owners	18	10	28
Managers	01	03	04
Total	19	13	32

Table 5.7 Respondents' profile [Source: current research]

Among the entrepreneurs/owners group, twelve (43%) out of twenty eight on average spent their working time mostly on entrepreneurial activities, as opposed to the majority (57%) who spent most of their time in managerial activities (see Table 5.8). In fact, it does not mean that this majority group was not engaged in entrepreneurial activities, but a great part of their working time was mainly dedicated to running the business. Among the respondents who were managers, no one actually spent over 50% of working time on entrepreneurial activities.

Working time availability: over 50% of entrepreneurial activities	Campinas	Recife	Total
Owners	07	05	12
Managers	-	-	-
% of respondents (owners)	39%	50%	43%

Table 5.8 Working time respondents' profile [Source: current research]

Time spent on managerial activities is not completely inappropriate or prejudicial to innovation itself. Schumpeter (1976) recognized the importance of the managerial role of entrepreneurs, when he pointed out that an entrepreneur is not only those who only invent something or implement the change, but those who create conditions to get things done.

Finally, Table 5.9 summarizes that, even considering various dimensions (e.g. firm's maturity, firm's size and nature of the businesses), the sampling population described in this section allowed the researcher to address the research problem and to answer the research question. The fact that they are from different regions and different economic, social and institutional environments may also allow establishing reasonable generalizations.

Campinas	Recife
Mostly micro sized firms	Mostly small sized firms
Mostly star-up firms	Mostly mature firms
Mostly focused on technology sectors in general	Mostly focused on ICT and computing sectors
Most of entrepreneurs are aged between 31-50 years old	Most of entrepreneurs are aged between 31-50 years old
Highly specialized labor force	Highly specialized labor force
37% of respondents dedicated 50% or more of their time to entrepreneurial activities	39% of respondents dedicated 50% or more of their time to entrepreneurial activities
Business arrangement management units: INCAMP, SOFTEX AND CIATEC	Business arrangement management unit: NGPD (Porto Digital management unit)

Table 5.9 Overview of locations, firms and respondents' characteristics [Source: current research]

5.2 Are firms surveyed innovative?

The first premise of this study is to investigate whether firms surveyed are innovative or not. Innovative firms are those engaged in innovation activities which have implemented innovation or innovation is in progress during the period of investigation. Firms engaged in innovation activities, according to the Oslo Manual (OECD/EUROSTAT 2005), are those which have implemented innovations during the period investigated. It states that *"the innovative status of a firm can be defined in several ways. The basic definition of an innovative firm is a firm that has implemented at least one innovation...."* (p. 58). Innovation according to this study and the Oslo Manual (OECD/EUROSTAT 2005) is any product/service, process or marketing and

organizational changes which are new or significantly improved to the firm or to the market.

In this sense, the analysis of the empirical evidence shows that the great majority of firms in both locations are unarguably innovative (See Table.5.10). This evidence is based on the calculation of innovation rate which involves only innovation that was effectively implemented during the period investigated (innovation rate is the calculation of the implemented innovations over the total of firms engaged in innovation activities).

Individually, the empirical evidence showed that Recife, for instance, has presented evidence showing that all thirteen firms surveyed were engaged in innovation activities during the period investigated with an innovation rate of 100%. In Campinas, the evidence shows that eighteen firms (95%) out of nineteen were engaged in innovation activities with an innovation rate of 61% (See Table 5.10).This author would like to call attention to the fact that this is not a comparison study between firms in Campinas and firms in Recife; but an analysis of the innovation performance of a group of firms under diverse circumstances in different locations. Therefore, the difference, between rates of innovation of firms in Recife (100%) and Campinas (61%), does not imply that firms in Recife were much more innovative than Campinas; in fact, in Campinas, firms just presented some innovations in progress or not fully implemented during the period of investigation (See Table 5.10a). This seems to be a result of the stage of maturity of each group of firms (See table 5.3). In Recife, 85% of firms are mature against Campinas, where 74% of firms surveyed are start-ups; therefore with some innovation projects still in progress.

Other aspects also called this researcher's attention such as the fact that, on average, 50% of firms engaged in innovation activities develop innovations (product/service, process and organizational / marketing) directly through collaborative arrangements (See Table 5.10.a); secondly, the fact that firms surveyed seemed to be very flexible as half of the firms in Campinas and all firms in Recife developed more than one type of

innovation during the period investigated (See Table 5.10b). This evidence suggests that whenever firms are engaged in innovation projects, they are, in fact, a set of "individual" projects together involving innovations in the product or service, in the process or even in the organizational structure and marketing strategy. At last, regarding specifically innovations in product / services, Table 5.10c shows that, in general, for the great majority of firms surveyed, innovations were technically novelties and new to the market.

Innovation indicators	**Campinas**	**Recife**
Total firms surveyed	19	13
Overall firms engaged in innovation activities	18	13
% of firms engaged in innovation activities	95%	100%
No. of firms which fully implemented innovations	11	13
Innovation rate (%) (implemented innovations)	61% (11/18)	100%
1. Innovation IMPLEMENTED – Types of innovation		
Firms engaged in product / service innovation	11	13
Firms engaged in process innovation	07	07
Firms engaged in organizational/marketing	05	11

Table 5.10 Innovation performance at a glance [Source: current research]

Innovation indicators	**Campinas**	**Recife**
2. Innovation IN PROGRESS – Types of innovation		
Firms engaged in product / service innovation	07	-
Firms engaged in process innovation	-	-
Firms engaged in organizational /marketing innovation	-	-

Table 5.10a Innovation performance at a glance [Source: current research]

Indicators – Innovation performance	Campinas	Recife
Firms which developed only one type of innovation	9 (50%)	-
Firms which developed two or more types of innovation	9 (50%)	13 (100%)
Firms involved in collaborative arrangements in the development of product/service innovations	09 (50%)	07 (54%)
Firms involved in collaborative arrangements in the development of process innovations	-	04 (57%)
Firms involved in collaborative arrangements in the development of marketing/organizational innovations	01 (9%)	01 (20%)

Table 5.10b Innovation performance at a glance [Source: current research]

Indicators – Innovation performance	Campinas	Recife
Firms for which technically product/service innovations were novelties	10 (50%)	05 (31%)
Firms for which the product/service innovations were new to the market	12(67%)	10 (77%)
The most relevant group of problems hampering innovation	Economic problems	Economic problems
% of this type of problem considering the total number of problems reported by firms	(69%)	(70%)
The less relevant group of problems hampering innovation	Market problems	Market problems
% of this type of problem considering the total number of problems reported by firms	(40%)	(48%)
The most important innovation partners	"Government agencies and Universities"	"Government agencies and Business network organization"

Table 5.10c Innovation performance at a glance [Source: current research]

Regarding the types of innovation partners, the most important partners seem to be government agencies. The reason seems to be the fact that for micro and small sized firms, the government is the most important financial source to the development of innovation. Despite understanding that innovation is a core activity vital for the long term firm's sustainability, according to some interviewees, innovation is still seen as an expensive and risky activity therefore they need financial support to undertake such activity (See Table 5.10c).

At last, the high level of firms engaged in innovation activities as shown in Table 5.10 seems to be explained by the fact that, even though, firms have mentioned problems in the development of innovation activities, they did not seem to have had any effective impact on the firms' innovation initiatives as they did not stop innovating. As an example of problems hampering innovation, economic problems seemed to be the most relevant (70% of firms in both locations reported this type of problem). On the other hand, firms did not seem to have problems in accessing information, finding innovation partners or meeting regulations and norms as problems related to the market environment were listed as the less relevant (See Table 5.10c).

5.3 Firms' interaction behaviour focused on the innovation process

Pragmatically, another key point of this research is the investigation of whether or not interaction linkages within local clusters have an affective impact on firms' innovativeness. The main issue of this discussion is the argument that local interaction linkages are crucial for innovation. Some authors such as Cortrights (2006), for instance, stated that in order to succeed firms have to network and collaborate with each other, but it is not clearly specified whether firms needed to be geographically close or not. To others such as Rosenfeld (1997), Porter (1998), Malmberg and Maskell (2002) and Malmberg and Power (2005), clusters promote the ideal environment to stimulate interactions leading to the increase of firm's innovation activities.

So, as seen in Section 5.2, the empirical findings showed that firms surveyed were highly innovative. Two facts seem to be relevant to facilitate the development of innovation activities: firstly, it is the fact that firms are engaged in collaborative arrangements in order to gain "muscles" to innovate (See Table 5.10b); secondly, it is the relative ease in accessing information and finding innovation partners as shown in Table 5.10c. On the other hand, despite that the findings show that firms perceive networking is of high importance to the development of innovation activities (See Table 5.11), the motives seem to be related to individual gains rather than collective benefits. To illustrate, according to one of the interviewees, "…Interaction is about gains" and "...Firms collaborate with each other because there is no other way ....in the IT business, interactions and partnerships are fundamental....".

Another relevant finding is the fact that according to the majority of interviewees, firms perceive themselves belonging to business arrangements as well as see advantages in belonging to those arrangements as far as innovation is concerned (See Table 5.11); but again, the motives seem to be related to other reasons such as marketing, financial or infrastructure factors rather than facilitation of knowledge and information exchanges due to geographic proximity. This is demonstrated by some interviewees' comments such as "....Yes, because I am located here [Porto Digital], it brings reliability to the business....it is a subjective advantage as well as technical, because firms located here [in the Porto Digital] are more likely to be good (technically)" or "…..when you tell your client you are located in the Porto Digital area, it becomes an important competitive advantage…..the brand name "Porto Digital" is relevant….while at a business meeting with a Client in Curitiba, Parana state, they told me that before confirming the meeting, they had investigated about Porto Digital…and now, they feel more confident to make business with us….".

Regarding interactions within and external to the clusters, the empirical evidence shows that firms surveyed are very active. In detail, the empirical evidence shows that the great majority of firms experienced interactions within and external to the business arrangements; however, most of the local interactions within the cluster were not on a regular basis and most of the times were superficial / informal in nature. Also, the study

showed that there were two distinct groups of firms: those which experienced interactions within the clusters and others which did not experience interactions within the clusters. In both groups, the level of engagement in innovation activities was quiet high. This finding suggests that even though firms did not experience interactions within the cluster, they still can be innovative.

Another important finding is regarding the location of innovation partners. Even though the great majority of firms have reported interactions within and outside the clusters, according to the investigation, most of the interaction partners are located outside the clusters (See Table 5.11b). 55% of interaction partners reported by firms in Campinas and 75% in Recife are located outside the clusters.

As far as the most important networking partners are concerned, in Campinas, 86% of firms surveyed reported that "university or other higher education institution" is the main networking partner and in Recife, 92% of firms reported "Competitors and other enterprises in your sector". This picture may reflect the specific characteristics of each cluster: in Campinas, the cluster is located within the University Campus, therefore it is a natural networking partner and also the majority of firms are start ups and consequently highly dependent on university resources and facilities such as laboratories. On the other hand, in Recife, the majority of firms are mature firms and therefore, much more dependent on "market" such as competitors and similar enterprises.

Indicators - Interaction behaviour	Campinas	Recife
No. of firms which perceived networking as of "high" or "medium" importance to innovation activities	Sixteen (94%) out of seventeen firms	Thirteen (100%) firms
No. of firms which perceive themselves belonging to a cluster	Fifteen (79%) out of nineteen firms	Twelve (92%) out of thirteen firms
No. of firms which perceive advantage in belonging to a cluster	Eighteen (95%) out of nineteen firms	Thirteen (100%)

Table 5.11 Summary of the interaction behaviour [Source: current research]

Indicators - Interaction behaviour	Campinas	Recife
No. of firms which experienced interactions within the clusters	Fifteen (79%) firms	Twelve (92%) firms
No. of firms which did not experience interactions within the clusters	Four (21%) Firms	One (8%) firm
The most common cited type of interaction experienced within the clusters	"Exchanging ideas and information"	"Exchanging ideas and information"
No. of firms which experienced this type of interaction	Thirteen (87%)	Twelve (100%)
No. of firms which experienced only one type of interaction within the clusters	Nine (60%)	-
No. of firms which experienced two or more types of interactions within the clusters	Six (40%)	Twelve (100%)
No. of firms which experienced interactions within the clusters considering the level of complexity: i) on a superficial level of complexity ii) complex or intermediary levels of interactions	 Fifteen (100%) Eight (53%)	 Twelve (100%) Ten (83%)
No. of firms which experienced interactions within the cluster: i) on a "regular" basis ii) on a "rare" basis iii) "occasionally"	 Five (33%) Two (14%) Eight (53%)	 Six (50%) - Six (50%)
The most important networking partner No. of firms which cited this type of networking partner	"university or other higher education institution" Twelve (86%)	"Competitors and other enterprise in your sector" Twelve (92%)

Table 5.11a Summary of the firms' interaction behaviour [Source: current research]

Indicators	Campinas	Recife
No. of firms which reported innovation interactions in general	Fourteen (100%)	Thirteen (100%)
No. of firms which experienced interaction with:		
"market" partners	Fourteen (100%)	Twelve (92%)
"institutional" partners	Twelve (86%)	Thirteen (100%)
"internal" partners	Two (14%)	Four (31%)
No. of firms which experienced innovation interactions with only one partner	-	Two (15%)
No. of firms which experienced interactions with two or more partners	Fourteen (100%)	Eleven (85%)
No. of firms which reported innovation interactions in general:		
i) Within the clusters only	Four (29%)	Two (15%)
ii) Outside the clusters only	Two (14%)	Two (15%)
iii) In both: within and outside	Eight (57%)	Nine (70%)
Overall no. of innovation interactions reported	Sixty seven (67)	Sixty five (65)
No. of innovation partners located:		
i) Within the clusters	Thirty (45%)	Sixteen (25%)
ii) Outside the clusters	Thirty seven (55%)	Forty nine (75%)
The most relevant problem hampering interactions	"Lack of trust"	"Lack of trust"
The less relevant problem hampering innovation	"Personal resistance to network"	"Lack of channels of communications"

Table 5.11b Summary of the firms' interaction behaviour [Source: current research]

5.4 Empirical evidence and the research question

One of the key elements of any research is related to the analysis and interpretation of gathered data and the relationship between those data and the research problem. Thus, the key goal of this section is to analyse how empirical evidence can provide information to answer the research question "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?"posed for this study.

In this context, the main preoccupation of this researcher while presenting the research findings was, at the first moment, to describe the results of the field of investigation and secondly, to present the links between the research findings and the research question in a way that conclusions can be drawn and the research question properly answered. To present the links between the research findings and the research question, some evidence of the interaction behaviour and innovation performance were identified, so that the outcome can lead to the answer of the research question.

The first group of relevant evidence considered significant to the understanding of the research context, is the perception of respondents regarding the importance of networking and business arrangements for the development of innovation activities. In both cases, respondents' perceptions were highly positive. The willingness to interact with others seems to be the core aspect of the process of innovation as it allows entrepreneurs to reach new information sources able to provide new competencies, knowledge, and technologies sufficient to increase firm's innovativeness. This evidence was also confirmed by some respondents' comments which additionally suggested some clues about the reasons (motives) why interactions are so important to innovation activities. One of the respondents explicitly suggested that there is no other way to innovate unless interacting with someone else. Others suggested that interaction is about mutual gains and interest. Overall, respondents demonstrated they perceive interactions as a very important element to the development of innovation activities, bringing benefits to all partners involved.

As far as the importance of clusters to the development of innovation activities is concerned, most of the respondents perceived advantages in belonging to some sort of spatial agglomeration; however, the findings also showed that firms which tend to recognize the importance of those arrangements are those which experience some sort of interaction within those clusters with apparent benefits. This is made clear by some interviewees' comments such as "....they [Porto Digital Management Unit] gave us a great help...virtual office, training room with all infrastructure...." and "...if I leave.....we are going to lose the advantages to be located in here [Porto Digital]....".

Secondly, the findings showed that there were two distinct groups of firms as far as interaction is concerned: i) the group of firms which did experience interactions within the clusters and ii) the group of firms which did not experience interactions within the clusters. In both groups, the level of engagement in innovation activities was quiet high. In the first group, 100% of firms in Recife and 75% in Campinas were engaged in innovation activities and in the second, 100% of firms in both locations were engaged in innovation activities (implemented or in progress) (see Table 5.12). This analysis is relevant because it indicates that even though firms did not experience interactions within the cluster, they still can be innovative.

So, considering only the group of firms which experienced interactions within the cluster, the findings showed the following empirical evidence: i) Superficial or informal interactions were the most common form of interactions experienced by firms in both locations. 100% of firms experienced this type of interaction and ii) 53% of firms in Campinas and 50% in Recife reported that interactions use to happen "occasionally".

Possibilities	Campinas	Recife
A) There are firms which experienced interactions within the clusters.	Fifteen (79%) out of nineteen firms	Twelve (92%) out of thirteen firms
A1. Firms engaged in innovation activities	Fifteen	Twelve
A2. Firms which did not develop any innovation activity	-	-
B)There are firms which did not experience interactions within the clusters	Four (21%) out of nineteen firms	One (8%) out of thirteen firmsRPD26
B1. Firms engaged in innovation activities	Three	One
B2. Firms which did not develop any innovation activity	One	-

Table 5.12 Scenarios suggested by the research question [Source: current research]

In general, the majority of firms in both locations experienced interactions with partners inside and external to the clusters. The most common group of innovation partners are those classified as "market" partners (i.e. clients, competitors, consultants) and the majority of them are external to the clusters. These data allows an evaluation of the influence of geographic proximity on the development of innovation. In more detail, 100% of firms in Campinas and 92% in Recife, experienced interactions with "market" partners. Considering the geographic distribution of innovation partners in general, the findings showed that 55% of the innovation partners identified by firms in Campinas and 75% in Recife are located mostly external to the clusters. Additionally, the findings show that in both locations, the number of external innovation partners is higher if compared with those from inside clusters.

So, considering the set of empirical findings (See Tables 5.11, 5.11a, 5.11b and 5.12), they did not seem to suggest that local interactions have an effective direct impact on firms' innovation activities, even though they contribute to the overall improvement of firms' innovation performance. To some interviewees even with a relative lack of trust,

local interactions are worthwhile because they can learn about market practices or from personal experiences as well as local interactions are facilitated by clusters' infrastructure such as restaurants, shopping mall and coffee shops.

5.5 Complementary data: interaction and innovation processes

In this Section, the researcher describes in detail, complementary data regarding the interaction and innovation processes.

5.5.1Types and location of innovation partners

One of the key points of this investigation is to identify the types and location of innovation partners. The complexity of the innovation phenomenon involves the access to various sources of knowledge and technologies. However, not all knowledge and technologies sources are found internally within an organization. To Powell, Kenneth and Laurel (1996), the consensus is increasing among entrepreneurs, policy-makers and scholars that individuals or firms themselves are no longer the locus of innovation but, the network in which a firm or individual is embedded. So, external sources can facilitate the access to new knowledge and information that cannot be generated internally (Nelson, 1990). Thus, the firms must search for external sources to create an evolutionary and sustainable development of the capacity to innovate. Therefore, the network of external relationships seems to define the propensity of the firms to innovate. In this context, the identification of types and locations of networking partners plays a critical role in the capacity of firms to innovate. Thus, in this study, the researcher investigated the network of interaction linkages as it is believed that it strongly influences the capacity of firms to innovate.

5.5.1.1 Types of innovation partners

Innovation partners are those which firms have some kind of interaction with in order to develop their innovation activities. So, the survey questionnaire presented a list of different agents and respondents were asked to identify those who they had interacted with during the period of investigation. This list was based on the Oslo Manual (OECD/EUROSTAT 2005) and comprised of eight potential partners as follow:

1. Other enterprises within your enterprise group,
2. Suppliers in general,
3. Clients and customers,
4. Competitors and other enterprises in your sector,
5. Consultants,
6. Universities or other higher education institutions,
7. Commercial laboratories or private R&D institutes and
8. Government agencies or public research institutes.

For analytical purposes, these potential partners were classified into three broad groups: internal, market and institutional. The objective was to identify which group of partners were the most influential and consequently had much more impact on the development of innovation activities (see Figure 5.1).

The findings show that firms in both locations were very proactive as far as the diversification of innovation partners is concerned. The diversification of partners demonstrates that firms seemed to develop a unique capacity to interact with different partners at the same time. The evidence shows that, on average, firms located in Campinas behaved, regarding types of innovation partners in general, slightly differently from firms in Recife. In Campinas, 86% of

firms reported that they experienced interactions with "universities or other higher education institutions" as oppose to 38% in Recife. As regards "competitors and other enterprises in your sector", in Recife, 92% and in Campinas, 50% of firms reported that they experienced interactions with this type of partner.

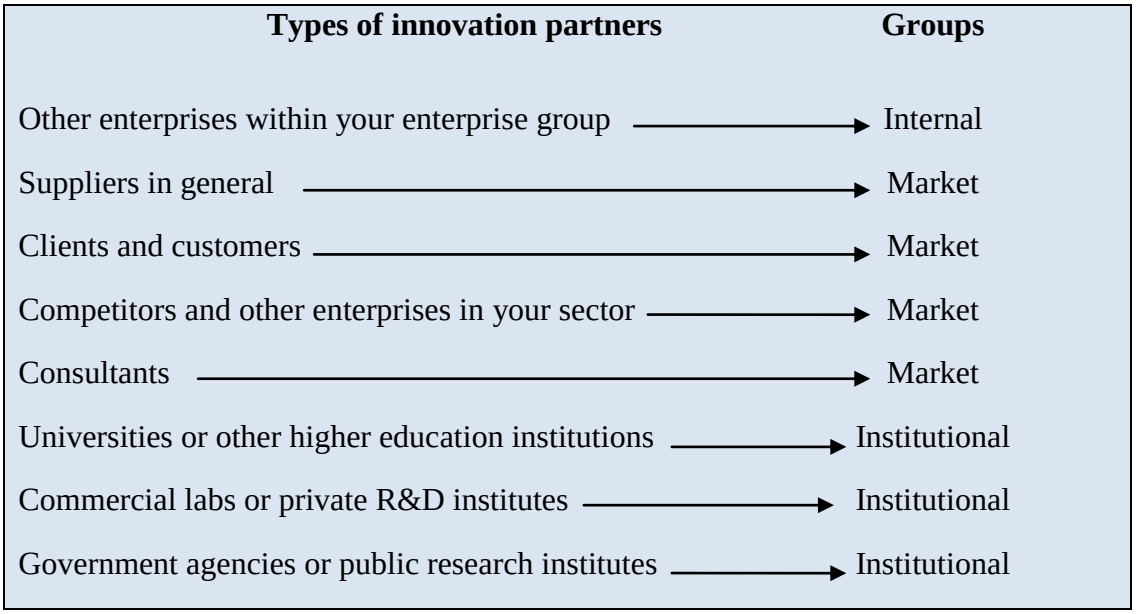

Figure 5.1 Classification of types of innovation partners [Source: current research]

Government agencies or public research institutes were another partner which presented a relative difference in interaction behaviour. In Campinas, for instance, 36% of the firms experienced interactions with this type of interaction partner, as oppose to Recife, where 100% of firms surveyed reported an interaction experience with this partner. Additionally, according to the findings, the interaction behaviour as regards the other innovation partners was relatively similar in both locations (see Table 5.13).

Considering the classification of types of innovation partners by groups (see Figure 5.1), Table 5.14 shows that 100% of firms experienced interactions with "market" partners in Campinas, against 92% of firms in Recife. Regarding institutional partners, 100% of firms in Recife and 86% in Campinas experienced interactions with this group of interaction partners.

Types of innovation partners	Group	Campinas No. of firms	Recife No. of firms
Other enterprises within your enterprise group	Internal	02 (14%)	04 (31%)
Suppliers in general	Market	05 (36%)	04 (31%)
Clients and customers	Market	06 (43%)	06 (46%)
Competitors and other enterprise in your sector	Market	07 (50%)	12 (92%)
Consultants	Market	08 (57%)	06 (46%)
Universities or other higher education institutions	Institutional	12 (86%)	05 (38%)
Commercial labs or private R&D institutes	Institutional	04(29%)	04 (31%)
Government agencies or public research institutes	Institutional	05(36%)	13 (100%)
No. of firms which answered this question	-	14 (100%)	13(100%)
No answer	-	05	-
Total of firms	-	19	13

Table 5.13 Classification of types of innovation partners [Source: current research]

Group of innovation partners	Campinas No. of firms	Recife No. of firms
Internal	02 (14%)	04 (31%)
Market	14 (100%)	12 (92%)
Institutional	12 (86%)	13 (100%)

Table 5.14 Classification by group of types of innovation partners [Source: current research]

The findings also showed that in Campinas, 100% of firms which answered this question experienced interactions with at least with two or more partners, against 85% in Recife (see Table 5.15).

Number of innovation partners by firm	Campinas No. of firms	Recife No. of firms
One	-	02 (15%)
Two or Three	08 (57%)	05 (38%)
Four or Five	04 (29%)	02 (15%)
Six or more	02 (14%)	04 (32%)
Total of firms	14 (100%)	13(100%)
No answer	05	-

Table 5.15 Number of innovation partners by firm [Source: current research]

At last, this research analysed the number of times each different innovation partner was cited by firms. This indicator tells how many partners each firm used to interact with during the period of investigation. According to Table 5.16, in Campinas, the firms reported that individually, the most cited innovation partner is "university or other higher education institution" (20%), followed closely by "client and customer" (18%). In Recife, the most common innovation partner is "competitor and other enterprise in your sector" (22%), also followed closely by "client and customer" (17%) and "government agency and public research institute" (17%). When the innovation partners are sorted by groups, it is unanimous that "market" partners are the most important. In Campinas, 57% and Recife, 60% of partners cited as important to innovation are in this group (see Table 5.16a).

Types of innovation partners	Group	Campinas frequency	Recife frequency
Other enterprises within your enterprise group	Internal	02 (3%)	04 (6%)
Suppliers in general	Market	05 (8%)	06 (9%)
Clients and customers	Market	12 (18%)	11 (17%)
Competitors and other enterprise in your sector	Market	10 (15%)	14 (22%)
Consultants	Market	11(16%)	08 (12%)
Universities or other higher education institutions	Institutional	14 (20%)	06 (9%)
Commercial labs or private R&D institutes	Institutional	05 (8%)	05 (8%)
Government agencies or public research institutes	Institutional	08 (12%)	11 (17%)
No. of innovation partners reported	-	67 (100%)	65 (100%)
No. of firms which answered this question	-	14	13
Average of interaction partners / firm	-	4.8	5.0

Table 5.16 Types of innovation partners - Campinas **[**Source: current research]

Group of innovation partners	Campinas frequency	Recife frequency
Internal	02 (3%)	04 (6%)
Market	38 (57%)	39 (60%)
Institutional	27 (40%)	22 (34%)
No. of innovation partners reported	67 (100%)	65 (100%)

Table 5.16a Classification by group of types of innovation partners **[**Source: current research]

During the interviews some interviewees provided valuable insights about their understanding of the significance of those partners to the development of innovation activities such as: *"The client demands solutions which generates innovations*" (RPD29); *"...we are developing [innovation] together with the client..."* (RPD27);

"....the software test factory [one of the firms' services] became viable with the support of our clients....one of our clients wanted to validate their products (software) and asked us to execute this activity....." (RPD34); *"...since the beginning of our firm, the aim was to develop new products that did not yet exist in the market ....the only problem was to convince the clients that they are going to need them even though they did know they existed....but always focused on telecommunication sector...."* (RPD29); *"...we submitted a project for funding to FINEP (government agency), but it was not approved...actually, we believed it was interesting.....then, VIVO (client) decided to go with the proposal...."* (RPD32) and *"...rather than be a Siemens' competitor…we became its client…"* (CSC14). The key message behind these comments reflects the importance of the market players in which the innovation process is partly oriented toward market problem-solving.

5.5.1.2 Location of innovation partners

More than investigating the interaction behaviour in general or simply identifying types of interaction partners, this methodology involved investigating where these innovation partners were located. This was important to determine the influence and importance of the impact partners within business agglomerations may have in the development of innovation initiatives and consequently in the overall innovation performance of firms surveyed.

The respondents were asked to identify geographically where those innovation partners were located, according to the following options: i) in the cluster (business arrangement), ii) elsewhere in the city, in another part of the region, iii) another region and iv) foreign country. These options were selected, considering that firms may have access to partners in different geographic sites as well as to facilitate further analysis and conclusions. The aim was also to verify the geographic extension of the network of relationships for innovation activities and specifically whether it was inside the business arrangement or elsewhere.

The findings present that as regards the location of innovation partners, they are located in all five localities (see Table 5.17 and Figure 5.2). Also, the evidence shows that the majority of firms in both locations (in Campinas, 57% and in Recife, 70%) experienced interactions with innovation partners located within and outside the clusters (see Table 5.17a) during the investigation period and only six (43%) firms out of fourteen in Campinas and four (30%) in Recife, experienced interactions with partners exclusively within or outside the clusters (see Table 5.17a).

Locations of innovation partners	**Campinas** **No. of firms**	**Recife** **No. of firms**
In the Cluster	12 (86%)	09 (69%)
Elsewhere in the city	04 (29%)	10 (77%)
In another part of the same region	05 (36%)	02 (15%)
Another region	03 (21%)	07 (54%)
Foreign country	03 (21%)	02 (15%)
No. of firms which answered the question	14 (100%)	13 (100%)
No answer	5	-

Table 5.17 Locations of innovation partners [Source: current research]

Locations / No. of firms	**Campinas**	**Recife**
Within the cluster only	4 (29%)	2 (15%)
Outside the cluster only	2 (14%)	2 (15%)
Both (within and outside the clusters)	8 (57%)	9 (70%)
Total of firms	14 (100%)	13 (100%)

Table 5.17a Locations of innovation partners [Source: current research]

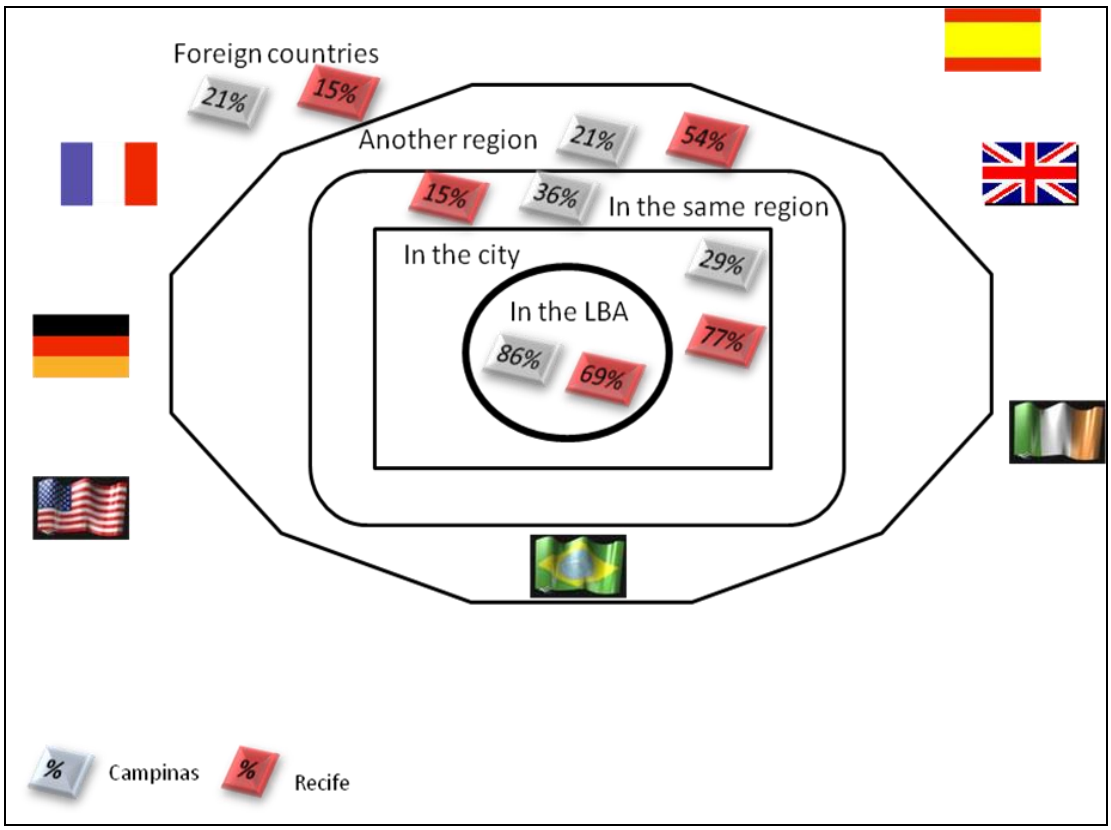

Figure 5.2 Map of interaction partners [Source: current research]

Furthermore, the firms reported that during the period of investigation, they experienced interactions with sixty seven and sixty five innovation partners in Campinas and Recife respectively. These partners are distributed geographically among the five localities suggested by the survey. On average, the empirical evidence presents that 55% of the innovation partners identified by the firms in Campinas and 75% in Recife are located mostly outside the clusters (see Table 5.18).

Additionally, considering the group of innovation partners (i.e. internal, market and institutional) and respective location, the empirical evidence shows that numerically, the "internal" and "institutional" partners in Campinas are equally located inside and outside the clusters, against 25% and 75% of "internal" and 9% and 91% in Recife respectively. As regards the "market" partners, in both locations they are mostly located outside the clusters (see Table 5.18.a). However, it is important to highlight that firms in both locations identified the same type of innovation partner in different localities.

Types of innovation partners in general	Campinas frequency		Recife frequency	
	Within clusters	Outside clusters	Within clusters	Outside clusters
Other enterprises within your enterprise group	01(50%)	01 (50%)	03 (75%)	01 (25%)
Suppliers in general	03 (60%)	02 (40%)	02 (33%)	04 (67%)
Clients and customers	02 (17%)	10 (83%)	-	11 (100%)
Competitors and other enterprise in your sector	03 (30%)	07 (70%)	09 (64%)	05 (36%)
Consultants	07 (64%)	04 (36%)	-	08 (100%)
Universities or other higher education institutions	09 (64%)	05 (36%)	-	06 (100%)
Commercial labs or private R&D institutes	02 (40%)	03 (60%)	02 (40%)	03 (60%)
Government agencies or public research institutes	03 (37%)	05 (63%)	-	11 (100%)
Total of innovation partners reported	30 (45%)	37 (55%)	16 (25%)	49 (75%)
No. of innovation partner by firm	2.1	2.6	1.2	3.8
No. of innovation partners reported	67 (100%)		65 (100%)	

Table 5.18 Types of innovation partners [Source: current research]

At last, the number of innovation partners when divided by the number of firms, the result shows that firms in Campinas and Recife are much more interaction active, as far as innovation is concerned, outside than inside the clusters. In Campinas and Recife, for instance, the averages of innovation partner by firm inside the clusters is 2.1 and 1.2 respectively, as against 2.6 and 3.8 considering partners outside the clusters in both locations.

Groups of types of innovation partners	Campinas frequency		Recife frequency	
Location of innovation partners	**Within clusters**	**Outside clusters**	**Within clusters**	**Outside clusters**
Internal	01(50%)	01 (50%)	03 (75%)	01 (25%)
Market	15 (39%)	23 (61%)	11 (28%)	28 (72%)
Institutional	14 (52%)	13 (48%)	02 (9%)	20 (91%)
No. of innovation partners reported	30 (45%)	37 (55%)	16 (25%)	49 (75%)
No. of innovation partners reported	67 (100%)		65 (100%)	

Table 5.18a Classification by group of types of innovation partners **[**Source: current research]

One factor that might explain why the average of innovation partners outside the clusters compared with partners inside the business arrangement seems to be the fact that as shown in Table 5.16.a, the most frequent innovation partners are those classified as "market" partners and according to Table 5.18a, they are mostly located outside the business arrangements. Moreover, among the "market" players, "competitors or other enterprises in the same sector" are numerically the main group of partners, which in general does not seem to facilitate the creation of interaction linkages, as they are direct competitors.

The argument that the composition of innovation players may influence the intensity of interactions within or outside the business arrangements is illustrated by two specific comments captured during the interviews: *"...Porto Digital [firms in PD] is not face-to-face with its clients [market]…"* (RPD30) and *"…..there is no interaction with direct competitors…….I tried to reach them once, but they were not so receptive…..they are afraid of something…..I could not even enter in their firms……"* (RPD24).

5.5.2 Types, complexities and frequency of innovation interactions within clusters

In this section, the researcher describes the types, frequency and complexities of interactions firms experienced within clusters. In this case, the list of five types of interactions suggested by the Oslo Manual (OECD/EUROSTAT 2005) was adopted as follows:

a) Exchanging ideas and information

b) Sharing equipment, machinery and software

c) Joint projects (including R&D)

d) Training

e) Exchanging technologies and know-how

So, to facilitate the general understanding, the analysis of the types of innovation interactions was designed considering two dimensions: individual and group. Firstly, it was considered each type of interaction individually and secondly, the types of interaction were grouped in three categories, according to the complexity and degree of commitment as follows: superficial or elementary, intermediary and sophisticated or complex levels (this classification of types of interactions was not based on any previous model, but according to this author's understanding) (see Figure 5.3).

The findings showed that the great majority of firms experienced some type of innovation interaction within the business arrangements. In Campinas, fifteen (79%) out of nineteen and in Recife, twelve (92%) out of thirteen firms experienced interactions within the clusters. In general, from the thirty two firms surveyed, twenty seven (84%) in both locations experienced interactions within the business arrangements. Firms CI1, CI3, CSC13 and CSC18 in Campinas and RPD26 in Recife did not report any interaction experiences within the clusters.

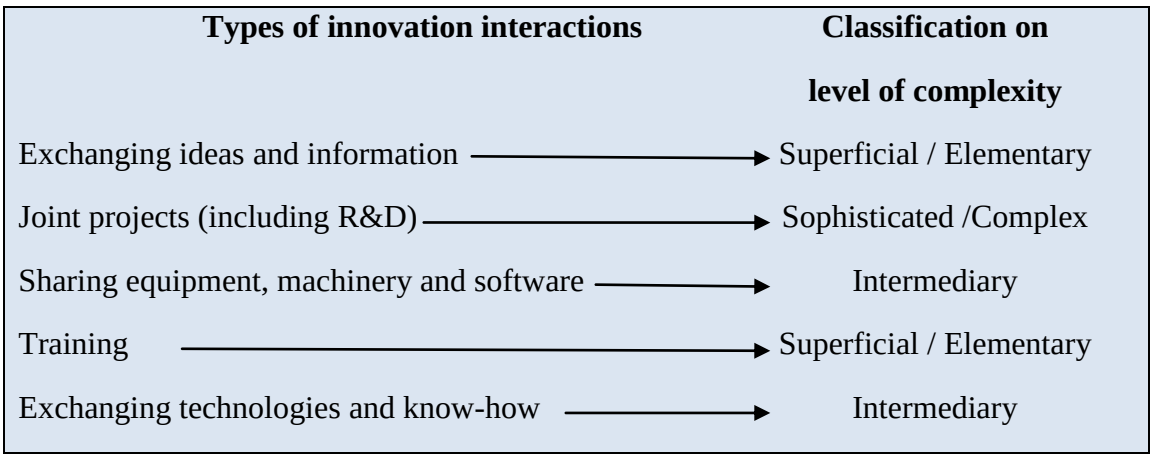

Figure 5.3 Types of interactions within the CLUSTER [Source: current research]

Individually, among the five different types of innovation interactions experienced, "exchanging ideas and information" is the most frequent type in both locations. In Campinas, thirteen (87%) out of fifteen firms surveyed and in Recife twelve (100%), reported that they experienced this type of interaction during the period investigated. The second most frequent type of interaction is "joint projects" ("joint project" is the more complex type of collaborative interaction in which two or more participants are involved in the development of a specific project, so that the resources and outcomes can be shared between them). In Campinas, six (40%) out of fifteen firms and in Recife, ten (83%) out of twelve firms experienced this type of interaction. When the types of interactions are sorted considering the complexity and degree of commitment, the findings showed that 100% of firms in both locations experienced "superficial or elementary" types of interactions. As opposed to complex or sophisticated types of interactions were experienced only by six (40%) firms in Campinas and ten (83%) in Recife (see Table 5.19).

Superficial interactions, in particular, are characterized by informality and "ad hoc" relationships rather than structured or formal interactions. Informality seemed to be part of the behavior of respondents in both locations as some have reported that it was quiet frequent they met people during lunch time or in short breaks for coffee in the afternoon: *"…the biggest advantage [to be located at Porto Digital (PD)] is that we can meet people during lunchtime...it is a differentiation...it generates innovation..."* (RPD27); *"….the fact that we are located on an island, makes geographic proximity an*

advantage…..we can meet people during lunch time and talk…." (RPD24) and *"…to create and maintain trust, nothing is better than a face-to-face contact….it breaks the ice…."* (CSC14).

Types of innovation interactions	Classification on level of complexity	Campinas No. of firms	Recife No. of firms
Exchanging ideas and information	Superficial	13	12
Joint projects (including R&D)	Sophisticated / Complex	6	10
Sharing equipment, machinery and software	Intermediary	-	8
Training	Superficial	2	6
Exchanging technologies and know-how	Intermediary	3	9
No. of firms which experienced innovation interactions within the clusters	-	15	12
No. of innovation interactions reported	-	24	45
Average of interactions / firm within the clusters	-	1.6	3.7
No. of firms which did not experience innovation interactions within the clusters	-	04	01

Table 5.19 Types of interactions within business arrangements **[**Source: current research]

Regarding the intensity of interactions, these findings show that firms located in Recife were much more interaction active than those located in Campinas. The average interaction/firm in Recife was almost three times the average in Campinas (i.e. 3.7 interactions by each firm in Recife, against 1.6 in Campinas). Furthermore, the findings also showed that six (40%) firms in Campinas and all firms in Recife experienced more than one type of interaction within the clusters (see Table 5.20).

Number of innovation interactions	Campinas No. of firms	Recife No. of firms
One	09	-
Two	04	02
Three	01	04
Four	01	01
Five	-	05
Total	15	12

Table 5.20 Number of innovation interactions within clusters [Source: current research]

At last, this research also investigated the frequency of those interactions. In order to do so, the following question was posed: "What is the frequency of those business interactions?" The responses were ranked considering four levels of frequency: on a regular, occasional, or rare basis and not applied. The empirical findings show that the majority of firms in both locations reported that interactions used to happen "occasionally" (53% of firms in Campinas and 50% in Recife), followed by "on a regular basis" (33% of firms in Campinas and 50% in Recife) and rare (14% of firms in Campinas and none in Recife) (see Table 5.21).

Frequency of innovation interactions	Campinas No. of firms	Recife No. of firms
Regular	05 (33%)	06 (50%)
Occasional	08 (53%)	06 (50%)
Rare	02 (14%)	-
Not applied	-	-
Total	15 (100%)	12 (100%)

Table 5.21 Frequency of interactions [Source: current research]

The highest percentage of firms in Recife which experienced interactions "on a regular basis" might be justified by the active presence of the governance body of the Porto Digital (NGPD). According to one of the respondents, *"…the presence of a management body [NGPD] is important……. [to facilitate interactions among firms] it is part of its agenda….."* (RPD36). Other aspects such as evidence of previous personal relationships among entrepreneurs before the existence of Porto Digital and the good infrastructure of restaurants and coffee shops in the area stimulates "occasional" meetings as reported by some respondents: *"Personal relationship was an important factor to create the Porto Digital "movement"...in the early 90's, after the dismantling of large firms' computing centres [Banorte and Bompreco], a group of computing skilled workers were unemployed....this is the origin of Porto Digital"* (RPD30); *"...Yes, everything is close....during lunch time we meet and talk to people..."* (RPD25); *"....the environment [PD] facilitates interactions....we meet people, have lunch together, and naturally create trust..."* (RPD32).

5.5.3 Other issues about the firms' interaction behaviours: the entrepreneurs' perceptions about networking for the development of innovation activities

In the previous sections, this researcher has presented the typology and locations of innovation partners of firms surveyed. Perceptions are psychological insights able to change reality. Things can be perceived in different ways and each way influences how people make decisions; therefore with different outcomes. This study investigated the respondents' perceptions about the importance of issues such as networking, clusters and innovation agents.

As regards the creation of a network of collaborative relationships, it seems to be crucial for the search of new sources of information on innovation, complementarities of knowledge and competencies needed to promote innovation continuously. Whereas interactions are based on reciprocities, the value created in those interactions must be perceived as mutually beneficial. So, to completely understand the firm's interaction

behaviour, this researcher asked the respondents how they perceived the importance of networking to the development of innovation activities.

To investigate the perceptions of the respondents about the importance of networking for the development of innovation activities, the methodology used was to ask respondents to classify the importance of networking for innovation activities based on four main degrees of importance: high, medium, low or not important. So, through the question "How significant is networking to the development of innovation activities in your enterprise", this researcher investigated more closely how respondents perceived those interactions which effectively seemed to have an impact on the innovative capacity of firms. In this context, networking was suggested as a synonym of interaction and it was defined as the capacity of individuals and/or organizations to collaborate and co-operate in a process of exchanging information, skills, equipments and competencies for mutual benefit.

Not surprisingly given the small size of businesses interviewed, the findings showed that, 94% and 100% of firms surveyed in Campinas and Recife respectively, answered that interactions were of "high" or "medium" importance to innovation activities. This high percentage of responses considering interactions to be of high or medium importance to innovation activities reflected the significant role of interactions to those firms in the development of innovation activities (see Table 5.22).

Besides the identification of respondents' perceptions about the importance of networking to the development of innovation activities, some respondents also suggested clues about the motives for the engagement in interaction activities. To them, the motives were related to individual gains and benefits rather than related to the "collaborative and collective" spirit result of factors such as the geographic proximity as suggested by some authors such as Porter (1998a).

Degrees of importance	Campinas No. of firms	Recife No. of firms
High	10(59%)	09 (69%)
Medium	06 (35%)	04 (31%)
Low	01 (6%)	-
None	-	-
Total	17 (100%)	13(100%)
No answer	02	-

Table 5.22 Importance of interactions for innovation activities [Source: current research]

Identifying that interactions are of high importance, another aspect investigated was the respondents' perceptions about the role of the cluster environment on the firm's innovation activities. In Chapter 2, this researcher identified that many aspects seem to have influence on innovation initiatives. From the economic geography perspective, some authors such as Porter (1998), Dicken (1999), Longhi and Keeble (2000), Malmberg and Power (2005) and others, agree that location and local business arrangements have significant influence on the formation of an environment appropriate to the development of innovation activities. Malmberg and Power (2005), for example, stated that spatial agglomeration is used to enhance learning processes through face-to-face interaction, trustful relations between various actors, to reduce short cognitive distance and to facilitate easy observation and immediate comparison.

To Porter (1998a), proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions. So, assuming these arguments reflect the reality, this study investigated whether entrepreneurs perceive themselves belonging to a cluster and moreover, whether there are advantages, as far as innovation is concerned, in belonging to this type of agglomeration. So, in order to examine these issues, two questions were asked as follows:

1. Does your enterprise belong to any business arrangement?

2. According to your own experience, do you perceive any advantage, as far as innovation is concerned, in belonging to a business arrangement?

Regarding to the first question, empirical evidence showed that the majority of respondents recognized that they belong to a business arrangement. Table 5.23 shows that 79% and 92% of firms in Campinas and Recife respectively, perceived themselves belonging to a business arrangement. As regards the second question, 95% of firms in Campinas and 100% in Recife agreed that there are advantages in belonging to those business arrangements.

Even though the motivations to be located in a business arrangement were not directly asked, some entrepreneurs during the interviews reported some clues. Surprisingly, very few were related to the advantages of geographic proximity or related to gains of knowledge or competencies or even interactions leading to an improvement of innovativeness.

Questions	**Campinas No. of firms**		**Recife No. of firms**	
	YES	**NO**	**YES**	**NO**
1. Does your enterprise belong to any business arrangement?	15 (79%)	04 (21%)	12 (92%)	01 (8%)
2. According to your own experience, do you perceive any advantage as far as innovation is concerned, in belonging to a business arrangement?	18 (95%)	01 (5%)	13 (100%)	-

Table 5.23 Perception of significance of locating in clusters [Source: current research]

The motivations were mostly related to marketing, economic and/or strategic issues, such as taking advantage of the positive reputation and image of business arrangements, attractive fiscal incentive policies or modern telecommunication infrastructure. Some comments are as follows: *".....when you tell your client you are located in the Porto Digital area, it becomes an important competitive advantage.....the brand name "Porto Digital" is relevant..."*(RPD 24); "*.....while at a business meeting with a client in*

Curitiba, Parana state, they told me that before confirming the meeting, they had investigated about Porto Digital…and now, they feel more confident to do business with us…." (RPD24); *"....we were in a trade fair in Sao Paulo, when a client asked us if were located in Porto Digital (PD) area...I said YES....then, they said that PD was very well known and has a good reputation..."* (RPD29); *"....Yes, because I am located here [Porto Digital], it brings reliability to the business....it is a subjective advantage as well as technical, because firms located here [Porto Digital] are more likely to be good (technically)"* (RPD25) and *"...as a positive factor, PD has a good infrastructure of restaurants, shopping mall and coffee shops.....we close many deals while we are in coffee shops..."* (RPD31).

Other respondents made comments regarding the advantages of belonging to business arrangements such as: *"...advantages to belong to a cluster? ....it facilitates exchange of experiences.....we learn about market practices…"* (CSC14); *"Porto Digital concentrates IT associations in the same location....it is unique in Brazil...."* (RPD30) and *"...The biggest advantage [to be located at PD] is that we can meet people during lunchtime...it is a differentiation...it generates innovation..."* (RPD27). Whatever the motivations were, it was almost unanimous that especially for micro and small firms, locating and belonging to a business arrangement on a geographic concentration basis seemed to bring competitive advantages that can be translated into an overall improvement of firms' competitiveness.

Following the logic of capturing the respondents' perceptions about issues regarding the relationship between interaction and innovation processes, next, this researcher looked at identifying which external agents were important to the development of innovation activities. So, regarding the importance of external agents to innovation, very few would disagree that interactions with those agents are important for the development of any innovation initiative as they seem to provide a wide range of benefits in terms of new sources of complementarities such as financial aid, knowledge exchange and market information. Empirical evidence and specialized literature seem to strengthen the power of the external interactions for the success of innovation initiatives. Since the late 90's many authors such as Rugman and D'Cruz (1996), Minguzzi and Passaro (2000), Porter

and Ketels (2003), Pittaway, Robertson, Munir, Denyer and Neely (2004), for instance, argued that business interactions are emerging as an important means to promote the improvement of firm's innovativeness.

So, in this context, this researcher also investigated the perceptions of entrepreneurs regarding the importance of some external agents that might influence or contribute to the development of innovation activities. The list of players presented to the respondents was based on the Oslo Manual (OECD/EUROSTAT, 2005) and included: universities or higher education institutions, private research institutes, public research institutes, government agencies, private and public financial institutions and business network organization.

The respondents were asked to classify those innovation agents individually, according to their importance for innovation activities and to rank them considering the following: high, medium, low importance or none (not important at all) for innovation activities. Literally, the question posed was: "How important is the contribution of the following institutions listed below to the success of innovation activities in your enterprise?". These institutions are as follows: universities or higher education institutions, private research institutes, public research institutes, government agencies, private and public financial institutions and business network organization.

The findings show that in both locations, the three most important agents influencing innovation were: government agencies, business network organizations and universities or high education institutions (see Table 5.24). Each individual agent is particularly important to the development of innovation. Government agencies are important in financing or funding innovation projects, business networks in facilitating information exchange and universities in formation of skilled people; but, depending on the place they are located, the perception of the importance to innovation may vary. In Campinas, 68% of respondents ranked this agent as of "high" importance to innovation against 46% in Recife. This lower level of perception in Recife compared to Campinas may partly be explained by the fact that while in Campinas, the three business arrangements

surveyed are located inside the university's campus; in Recife, the university is not geographically close (see Figures 4.2 and 4.3).

However, and this may be a more significant factor, in Campinas, the university itself was always effectively present in firms' development of innovation through the availability of appropriate infrastructure such as laboratories for Research & Development or through the massive formation of highly specialized labour force. On the contrary, in Recife firms rarely use university's facilities or infrastructure and perceive the local university as the main source of skilled labour force solely. This is evident in some respondents' comments as follows: *"....university is merely a source of good skilled labour to PD..."* (RPD36) and *"...the importance of university is low.....they only contributed to my [academic and technical] formation...."* (RPD29). Although, these comments may not sound good or even positive, it does not mean that these firms do not recognize the important role of the University for the Development of innovation.

Other innovation agents also perceived as "important" for firms involved in innovation activities were: government agencies and business network organizations. 77% of firms in Recife and 78% in Campinas ranked government agencies as an important agent in facilitating innovation. Business network organizations were mentioned by 62% and 50% of firms in Recife and Campinas respectively as being important for innovation (See Table 5.24).

List of agents / location	High frequency	Medium frequency	Low frequency	None frequency
Universities or higher education institutions				
1. Recife	06 (46%)	05	01	01
2. Campinas	13 (68%)	04	01	01
Private research institutes				
1. Recife	03	01	02	07(54%)
2. Campinas	03	03	01	11
Public research institutes				
1. Recife	02	01	01	09 (69%)
2. Campinas	07	05	01	05
Government agencies				
1. Recife	10 (77%)	-	-	03
2. Campinas	14 (78%)	03	01	01
Private financial institutions				
1. Recife	01	03	03	06 (46%)
2. Campinas	04	-	03	11
Public financial institutions				
1. Recife	02	03	03	05 (38%)
2. Campinas	05	04	02	07
Business network organization				
1. Recife	08 (62%)	03	01	01
2. Campinas	09 (50%)	04	01	04

Table 5.24 Classification of importance of innovation agents by location [Source: current research]

The relevance of these agents to the success of innovation activities was not translated only in numbers or percentages but also were captured by the respondents' comments, as follow: *"...Softex [business arrangement organization] has a great*

advantage.....nobody imposes anything..." (RPD27); "*...the link with INCAMP does not close business deals, but opens doors"* (CI 10); *"...we have a culture to get money from FINEP (government agency)..."* (RPD31); *"...we were closing a deal with a client....and he used his BNDES (Brazilian Development Bank) corporate card....cheap money..."* (RPD35); *"...Porto Digital management unit helps "to sell" your company's image…….decorate your business card…."* (RPD36) and *"...Porto Digital cluster was crucial to the opening of our branch in Recife.....they [Porto Digital Management Unit] gave us great help...virtual office, training room with all infrastructures...."* (RPD35).

Additionally, as opposed to the most important agents influencing innovation activities, Table 5.24 also presented other players that were ranked as low or not important for the development of innovation activities such as: private and public research institutes as well as private and public financial institutions. Private and public financial institutions (i.e. banks) are not perceived as important actors in supporting innovation because, in general, they charge market interest rates and do not offer any special conditions for micro and small sized firms to develop innovation activities; therefore, the main financial aid usually comes from the government through special programmes designed to support small business enterprises. This argument is supported by these two respondents' comments: *"....public financial institutions charge the same interest rate as private ones……"* (RPD24) and *"...we have a culture of getting money from FINEP (government agency)..."* (RPD31).

5.5.4 General information about the firms' innovation processes

In the next paragraphs, details of the innovation process are presented under the perspective of each type of innovation individually and problems hampering innovation.

5.5.4.1 Product / Service Innovation

For the purpose of this study, product / service innovation is defined as follows:

> *"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. Product innovations can utilise new knowledge or technologies, or can be based on new uses or combinations of existing knowledge or technologies. The term "product" is used to cover both goods and services. Product innovations include both the introduction of new goods and services and significant improvements in the functionality or user characteristics of existing goods and services."* (OECD/EUROSTAT, 2005, p.48)

Product / service innovation seems to be the core activity of any innovative organization and there is no doubt about the importance of this type of innovation for the overall innovation performance. The importance of this type of innovation (product/service innovation) to the firms is reinforced by two aspects: firstly, the fact that all firms are engaged in innovation activities (implemented or in progress) in both locations and secondly, by the recognition of the entrepreneurs of the high relevance of this type of innovation to the overall business performance as stated in this comment: *"...we never stop developing the 'system' [firm's main product] ...every new client demands us to update the general concept of the 'system'..."* (RPD26).

However, as presented in this Section, innovation does not seem to be an activity which firms perform in isolation. In fact, innovation activities may involve partnerships with other innovation agents, such as: other enterprises, third level institutions, research centres or government agencies. This kind of partnership seems relevant to the development of innovative projects, because it may allow firms to have access to new technologies and complementarities of knowledge and competencies.

The findings reveal that the majority of firms had partners in the development of product/service innovations. In Recife and Campinas, seven (54%) out of thirteen and nine (50%) out of eighteen firms respectively, developed innovation through a collaborative arrangement (see Table 5.25).

Responsibility for the development of product/service innovation	**Campinas No. of firms**	**Recife No. of firms**
Mainly the enterprise alone	09(50%)	06 (46%)
Collaborative arrangements	09(50%)	07 (54%)
Total	18 (100%)	13 (100%)

Table 5.25 The development of product/service innovation [Source: current research]

Regarding the technical aspect of this type of innovation, not every product/service innovation must be completely new. According to the Oslo Manual (OECD/EUROSTAT 2005), every innovation must contain a certain degree of novelty. Technically, product/service innovations involve: i) a significant improvement of existing products or service or ii) a completely new product or service to the firm. So, regarding the degree of novelty involving product/service innovation, Table 5.27 shows that as far as technical changes is concerned, in Recife, 69% of the product and service innovations were an "improvement" of existing products and 31% were "completely new" to the firm. In Campinas, 56% were "improvement" of existing products and 56% "completely new" to the firm. In the case of this study, some firms surveyed had more than one product/service innovation, either implemented or in progress.

Another dimension of analysis, involves the evaluation of whether those innovations were "new to the firm" or "new to the market". According to the Oslo Manual (OECD/EUROSTAT, 2005), "new to the firm" is any innovation not yet implemented by the firms themselves, although it may have been implemented by others. "New to the market" is any innovation absolutely new to the market; either domestic or international markets. So, Table 5.26 also reveals that in Recife and Campinas, 77% and 67% respectively, of those innovations were "new to the market" and all firms (100%) in

Recife, against 83% of firms in Campinas revealed that the innovations were new to the firm.

Indicators	Campinas No. of firms	Recife No. of firms
Improvement of existing product/ service	10 (56%)	09 (69%)
Completely new to the firm	10 (56%)	05 (31%)
New to the market	12(67%)	10 (77%)
New to the firm	15(83%)	13 (100%)

Table 5.26 Degree of novelty – Product/service Innovation [Source: current research]

5.5.4.2 Process innovation

The next type of innovation is "process innovation". Process innovation is defined as an innovation focused on the implementation of a new or significantly improved production or delivery method. Process innovation is intended to reduce cost of production or delivery, improve quality and deliver new or significant products and services (OECD/EUROSTAT, 2005,).

One of the advantages of developing process innovation is the fact that it may lead to the improvement of a firm's relationship with clients as stated by some of the respondents, such as: *"...the process innovation helped us to rescue our relationship with our clients that we had lost....."* (RPD 35) and *"... innovation in some processes made us more agile."* (RPD31).

Table 5.27 shows that 54% of firms in Recife and 39% in Campinas were engaged in the development of process innovation. Moreover, the great majority of firms in both

locations: Recife and Campinas, 86% and 100% respectively, developed "a method of manufacturing or producing goods or services". Additionally, Table 5.27 presents that firms may develop more than one type of process innovation at the same time. In Campinas, for instance, each firm developed 1.3 types of process innovation during the period of investigation.

Types of process innovation	**Campinas** **No. of firms**	**Recife** **No. of firms**
Method of manufacturing or producing goods or services	07 (100%)	06 (86%)
Logistics, delivery or distribution methods for your inputs	01	-
Supporting activities (maintenance system, operation for purchasing, accounting or computing	01	01
Nr. of firms involved in the development of process innovation	07 (39%)	07 (54%)
Average of innovation / firm	1.3	1.0

Table 5.27 Types of process innovation **[**Source: current research]

Another dimension of analysis is the interactivity. As well as in the product/service innovation, process innovation seems to be characterized also by some sort of interactivity. It means that firms also tend to interact with others in the development or implementation of process innovation. The findings show that in Recife, 57% of firms developed process innovation in collaborative partnerships, as oppose to Campinas, where all firms engaged in this type of innovation had no innovation partner (see Table 5.28).

Overall, according to some respondents, the development of process innovation is a very important contributor to the general improvement of firm's performance: *"...the firm experienced a huge growth in 2005/2006, but we were not prepared....the quality of our software was declining...and this is what motivated us to innovate our processes..."*

(RPD35) and *"...the biggest gain with process innovation was that we are dedicated to the development of new technologies solely ..... we are now specialists in generating novelties...and we do not manufacture anymore"* (RDP29).

Responsibility for the development of Process innovation	**Campinas** **No. of firms**	**Recife** **No. of firms**
Mainly the enterprise alone	07 (100%)	02 (29%)
Mainly other enterprise	-	01 (14%)
Collaborative arrangement	-	04 (57%)
Total……	07 (100%)	07(100%)

Table 5.28 Responsibility for the development of Process innovation **[**Source: current research]

5.5.4.3 Organizational /Marketing innovation

The Oslo Manual (OECD/EUROSTAT, 2005) considers four different types of innovation: product/service, process, marketing and organizational innovations separately. As marketing and organizational innovations, the Oslo Manual (OECD/EUROSTAT, 2005) presents two distinguished concepts as follows:

> *"Marketing innovations include significant changes in product design that are part of a new marketing concept. Product design changes here refer to changes in product form and appearance that do not alter the product's functional or user characteristics. They also include changes in the packaging of products such as foods, beverages and detergents, where packaging is the main determinant of the product's appearance."* (OECD/EUROSTAT, 2005, p.50)

> *"An organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations. Organisational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to non tradable assets (such as non-codified external knowledge) or reducing costs of supplies."* (OECD/EUROSTAT, 2005, p.51).

However, to this author, marketing is part of the organizational strategy of the organization and therefore, there was no reason to consider it separately. So, the definition of organizational/marketing used in the current study is as follows: *"Organizational and marketing innovations are the implementation of new or significant changes in firm's structure, management or marketing methods that are intended to improve firm use of knowledge, the quality of goods and services, product design, distribution, pricing, product promotion or the efficiency of work flows."* (Author of the current research- based on the Oslo Manual (OECD/EUROSTAT, 2005)). So, this sub-section outlines empirical findings regarding organizational and marketing innovations. It presents that eleven (85%) firms in Recife and five (28%) in Campinas developed and implemented this type of innovation. In more detail, Table 5.29 shows that within the group of different forms of organizational/marketing innovation, the most common was "new business practices for organizing work or procedures" in Recife and "New methods of organizing external relations" in Campinas.

Types of organizational/marketing innovation	**Campinas** **No. of firms**	**Recife** **No. of firms**
New business practices for organizing work or procedures	2	8
New knowledge management systems	-	5
New methods of workplace organization	1	2
New methods of organizing external relations	3	-
Implementation of significant changes in the organizational structure	1	2
Implementation of significant changes or new methods in the marketing strategy	2	6
Total of marketing/organizational innovations	09	23
No. of firms engaged in this type of innovation	05 (28%)	11 (85%)
No. of marketing/organizational innovation / firm	1.8	2.0

Table 5.29 Types of organizational/marketing innovations [Source: current research]

As regards other types of innovation, firms also developed more than one form of marketing/organizational innovations during the period of investigation. Also, the findings show that in Campinas, firms developed 1.8 and in Recife, 2 marketing/organizational innovations simultaneously.

Regarding the responsibility for the development of organizational/marketing innovations, the firms surveyed in each location (Recife and Campinas) presented a relatively low degree of interactivity. In Campinas, only one firm out of five and in Recife, also one firm out of eleven developed that type of innovation in collaboration with others (see Table 5.30).

Responsibility for the development of organizational/marketing innovation	**Recife No. of firms**	**Campinas No. of firms**
Mainly the enterprise alone	09	04
Mainly other enterprise	01	-
Collaborative arrangement	01	01
Nr. of firms……	11	05

Table 5.30 The development of organizational/marketing innovations [Source: current research]

The low level of interactivity in this specific type of innovation if compared to the product/service innovation, was made clear when one of the respondents stated the following comment: *"...product / service innovation is cost risky....there is always a fear of not getting there.....organizational innovations, on the other hand, depend on internal factors and creativity...."* (RPD30). This quotation seems to suggest that organizational / marketing innovation, as opposed to the product/service, can be developed using internal resources mainly as well as it does not seem to compromise the firm's performance.

5.5.5 Problems hampering interactions and innovation activities

Of course, interactions and innovation activities are not free of problems. Many interactions, for instance, may not necessarily guarantee innovation as innovation is neither an easy nor simple task. Many problems or barriers may hamper or block interactions and innovation initiatives. Problems or obstacles are always a major concern for entrepreneurs and policy makers and need to be properly examined. Therefore this study investigated the main problems which may hamper or block interactions and innovation activities. As the main research question suggests a potential relation between interactions and innovation, the relevance of this issue is directly linked to the understanding of those problems in order to design public and organizational policies able to help firms to overcome those barriers, allowing them to be as innovative as they can.

5.5.5.1 Problems hampering interactions

Many factors may block, hamper or inhibit interactions. So, this study also investigated problems hampering interactions. To investigate the problems hampering interactions, a list of eight problems based on the Oslo Manual (OECD/EUROSTAT 2005) methodology was presented to each respondent. This included the following factors: lack of trust, personal resistance to network, organizational culture, competitive sector, lack of network facilitator, lack of face-to-face interactions, lack of personal relationship and lack of channels of communications. Then, the respondents were asked to classify these problems according to their importance for innovation activities. Three categories were suggested as follow: i) major problem, ii) a bit of a problem and iii) not a problem at all.

In Campinas, however, this methodology was slightly different. For the firms which belonged to INCAMP, respondents were asked to select the three most important problems hampering innovation activities. For firms in the CIATEC and SOFTEX,

respondents were asked to classify each individual problem suggested according to the three categories (i.e. major problem, a bit of a problem and not a problem at all). The findings show that in Campinas, both methodologies presented the same result: "Lack of trust", "organizational culture" and "lack of networking facilitator" are the most significant problems hampering interactions (see Table 5.31). In Recife, according to Table 5.31a, the most significant problems hampering interactions are as follows: "lack of trust", "organizational culture" and "lack of face-to-face interactions".

List of problems	Major problem frequency	A bit of a problem frequency	Not a problem at all frequency
Lack of trust	07	04	02
Personal resistance to network	01	01	06
Organizational culture	06	03	03
Competitive sector	05	04	03
Lack of network facilitator	06	03	03
Lack of face-to-face interactions	05	02	04
Lack of personal relationship	04	03	04
Lack of channels of communications	01	01	05

Table 5.31 List of problems hampering networking – Campinas [Source: current research]

Whereas problems such as: lack of trust, organizational culture and lack of face-to-face interactions seemed to be the problems mentioned most, firms tended to overcome these problems and build interaction linkages anyway to gain competitive advantages as exemplified in some respondents' comments: *"..Many things are not done, because of lack of trust..."* (RPD33); *"...trust is a relative problem.....we can build trust……lack of face-to-face contact generates communication problems."* (RPD31); *"…to create and maintain trust, nothing is better than a face-to-face contact….it breaks the ice…."* (CSC14) and *"....partnerships are closed trough a face-to-face contact..."* (RPD29).

List of problems	Major problem frequency	A bit of a problem frequency	Not a problem at all frequency
Lack of trust	07	02	04
Personal resistance to network	04	05	04
Organizational culture	06	03	03
Competitive sector	01	08	04
Lack of network facilitator	04	05	04
Lack of face-to-face interactions	05	05	03
Lack of personal relationship	03	04	06
Lack of channels of communications	04	02	07

Table 5.31a List of problems hampering networking – Recife [Source: current research]

5.5.5.2 Problems hampering innovation

To gather the data, this researcher asked firms to evaluate a pre-defined list of problems hampering innovation activities. These problems were defined according to the list presented by the methodology suggested by the Oslo Manual (OECD/EUROSTAT 2005). It involves economic (high costs, lack of funds and lack of finance), knowledge (lack of skilled personnel and lack on information on technology), organizational (organizational rigidity) or market (lack of demand or need to meet norms and regulations) factors. So, for this investigation, each respondent evaluated each individual problem based on three degrees of importance: i) major problem, ii) a bit of a problem or iii) not a problem.

In Campinas, the methodology was slightly different. The first group of firms selected the three most important problems hampering innovation activities. This group (Campinas I) was formed by eleven firms. All of them part of the INCAMP business

arrangement. They were identified as follows: CI1, CI2, CI3, CI4, CI5, CI6, CI7, CI8, CI9, CI10 and CI11. The second group of firms is formed by eight firms which belonged to SOFTEX and CIATEC (CSC12, CS13, CS14, CS15, CS16, CS17, CS18 and CS19). For this group, the researcher adopted the general methodology outlined above which asked the entrepreneurs and senior executives to assess each individual problem and classify them as: i) major problem, ii) a bit of a problem or iii) not a problem. Table 5.32 shows the list of the problems hampering innovation according to the first group of firms (Campinas I). For this group of firms, "lack of funds" (insufficient internal financial resources to develop innovation), "lack of finance" (lack of external mechanisms to finance the development of innovation) and "high costs of innovation" were the three most relevant.

List of problems	**Classification by group of problems**	**Major problem frequency**
Lack of funds	Economic	08
Lack of finance	Economic	06
High costs	Economic	06
Lack of qualified personnel	Knowledge	03
Lack on information on technology	Knowledge	-
Lack on information on markets	Knowledge	03
Difficulty in finding co-operation partners for innovation	Market	01
Market dominated by established enterprises	Market	02
Uncertain demand for innovative goods and services	Market	01
Need to meet regulations and norms	Market	-
Excessive perceived economic risk	Market	-
Organizational rigidity	Organizational	-
Resistance of staff / personnel to innovation	Organizational	-

Table 5.32 List of problems hampering innovation – Campinas I **[**Source: current research]

In sequence, Table 5.33 presents the results of the evaluation of the problems hampering innovation according to the second group of firms in Campinas. For this group of firms, the three most important problems were: high costs of innovation, lack of finance and lack of funds. In both groups, even with different methodologies, the results were the same: problems related to economic issues appeared to be the main obstacles to innovation activities. Lack of finance and lack of funds, as well as high costs of innovation were the main obstacles to the development of innovation activities.

List of problems	Classification by group of problems	Major problem frequency	A bit of a problem frequency	Not a problem frequency
Lack of funds	Economic	04	03	-
Lack of finance	Economic	05	02	-
High costs	Economic	05	-	02
Lack of qualified personnel	Knowledge	01	03	03
Lack on information on technology	Knowledge	-	-	07
Lack on information on markets	Knowledge	03	01	03
Difficulty in finding co-operation partners for innovation	Market	01	04	02
Market dominated by established enterprises	Market	-	03	04
Uncertain demand for innovative goods and services	Market	-	04	03
Need to meet regulations and norms	Market	-	02	05
Excessive perceived economic risk	Market	-	02	05
Organizational rigidity	Organizational	-	-	07
Resistance of staff / personnel to innovation	Organizational	-	-	07

Table 5.33 List of problems hampering innovation – Campinas II [Source: current research]

When sorting the problems by categories (i.e. economic, knowledge, market and organizational), the most relevant category of problems hampering innovation is the

economic group of problems. Almost 70% of problems cited by the firms surveyed in Campinas reported that economic problems are the most relevant (see Table 5.34).

Groups of problems	Major problem frequency	A bit of a problem frequency	Not a problem frequency
Economic	34 (69%)	05 (21%)	02 (4%)
Knowledge	10 (20%)	04 (16%)	13 (27%)
Market	05 (11%)	15 (63%)	19(40%)
Organizational	-	-	14 (29%)

Table 5.34 Groups of problems hampering innovation – Consolidated [Source: current research]

In Recife, not different from Campinas, the findings present that "lack of finance", "lack of funds" and "high costs of innovation" are the major problems blocking or hampering innovation activities (see Table 5.35). Considering the categories of problems hampering innovation activities: economic, knowledge, market and organizational, problems classified in the economic category (70%) were the major problems, followed by market (14%), knowledge (11%) and organizational (4%), the less important (see Table 5.36).

Table 5.37 shows that for either Recife or Campinas, economic factors seemed to be the major problems faced by firms to develop innovative initiatives. Market factors were less important factors hampering innovation activities. It was interesting to note that in spite of there being many problems hampering or blocking innovation initiatives, such as economic factors, firms did not stop innovating.

List of problems	Classification by group of problems	Major problem frequency	A bit of a problem frequency	Not a problem frequency
Lack of funds	Economic	08	03	02
Lack of finance	Economic	10	01	02
High costs	Economic	05	05	03
Lack of qualified personnel	Knowledge	02	07	04
Lack on information on technology	Knowledge	-	02	11
Lack on information on markets	Knowledge	02	09	02
Difficulty in finding co-operation partners for innovation	Market	01	03	09
Market dominated by established enterprises	Market	03	03	07
Uncertain demand for innovative goods and services	Market	01	07	05
Need to meet regulations and norms	Market	-	02	11
Excessive perceived economic risk	Market	-	05	08
Organizational rigidity	Organizational	-	01	12
Resistance of staff / personnel to innovation	Organizational	01	04	08

Table 5.35 List of problems hampering innovation – Recife [Source: current research]

Group of problems	Major problem frequency	A bit of a problem frequency	Not a problem frequency
Economic	23 (70%)	09 (17%)	07 (8%)
Knowledge	04 (12%)	18 (35%)	17 (20%)
Market	05 (15%)	20 (38%)	40 (48%)
Organizational	01 (3%)	05 (10%)	20 (24%)

Table 5.36 Summary of group of problems hampering innovation – Recife [Source: current research]

Group of problems	Major problem frequency		A bit of a problem frequency		Not a problem frequency	
Locations	Campinas	Recife	Campinas	Recife	Campinas	Recife
Economic	69%	70%	28%	17%	6%	8%
Knowledge	20%	12%	15%	35%	27%	20%
Market	11%	15%	49%	38%	40%	48%
Organizational	-	3%	8%	10%	27%	24%

Table 5.37 Group of problems hampering innovation – Consolidated I [Source: current research]

5.6 Chapter Summary

This chapter described the main characteristics, interaction behaviours and innovation performance of firms located in Campinas and Recife. Besides that, it presented the main problems hampering interactions and innovation, respondents' perceptions about the importance of: networking, local business arrangements and innovation agents (i.e. government agents, business network organizations, universities or high education institutions) for innovation activities.

In summary, the respondents demonstrated willingness to interact and perceived networking as of high importance to the development of innovation activities. Also, the empirical findings showed that there is strong evidence connecting interactions in general and innovation performance. Firms in both locations were highly innovative (100% of firms in Recife and 95% of firms in Campinas were engaged in innovation activities) and the great majority of firms reported some sort of interaction (within or/and external to the business arrangements) for the development of innovation.

Regarding the answer for the research question posed for this study "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly to

local or non-local interactions?" in general, the findings showed that both local and non-local interactions are important for the development of innovation activities; but, considering the geographic distribution of the innovation partners (55% of innovation partners identified by firms in Campinas and 75% in Recife are external to the clusters) and the fact that the firms which did not report any interactions experience within clusters in both locations (Campinas and Recife) were highly innovative, suggests that local interactions alone, despite being highly relevant to the development of innovation activities for some firms cannot be regarded as an essential factor influencing all firms' innovation performance in general.

Furthermore, considering the group of twenty seven firms (fifteen firms in Campinas and twelve in Recife) which experienced interactions within the business arrangements, the findings showed that they experienced interactions from many types: superficial, intermediary and/or complex. However, most of the interactions were at superficial/informal level in nature. Additionally, the findings revealed that 53% of firms in Campinas and 50% in Recife reported that interactions used to happen "occasionally". This set of evidence strongly suggests that even though firms did not experience interactions within the clusters, they were still innovative.

Despite of it was not the main focus of this thesis, the empirical findings suggest that spatial agglomerations are important to the development of innovation initiatives, especially for micro and small sized firms, to overcome barriers to innovation such as economy of scale, infrastructure and access to potential cooperation partners. Specifically regarding the level of interactivity among players inside those arrangements, the findings demonstrated that geographic proximity was not as important as many scholars suggested as most of the important innovation partners were external to the clusters.

In fact, the findings demonstrated that clusters are of significant value for firm's development of innovation whilst provider of gains related to marketing (i.e. taking advantage of the positive reputation of the clusters), economic factors such as fiscal and

tax incentives and strategic issues such as modern telecommunication infrastructure and the attraction of skilled labour force.

One final lesson learned from the results of the research findings was that innovation performance was highly influenced by the level of interactivity; but it was not based solely on interactions within the clusters; on the contrary, it was determined by a combination of interactions within and external to the clusters, even in situations where the majority of innovation partners are external to the cluster.

In the next chapter, the findings are examined within the context of the existing literature, so that some theoretical and practical implications can be discussed. The final outcome shall contribute to the development of new theories about the relationship between firm's interaction behaviour and innovation.

CHAPTER 6

DOES GEOGRAPHIC PROXIMITY ENABLE LOCAL INTERACTIONS WITH AN EFFECTIVE IMPACT ON FIRM'S INNOVATION ACTIVITIES? – A DISCUSSION IN THE CONTEXT OF THE THEORETICAL AND CONCEPTUAL FRAMES

One of the key elements of any research is related to the analysis and interpretation of gathered data within the context of existing literature. The current section analyses and discusses the main findings against the existing literature, theories and hypothesis focused on the central issue of this study (to what extent innovation is associated with local or non-local interactions). Any interpretation or analysis, however, took into account the context in which the investigation was performed.

It is growing the awareness that to gain competitive advantage, firms must innovate and also that innovative firms are involved in a set of interaction linkages which presumably provide new innovation resources such as knowledge, information and technologies.

This approach allows this researcher to answer the main question of this thesis (In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?) which revolves around two apparently contrary arguments: the emphasis on the local interaction and local buzz as sufficient mechanisms to promote and sustain the development of firm's innovation activities and the idea that "pipelines" need to be built in order to open new channels of accesses to important innovation sources localised outside cluster's borders.

So, the research findings showed that there is strong evidence connecting interactions in general and innovation. From the thirty two firms surveyed in both locations (Campinas and Recife), thirty one (97%) were engaged in innovation activities and all of them reported interaction experiences inside and/or outside the clusters. This model is

described by Rothwell (1994) which shows that after 1990's, innovation has been a result of a strategic networking approach rather than a result of the technology-push and market-pull approaches or even the result of an alliance between the firm and a single partner. This relationship seems to happen naturally and respondents demonstrated willingness to interact and perceived networking as of high importance to the development of innovation activities.

The interpretation of the findings suggests that the interviewees were very open to interact and perceived interactions as of relevant importance as a means to access new knowledge, information, technologies and competencies so important to the development of innovation. These interactions, according to them, are based on reciprocities and the value created in those interactions seems to be perceived as mutual benefit.

The complexity of this issue is illustrated by the analysis of the motives of firms' engagement in networking activities. Based on some interviewees' comments, interactions and cooperation between firms happen due to the perception of mutual gains involved in the process. To them, networking was motivated by self-interest and in order to maintain a constant access to new innovation resources, firms tend to interact intensively. In line with the research findings, some authors such as Huxham (1996), stated that despite differences in language, aims and culture, collaborative interaction happens due to the perception of mutual gains and it is highly motivated by self-interest. In this case, the benefits of interactions range from gains in competitive advantage through access to new knowledge, information and technologies sources to access finance, fiscal benefits and assistance in the purchase of material and equipment (Mohannak, 2007). In this context, to Huxham (1996) and Balestrin and Verschoore (2008), networked environments reflect the search for competitive gains which could not be obtained by individual efforts.

While the current investigation revealed that the networking approach is recognized as relevant and has a direct impact on the development of firm's innovation activities,

there are some elements that cannot be ignored and needed to be identified in order to understand the firms' interaction behaviour. These elements are as follows: the types of partners, frequency, degree of commitment, intensity of interactions and the geographic scope of firm's interaction network.

Overall, the research findings showed that these interactions were from different types, degrees of commitment and intensity and with different partners from different locations. These constitute one of the most critical and important parts of this study. In detail, the empirical findings showed that the firms, in general, experienced various types of interactions: from exchanging ideas and information to joint projects with partners from inside and outside the clusters during the investigation period. Given the firm's interaction behaviour within the clusters, they were at different levels of complexity: from superficial to sophisticated types of interaction; however, quantitatively, the number of the "superficial" type of interaction reported by the firms was higher if compared with a more complex and sophisticated one. Additionally, the findings also showed that most of those interactions used to happen "occasionally".

Moreover, the findings also showed that local interactions seem to tend to be weighted towards institutions that provide supply-side support for innovation (skills, public funding and technical advice) whereas non-local interactions are associated mostly with the demand side linkages such as clients, customers and competitors. This might be related to the composition of types of members within the clusters and the location itself. The difference in interaction behaviours between firms in Campinas and Recife seems to be mainly due to the fact that in Campinas, the cluster is located within the university Campus and UNICAMP is of significant relevance to firms within the cluster, especially because the majority of firms are start-up firms as opposed to Recife, where firms are mostly mature and the cluster composition is basically of competitors, therefore the level of collaboration is relatively low.

Two types of supporting argumentation can be produced. Firstly, local business agglomerations formed by direct competitors does not facilitate the formation of an

interactive environment (Eickelpasch et al., 2007). This argument is supported by one of respondent's comments which objectively stated that there is no interaction with direct competitors*: "…..there is no interaction with direct competitor"* (RPD24). In fact, the current research showed that wherever interactions exist, they are mainly focused on clients and customers, suppliers and consultants and are located outside the cluster borders.

Secondly, even though geographic proximity may stimulate trustful relationships, most of the interactions generate redundant information not useful to increase a firm's innovativeness (Granovetter, 1973). This implies that the current combination of both factors: low level of complexity and frequency of interactions seem to suggest that the direct impact of those interactions on firm's innovation activities were not effectively relevant. The current findings demonstrated that Granovetter's arguments of weak and strong ties seemed to be valid. Even though some respondents (15% of respondents in Recife and 29% in Campinas) interacted with partners inside the clusters solely, the geographic range of interactions spread across the cluster, regional and national borders (Figure 5.2).

So, as far as the geographic scope of interactions is concerned, the findings showed that the great majority of firms reported that most of the important innovation partners were located outside the business arrangements. Additionally, quantitatively, the number of innovation partners by firm outside the clusters was higher if compared with the partners within the clusters. The analysis of the effect of the geographic scope of firms' interaction network suggests that local and non-local interactions are both of significance for the development of firm's innovation activities. However, the fact that firms are building "pipelines" to gain access to distant innovation partners reinforces the argument that local interactions may not be sufficient to keep pace with the speed of the growing demand for new products and services; thus, firms need to search for new innovation sources outside cluster's borders. In the case of the current study, the empirical evidence suggests that outside partners seem to have more effective impact than from partners within the clusters.

Theoretically, with the heavy influence of the economic geography school on innovation literature, some authors would address this phenomenon as a localized phenomenon intrinsically linked to locational factors. This relationship between innovation and locational factors is heavily supported by some studies and writers such as Tidd et al. (2001), Malmberg and Maskell (2001) and Power (2005). This perspective stresses the benefits of geographic proximity (i.e. face-to-face interactions and knowledge spillovers) facilitating the increase of interactions and the matureness of the local innovation systems formed by the spatial agglomerations. One particular factor is the spatial agglomeration structures which seem to facilitate the formation of an interactive environment enhancing firm's capability to innovate. Secondarily, but not less important, a debate is introduced: the discussion about the role of the spatial agglomerations in providing an environment where interaction is induced and creating favourable conditions to innovation.

To authors from other areas such as Porter (1998a, 1998b, 1998c, 1998d), the way firms are spatially organized also have impacts on the firm's innovativeness; therefore firm's innovation performance is also related to a locational factor. To Porter (1998a), spatial agglomerations of businesses such as clusters provide the ideal environment able to foster innovation because, mainly due to the geographic proximity which facilitate the impact of interactions leading to the increase of new innovation activities. This type of cluster-based environment, according to him, gives support to firms to reach a stage of innovation excellence based on extensive informational and collaborative networks of relationships between firms and other cluster members.

However, in the 21st century economy, on the contrary, new discussions about spatial agglomerations and territoriality have suggested that there seems to be a relative decline in the importance of geographic proximity on the development of firm's innovation activities. Some authors such as Dicken (1999) and Martin and Sunley (2002) have critically discussed Porter's theory of cluster and other forms of proximity (cognitive, social, organizational and institutional) besides geographical proximity has been considered to explain the increasing of long distance interactions in the interactive process focused on the development of innovation. Even though the so called local buzz

is still relevant to promote generation and transmission of new knowledge, information and competence within a certain spatial agglomeration of firms, many authors do not believe that it is enough to provide the necessary innovation inputs to the development of innovation activities. Facilitated by the global environment and new information and communication technologies, new channels are open through external pipelines to access new distant partners with significant impact on firm's innovativeness.

So, even though in general, the majority of firms in both locations experienced interactions with partners inside and external to the clusters, the findings showed, in particular, that there was a group of firms (5 firms in both locations) which did not experience local interactions, but they were still innovative. This analysis is relevant because it indicates that even though firms did not experience interactions within the cluster, they still can be innovative.

As far as the relationship between innovation and interaction is concerned, independently of influence of locational factors, authors such as Lundvall (1985 and 1992), Rosenfeld (1997), Porter (1998a), Ahuja (2000), Pittaway, Robertson, Munir, Denyer and Neely (2004) and Cortrights (2006) have argued that there is a close link between both concepts. In this particular study, the research evidence suggests that the development of firms' innovation activities, generally speaking, seems to be influenced by the strategic networking approach adopted by those firms and not by the way (cluster structures) they are geographically organized.

The analysis of the research evidence suggests significant clues for the conclusions of this study. One of the clues is the fact that strategically, according to this investigation, interactions, in general, seem to have a close link with the level of innovation activities performed by firms; however, this relationship does not seem to be limited geographically. In fact, according to some respondents, the close connection between interaction and innovation is a result of the firm's level of perception of mutual gains and benefits generated by the interaction linkages not by the fact that firms are geographically close to each other or within the same cluster. Overall, the empirical

finding support the arguments defended by Svetina and Prodan (2008) and Bathelt et al. (2004) that local buzz and local interactions alone are sufficient to have an impact on firm's innovation activities and therefore, firms need to search for new innovation sources regardless of whether they are geographically close or not. This argument is more consistent with the interactive behaviour observed in this study.

Aside from the discussion of the relationship between interaction and innovation and the association of innovation to local or non-local interactions, the findings strongly suggested that clusters are still attractive to firms, especially micro and small enterprises (MSEs). The majority of respondents do recognise that there are advantages to belonging to a cluster; however, the main benefits are related to good infrastructure, access to public funding and fiscal and tax incentives as well as specific gains related to the good reputation and image of excellence in technology that some clusters have. According to some respondents, the clusters surveyed offer good infrastructure, bring reliability to the business and have good reputation and image of excellence in technological leadership, which pragmatically are translated into trade and marketing advantages. This "reputation" effect creates meaning and value to specific places able to transform intangible gains into competitive advantages (Pike, 2010).

One last point this researcher would like to add to this discussion: the role of MSEs in the context of the innovation game. The concern that innovation is privilege of large corporations appears to be a fallacy. MSEs became important players in the economic and social fields (Fowler, 2001) and half of innovation introduced into the market after World War II, was generated by small firms (Timmons, 1990). Even though they are less likely to invest in R&D than large firms (OECD, 2000), they may be highly innovative in areas such as new techniques to enhance productivity, creating or re-engineering products or services and introducing new organizational approaches. This fits with the pattern this researcher observed in both locations. The findings showed that overall the firms surveyed were very flexible, conducted two or more types of innovation projects with two or more innovation partners at the same time.

On the other hand, it is not ignored that micro and small firms also use to face many problems. The difficulties may range from accessing new knowledge and technologies to the low level of formation of its labor force, difficulties to access credit and new markets as well as economy of scale (Sachs, 2001). In the current study, the most common problems were those related to economic factors in contrast to knowledge, market and organizational factors. Individually, the problem mentioned least was "lack on information on technology", which suggests that it is relatively easy to access innovation information from various sources. Despite there being many problems, the firms surveyed did not stop or slow down their innovation as they are increasingly aware of these shortcomings and recognize that the main problem is not their size but being isolated (Sengenberger and Pyke, 1991).

6.1 Chapter Summary

This chapter presented the analysis, position against the existing literature and explanations of the main research findings. Overall, the research findings confirmed the importance of interaction to the development of innovation. In reality the findings do not provide any evidence of causal relation between interaction behaviour and innovation performance, but strongly suggests that innovative firms are very interaction active. This argument is defended by many scholars such as Cortrights (2006) who argued that for firms to succeed they have to network and collaborate with each other and Ahuja (2000), who stated that firm's innovation activities increases with the number of interaction linkages that firms maintain.

The empirical evidence from the current survey seems to confirm that innovative firms' interaction behaviour involve interactions with partners both within and outside the spatial agglomerations and that access to those external sources of innovation do not appear to be limited geographically. The research findings reveal many cases where local interactions generate innovation but equally the innovative activities of many other firms appears to have been influenced very little by close proximity.

At very least, innovation does not seem to be associated with local interactions only; on the contrary, innovation seems to be associated with both local and non-local interactions. Overall, this study suggests that interactions are somewhat complex and have a direct influence on firms' innovation activities regardless of the location of the innovation partners.

These conclusions do not support entirely some innovation studies performed in early 1990's such as Porter's studies. His studies contended that geographic proximity promotes conditions to increase interactions between cluster members allowing the creation of an interactive environment able to impact firm's innovativeness. According to Porter's premises clustered firms are more likely to be innovative than others outside clusters.

However, as the Twentieth century ended, the advantage of geographic proximity seemed to collapse. Several factors are behind this. First and most important is explained by some authors such as Svetina and Prodan (2008). According to them, with the extraordinary advance and development of new information and communication technologies and the globalization phenomenon, geographic proximity does not seem to be relevant and if firms want to succeed in the innovation race, they need to search for innovation sources with no regard to its location. Secondly, from the sociological viewpoint, geographic proximity generates strong ties, which facilitates trustful relationships, but most of the time these close interactions generate redundant information not useful for the development of firm's innovation activities (Granovetter, 1973); nevertheless, there is evidence that local relational linkages are useful in particular aspects such as to facilitate the flows of knowledge and capital in a certain locations. At last, high concentration of firms in the same location does not seem to facilitate and stimulate the formation of interactive environments (Eickelpasch et al., 2007).

It is important to emphasize that this thesis is not neglecting the advantages of the geographic proximity (local interaction) nor the importance of spatial agglomerations such as clusters to innovation, but it calls attention to the fact that to become innovative, firms need to nurture interaction linkages regardless of whether they are geographically close to the firms or not.

In the modern world, with the phenomenal growth of new communication technologies and virtual networks, the advantages to be located inside spatial business agglomerations such as clusters are beyond the geographic proximity of actors. They are related to infrastructure, fiscal and tax incentive policies and good reputation and image of excellence in technology leadership.

In general, these research findings show that innovative firms are strongly influenced by their interaction linkages (inside and outside the clusters); however, those interactions are not limited geographically, restricted to local sources nor to local business arrangements. On the contrary, firms are constantly opening channels of interactions to reach new innovation sources regardless their geographical distance. In short, this study revealed that innovation is an interactive phenomenon, but not necessarily a territorial one.

It is useful to note that even though there were barriers to innovation, none of them were able to compromise the development of innovation initiatives; on the contrary, entrepreneurs did not identify any obstacles in reaching new innovation sources (relative easy accessibility) nor found any serious communication barriers.

As final outcomes, it is expected that new windows can be opened for further studies contributing to the theoretical debate of the understanding of the innovation phenomenon in general, specifically among micro and small sized firms. Also, it is expected that this research contributes to the debate about the importance of spatial

agglomerations and geographic proximity to the improvement of competitiveness through innovation.

These outcomes involve discussions particularly at two levels: organizational and governmental. At the organizational level, the results of this study show that entrepreneurs need to develop connections able to reach new innovation sources regardless of whether they are geographic close or not. At the governmental level, as many countries around the world are focusing on the creation of business agglomeration models as industrial districts, innovative milieux and spatial clusters of innovation, efforts should be made in the direction of guaranteeing modern technological infrastructure, public funding and financing as well as tax incentive policies able to stimulate new micro and small sized firms within these spatial innovation models to invest in innovation.

Finally, in the next chapter, this researcher draws together the main conclusions and limitations of this investigation as well as presenting suggestions for further studies as a complement to the present research.

CHAPTER 7

INNOVATION AND NETWORKING - LOCAL INTERACTIONS ARE GOOD BUT NOT GOOD ENOUGH FOR INNOVATION - CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

The previous chapter critically examined the results presented in the findings chapter within the context of some theoretical issues and conceptual framework posed in the existing literature and published studies on innovation. Now, in this chapter, the researcher combines the main research results to present the conclusions of this study.

The current chapter is structured into five sections. Section 7.1 presents a brief overview of the research. Section 7.2 presents the research findings and the research problem. Next, section 7.3 the core part of this chapter, covers the answers to the research questions. Section 7.4 presents the main conclusions and implications of findings. Section 7.5 describes the implications, main strengths, limitations of the research and provides suggestions for future researches as follow-up of this investigation.

7. 1 The research – a brief overview

From the viewpoint of the theoretical and conceptual frames of reference from which the current survey-based research is founded, this study followed predominantly the logic of the Austrian School of Economics which considers innovation as a systemic phenomenon driven by the entrepreneur and the firm's interaction behaviour, highly influenced by the external environment and by the changes in the economic scenario. Since this model defends that innovation is an economic phenomenon, but highly influenced by human actions, the role of the firm's interaction linkages are considered relevant to the development of its innovation activities

As innovation is a systemic and multifaceted phenomenon, a single study does not seem to cover all aspects involved with innovation. So, while there are many important issues to be covered, this thesis focused on one aspect only: the examination of the relationship between firm's interaction behaviour and its innovation activities under a geographic proximity context, more specifically interaction behaviours of firms within particular spatial agglomerations and the impact on firm's innovation activities. So, to accomplish this task, several studies on innovation from three specific areas such as business management, economic geography and sociology were reviewed to confirm (or not) the existence of such relationship and to determine whether innovation might be associated to local or non-local interactions.

Specific literature on economic innovation and economic geographic, most of them based on studies performed in early 1990's, presented evidence that this relationship (not causality) exists, in particular, within a geographic proximity circumstance; but there does not appear to be enough significant evidence about what is the effective impact these interactions have on the firm's interaction activities and the association of innovation to local or non-local interactions. Some authors, even from different areas, such as Porter (1998a) argued that geographic proximity stimulates the process of interaction between firms leading to the increase of firm's innovation activities. Thus, to understand whether innovation might be associated to local or non-local interactions, this researcher decided to investigate the interaction behaviour of clustered firms in the technology sector in Brazil.

In fact, the central question of this study merits attention: the important role of local interactions on the development of innovation. Here the consequences may lead to false conclusions about the importance of local interactions (interactions at the local level are sufficient enough to have an effective impact on firm's innovativeness) and therefore the argument that firms within clusters is more likely to be innovative due to the geographic proximity of members. Not surprisingly, with the advance and development of new information and communication technologies, virtual business and social networks and the globalization phenomenon, it is suspected that organizations' behaviour, as far as interactions are concerned, have changed (Svetina and Prodan,

2008). These new factors have allowed firms to access more easily an infinite number of sources of knowledge and information able to impact innovation regardless of whether they are physically close or not.

Pragmatically, to perform this study, this researcher investigated micro and small firms in the technology sector in Brazil. The choice for Brazil was motivated in essence by the fact that since 1998, according to PINTEC surveys, the average rate of innovation in the country has grown modestly, from 31.5% in 2000 to 38.6% in 2008, in spite of efforts undertaken by the Brazilian government at all levels (local, state and federal), entrepreneurs and other institutions to support firms to increase innovation activities. According to PINTEC survey, 2008 version, the innovation rate for small enterprises (37.1%) is still lower than the country's average of 38.6% which suggests that something needs to be done in order to improve that figure.

Two locations (Recife and Campinas) were selected to represent the sample population for this investigation. The reason for choosing these two locations was the fact that two of the most advanced technology centres in Brazil (Porto Digital in Recife and the Technology Pole in Campinas) are located here in these cities. They are also recognized internationally as niches of excellence in technology.

To collect the data for this investigation, this researcher adopted the survey interview strategy with administration of a structured closed-ended questionnaire. Thirty two entrepreneurs and senior executives were interviewed. The survey strategy seemed to be the most suitable choice to approach the research problem and to attend the research objectives. Methodologically, surveys seemed to attend the basic premises and methods adopted in this research process, such as: i) this research was framed within the phenomenological paradigm; ii) "intensive" form of research design; iii) it is a qualitative research; iv) explanatory study mainly; v) using an inductive method of reasoning and vi) regarding time perspective, it is a cross-sectional study.

To analyze the gathered data, the most sensitive and complex part of any thesis, this researcher adopted the grounded analysis method which seemed to be more appropriate to qualitative and inductive thinking research. The grounded analysis method searches for the understanding of the context and allows the data collection through the use of a variety of methods. At last, to present the data, this researcher decided to use two approaches: numerical format and tables, in order to emphasize percentages, proportions, frequency and distributions of the empirical evidence. Also, some transcripts of respondents' comments were used to emphasize or illustrate some important points during the findings chapter.

7.2 Research findings and the research problem

In the Findings Chapter, this researcher described the results of the investigation. In the current section, this researcher describes the main set of evidence comprising the interaction behaviour and innovation performance of firms which address the research problem and facilitate the answer of the research question ("In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?"). Besides, additional information such as the identification of problems hampering interaction and innovation processes, entrepreneurs' perceptions about the importance of networking, business arrangements and innovation agents for innovation activities are also given to complement the picture of the environment which this study is embedded.

This survey-based study comprised the investigation of 32 micro and small sized technology-based firms in Brazil, located in two distinct regions with different levels of economic development. The distribution of the population surveyed presented interesting characteristics: 56% of firms surveyed were micro and 44% were small sized firms and among them, 50% were star-ups and 50% were mature firms. Overall, the majority of startup firms were micro (67%) and ii) the majority of mature firms were small enterprises (61%). As far as entrepreneurs' profiles are concerned, the empirical evidence showed that entrepreneurs in both locations have similar profiles: relatively

young, well educated and almost 40% of them dedicate 50% or more of their time to entrepreneurial activities. In detail, the results showed that: i) the majority of entrepreneurs were aged between 31-50 years old, ii) highly specialized and educated and iii) on average, 38% of the entrepreneurs dedicated 50% or more of their time to entrepreneurial activities. This means that the great majority of respondents (62%) spend most of their working time on activities which are not directly linked to innovation. It is possible that in practice the differences in profiles and characteristics across firms in different locations and size of the sample population are not large enough to allow generalizations; but the results of the investigation did not present any apparent deviations or discrepancies, which can compromise the consistency of this study.

Regarding overall firms' interaction behaviour, the research findings showed that interaction is at the source of the innovation phenomenon. The direct link comes from the fact that, according to this study, the totality of firms experienced interactions with internal and/or external partners to the clusters as well as they were engaged in innovation activities and therefore highly innovative. As far as the importance of networking is concerned, interviewees considered networking essentially important to the development of innovation activities. So, as with this study successfully showed the links between interaction with innovation, this researcher presents then a prospective argument: innovation is indeed an interactive phenomenon, and interactions, in turn, are bridges of access to innovation sources and therefore very important to the development of innovation activities.

In detail, another set of data showed that firms interacted with partners inside and outside the clusters and were very flexible in developing different types of innovation (apparently, one type of innovation never comes alone) with different partners within and external to the cluster borders.

Regarding interactions within the clusters only, five firms did not report any interaction experience within the business arrangement, however, they were highly innovative

anyway. For those firms which experienced interactions within the clusters, on average, the nature of interactions was between superficial and intermediary and happened occasionally. In fact, most of the innovation partners are located outside the clusters and the intensity of interactions with internal partners was lower if compared to external partners.

Additionally, this set of data also revealed the important role of the spatial agglomerations to the development of firm's innovation activities. The majority of respondents recognized advantages in belonging to business arrangements. Surprisingly, these advantages were not related to the facilitation of collaborative interactions between members or the intensification of knowledge and information flows; but related to marketing and economic factors. Some emphasized advantages related to the positive image and reputation of technology leadership of business arrangements; others cited fiscal and tax incentive policies as the main motivations to belong to a certain cluster.

Even though the evidence revealed that spatial agglomerations are not the main locus for sources of innovation and did not seem to be vital to the development of firm's innovation activities, the role of the clusters are still relevant, especially for micro and small sized firms, to remove barriers to innovation. Clusters generate important benefits and competitive advantages through many mechanisms such as the facilitation to government financing and funding programs, fiscal and tax incentives, availability of skilled labour force as well as to provide a good reputation in technological excellence.

7.3 Answering the main research question

To address any phenomenon, the starting point is the elaboration of the research question(s); so, the way a researcher goes through to elaborate it, depends on how he/she thinks about the development of knowledge (Saunders, Lewis and Thornhill, 2003) and how he/she perceives the phenomenon to be researched. Thus, answering the research questions (RQ) properly is a complex task and involves some steps. One of the steps is to define how the researcher will collect the data so that he/she can answer the question(s). At this stage, the process is not merely a matter of collecting data, but it is about how the researcher organizes, analyses, interprets and presents the gathered data.

The first aspect related to the context of the current RQ is to understand how entrepreneurs perceive networking. This willingness to interact is an important element of the process of reaching external sources of innovation. In this aspect, the interviewees reacted positively. According to the research findings, the great majority of respondents agreed that networking is essentially important to the development of innovation. They not only perceived networking as of high importance to innovation as they actually use to interact intensively.

Given this context, the research investigated the geographic dimension in which these interactions were experienced. The findings on this question showed two scenarios: a) twenty seven firms experienced interactions within the clusters and b) five firms did not report any interaction experience within the clusters. For the twenty seven firms which did experience interactions within clusters, all of them were also engaged in innovation and four (80%) out of five firms which did not report any interaction experience with innovation partners inside the clusters were also engaged in innovation activities. The analysis indicates that even firms which did not experience interactions within clusters they can still be innovative (see Figure 6.1).

Secondly, the investigation also produced evidence showing that those interactions within the clusters were mostly superficial or informal in nature and happened occasionally. "Superficial or informal" interactions are those related to a non-formal contact with predominance of tacit and low relevance information not able to effectively impact the development of firm's innovation activities. Additionally, empirical evidence showed that the main innovation partners were those identified as "market players" (i.e. suppliers in general, clients and customers, competitors and other enterprises in your sector and consultants) and were mostly located outside of the cluster borders. At last, evidence showed that firms used to interact mostly with external partners to the clusters than with internal ones.

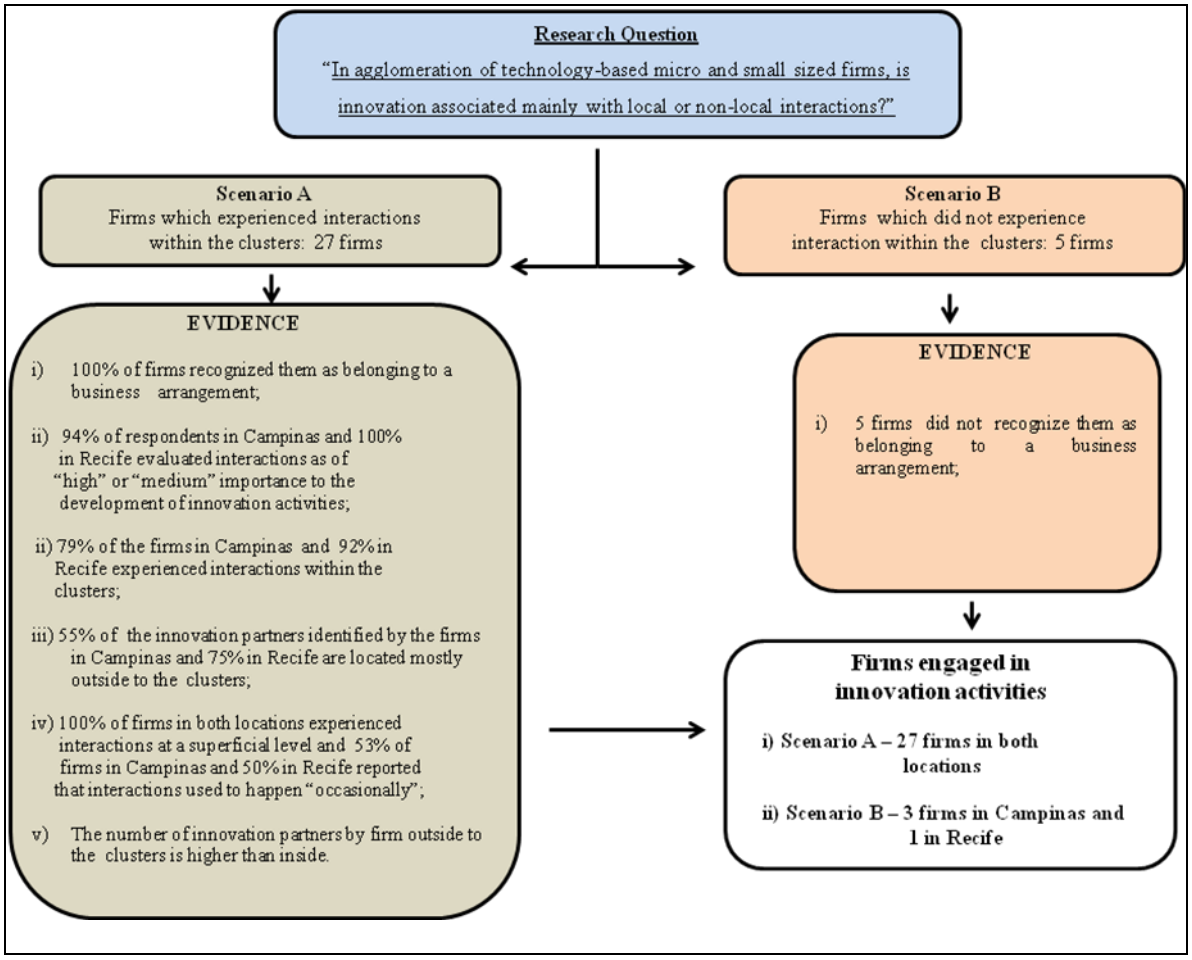

Figure 6.1 Research Findings and Research Question Diagram [Source: current research]

The set of evidence seems to suggest that interactions in general are of high importance to innovation. These empirical findings suggest that interactions within the clusters are also essential to the development of some firms' innovation activities, even though there seemed to be a tendency that these alone are not sufficient to guarantee an efficient level of innovation among firms.

This conclusion is based on a set of evidence which showed that the level of interactivity and quality of interactions within cluster borders are relatively modest to have an effective impact alone on firms' development of innovation. The majority of firms which experienced interactions within clusters reported that they were mostly "superficial or informal" in nature and happened occasionally. Also, most of the innovation partners are external to the clusters and the intensity of interactions with this type of partner was higher than with internal partners. At last, to sustain the argument that local interactions are relatively modest and have low effectiveness to impact innovation, the evidence showed that among the five firms which did not report any interaction experience within clusters, four (80%) were engaged in innovation activities anyway. This evidence demonstrated that for at least four firms, the fact that they did not experience local interactions did not make any difference.

Thus, it is fair to say that given the theoretical and conceptual frameworks and based on the analysis of the empirical evidence, the answer of the research question of "In agglomeration of technology-based micro and small sized firms, is innovation associated mainly with local or non-local interactions?" fits with the Svetina and Prodan's (2008) argument that geographic proximity alone cannot guarantee success in innovation and if firms want to succeed in the innovation race, they need to search for innovation sources with no regard to its location. So, it is clear that despite the fact that the environment of the clusters surveyed seemed to be dynamic with strong evidence of a vibrant local buzz; the clustered firms seemed to prioritize external linkages through the opening of new channels of communication rather than expecting substantial results from the local buzz. From the research findings and under this specific context, this researcher suggests that there is a tendency for innovation to be associated increasingly with non-local interactions rather than local ones alone.

7.4 Conclusions

Following the arguments posed to answer the research questions, the next paragraphs present the conclusions of this study drawn from the set of research evidence and analysis of the results presented in the Findings, Chapter 5.

In the literature review, two theoretical discussions were presented to explain the relationship between firm's interaction behaviour and innovation. In both cases, these groups agreed that innovation is an interactive phenomenon, but they defend view points from different perspectives: firstly, there are authors that defend the idea that to succeed, firms have to network and collaborate for the improvement of firm's innovation capabilities, but recognize that interactions are not limited to the local level only and to succeed in the innovation race, firms must search for innovation sources regardless of whether they are geographically close or not. The second group of authors argue that innovation is facilitated by locational factors and defend that spatial business agglomerations provide the ideal environment able to foster innovation due to the increase of local interactions favoured by the geographic proximity of firms (local interaction-based approach).

In essence, the current research problem approached exactly this issue and the analysis of the set of evidence suggests that the development of innovation for micro and small clustered firms in the technology sector in Brazil is not a solitary phenomenon restricted to the firm itself. In fact, it is a combination of various interaction linkages within and outside the business arrangements where geographic distance alone does not seem to be a problem. This network of internal and external linkages determines the development of innovation, affecting the level of firm's innovation performance. This general conclusion suggests that innovation is indeed an interactive phenomenon and there is a close relation between the frequency, nature and intensity of interactions and the firm's development of innovation. Thus, it is reasonable to affirm that interactions in general effectively have an impact on firm's innovativeness and can change or decisively influence the final innovation output. Considering specific sorts of interactions such as

those among clustered members, according to the analysis of the whole range of evidence, it is possible to suggest that this sort of interaction may be considered important to innovation; however, it does not imply that the local interactions are sufficient in terms of innovation. Firms need to access important innovation sources with no regard to their geographical origins.

Overall, this study suggests that the fact that firms are geographically close in the same local business arrangement, does not seem to have any effective impact on firms' development of innovation. Even existing literature explores the benefits of clusters in helping firms to remove barriers to innovation such as the difficulty to achieve economy of scale. According to the findings, the geographic scope of the network of relationships for innovation activities spread across the cluster, regional and national borders. In fact, the level of interactivity is not determined by geographic proximity, but by the quality and perception of gains or benefits of innovation sources, regardless of whether they are close or geographically distant from the firms. Geographic proximity fosters the creation of trustful environments, but does not necessarily generate useful information able to impact the development of innovation. By contrast, long distance relationships, usually weak ties, seem to facilitate the circulation of important information and knowledge able to influence innovation.

This study, however, does not neglect the overall importance of local interactions and spatial agglomerations to the development of innovation activities; on the contrary, this researcher believes that they are essential to the development of innovation initiatives, especially for micro and small sized firms. What this researcher does not suggest, based on the research's evidence, is that to firms located in spatial arrangements, the advantages are no longer the geographic proximity only, but the fact that these arrangements attract a skilled labour force and other important innovation agents such as universities and research centres; it usually offers special fiscal and tax incentives policies, modern infrastructure and marketing advantages such as positive image and reputation of niche of excellence in certain areas which can be translated into competitive advantages. Thus, it would be wiser for clustered firms to consider the

possibility to invest in the development new pipelines rather than to expect substantial results from the local buzz only.

7.5 Implications, strengths, limitations and future studies

The final outcome of the current research generated a piece of work which affects many areas with distinct implications. These areas are mainly: the academic, business management and public policies areas; the latter also related to the local and regional development.

In the academic area, this study aims to stimulate new debates on innovation; in particular, discussions on the role of geographic proximity as a competitive advantage, leading to the increase of firms' innovation activities, the importance of spatial arrangements to the improvement of competitiveness through innovation as well as the specific discussion of the innovation phenomenon among micro and small sized firms.

From the business management perspective, this investigation revealed that innovation seems to be an interactive phenomenon, therefore, firms need to interact to succeed and the interactions may not be limited to the local level. It is expected that entrepreneurs and decision-makers in general as well as managers who run business incubators or clusters may not have unrealistic expectations of local interactions to stimulate innovation or to worry if firms do not develop joint ventures, formal alliances or collaboration linkages locally. On the contrary, it might be more valuable to invest in marketing strategies to enhance the image of the business arrangement or to come together at trade fairs, exhibitions or conferences. Indeed, firms need to reach innovation sources with no regard to their location. Also, as far as local interactions are concerned, the findings showed that per se they do not guarantee any competitive advantage. So, in the present globalizing economy, business people (entrepreneurs and managers) need to develop connections able to reach new innovation sources.

From the public policy perspective, this study aims to stimulate new local and regional policies focused on fostering innovation initiatives through the creation of local innovation systems with favourable conditions to innovation. These conditions are mainly related to infrastructure, public funding and financing, fiscal and tax incentives policies and formation of skilled labour force. Of course, high innovation rates leads to the acceleration of the local and regional economic development. The inevitable effect is the increasing role of government actions in stimulating innovation initiatives. The growth of the state intervention on innovation has created a mind-set where the state alone is expected to be responsible for providing enough stimuli to its firms to innovate. The fear of the absence of government and institutional support particularly in countries with low level of innovation rate has become a major source of worry.

As the theme of innovation is very extensive and complex, it may surf from business management, economics to sociology fields. Thus, it is almost impossible to cover all aspects pertaining to this area in the same research. In this context, any research project presents strengths and limitations that need to be taken into consideration. Limitations do not mean weak points, but presents fruitful opportunities for future studies. Strengths, on the other hand, are important examples to be followed for other researchers in future investigations under the same theme.

One of the major strengths of this study is the diversity of respondents' profiles. There are firms from different sizes (micro and small sized firms), different corporate maturity stages (start-up and mature firms) as well as different natures (incubated and regular firms). In Campinas, for example, the majority of firms are start-up and in Recife, mature firms. In Campinas, the majority of firms are incubated and in Recife, regular firms. In Campinas, the majority of firms are micro and in Recife, small firms. This diversity assures that the current research covered a wide range of firms' characteristics and profiles yielding robust conclusions.

The research's strengths can also be associated to uniqueness and exclusivity. In this case, the fact that this investigation was performed in Brazil and based on micro and small firms solely, are strong aspects of this study. Even though the country is one of the top ten economies in the world, very few studies in the existing literature approached the innovation phenomenon in developing economies such as Brazil. As far as this researcher can ascertain, the combination of elements such as micro and small sized firms within the same economic sector (technology-based sector) and located in two distinct regions with different stages of economic development has not been presented in any previous study in this area.

As regards limitations, this researcher presents three main limitations as follows: firstly, the current research was studied from a rather narrow empirical perspective. While efforts were made to include a larger sample population, the decision to approach one single country, two locations, one economic sector (technology sector) and one class of economic actors (micro and small enterprises- 50 or less employees), naturally brings forth some limitations. Confining the study to these circumstances, are significant limitations as far as the generalisation of the conclusions of this study is concerned. To include other countries, locations, economic segments and classes of economic actors clearly represents one of the major challenges for future studies in this area. A multiple location study design would enable more robust conclusions.

Secondly, time perspective is presented as another limitation. This study adopted the cross sectional approach to gather data due to characteristics and nature of the phenomenon researched (innovation), the research question and objectives as well as the fact that academic projects are usually time and resource constrained. A cross sectional approach involves observation of a certain population at a defined time. Innovation, however, seems to be a sort of phenomenon in which defined time strategy may not be sufficient to reflect the real picture. Also, theoretical considerations indicate that innovation comes in waves and ideally, information on innovation activities should be carried out continuously (OECD/EUROSTAT, 2005). Just to illustrate, in this particular study, some firms reported that there were some innovations in progress and therefore not fully implemented which corroborates with the theory that the time perspective for

innovation projects needs to be enlarged. Moreover, presumably, during the period of development of innovation activities, other interaction linkages can be experienced and the map of interaction partners may change.

In this sense, for future studies, this researcher recommends that a longitudinal approach would better evaluate the real impact interactions have on the development of firm's innovation activities. A longitudinal study involves multiple observations during long periods of time and allows the investigator to understand the various stages of the development of innovation and to detect whether innovation sources and partners vary according to each phase. However, this limitation does not represent any threat to this study or to the conclusions of this study.

At last, this researcher describes the third apparent limitation of this study: the investigation was focused on firm's innovation process as a whole rather than on innovation projects individually; but why is this a limitation? The empirical evidence showed that firms interact with different innovation partners because they also develop different types of innovation (i.e. product/service, process or organizational/marketing) at the same time.

During the investigation, this researcher noticed that each individual innovation project may present its own dynamics and create its own network of interaction linkages. Therefore, this new approach can allow researchers to examine innovation projects individually, identifying specific impacts interactions or other innovation inputs have on the development of specific innovation projects. For future studies, whenever possible, investigations should focus on types of innovation projects inside organizations, ranging from conception to full implementation and commercialization.

Finally, in the course of this research, many questions emerged such as "how to connect different authors from different theoretical approaches under the same "umbrella" of innovation?"; "is the current research predominately a business management study or an

economic geography piece of work too?" or "does the world need yet another thesis on innovation?", but the efforts were always in the direction to answer all questions, even many are still open, stimulating the sense of constant search for new knowledge and information.

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SURVEY QUESTIONNAIRE

NR. ☐

INTRODUCTION

This survey collects information about innovation activities and interaction behaviour during the period of 2007 and 2008. Innovation activities include new or significantly improved products, processes, marketing and any organization methods implemented by the firms during the surveyed period. Data from the survey are essential to the accomplishment of the Ph.D. research " Do business interactions within a geographic proximity context still matter for innovation? A Brazilian case" carried out by Paulo Melo, WIT Ph.D. student, under the supervision of Dr. Bill O'Gorman.

The information provided will be treated as **strictly confidential** in accordance with Irish, EU and Brazilian laws. It will be used **only** for the purpose of this research.

Thank you in advance for participating in this survey.

Thank you very much

Paulo Melo
Researcher

Dr. William O'Gorman
Supervisor

1. GENERAL INFORMATION ABOUT THE ENTERPRISE

1.1 Company's name:

1.1.1 Respondent's Name:

1.1.2 Respondent's Email:

1.2 Address:

☐ Brazil

1.3 City: 1.4 Country: ☐ Ireland

1.5 Website:

1.6 Year started the operation: 1.7 No. Employees (by the end of 2008)

1.8 Please describe briefly your main economic activity (Product / Service)

2. PRODUCT INNOVATION (GOOD OR SERVICE)

A product innovation is the market introduction of a **new** or **significantly** improved good or service with respect to its capabilities, such as software, user friendliness, components or sub-systems. The innovation must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprise.

2.1 During the years 2007 and 2008, did your enterprise introduce any new or significantly improved goods or service?

☐ YES ☐ NO ☐ Innovation in progress (Ongoing innovation)

Please, describe briefly this product innovation

If **NO** to 2.1 go to Section 3

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

☐ Mainly your enterprise

☐ Mainly your enterprise group

☐ Your enterprise together with other enterprise

☐ Mainly other enterprise

☐ Your enterprise together with third level institution (e.g. university or research centre)

☐ Mainly a third level institution

☐ Your enterprise together with government agency or public institution

☐ Mainly a government agency or public institution

2.3 Were any goods or service innovations during 2007 and 2008:

New to your market ☐ YES ☐ NO

It may have already been available in other markets

New to your firm ☐ YES ☐ NO

It may have already been available from your competitors

2.4 In terms of technical aspects, were any goods or service innovations:

☐ Improvement of an existing good or service

☐ Completely new good or service to your enterprise

3. PROCESS INNOVATION

A process innovation is the implementation of a **new** or **significantly** improved production process, distribution method or support activities for your goods or services. The innovation (new or improved) is new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises. Exclude purely organizational innovations.

3.1 During the years 2007 and 2008 (inclusive), did your enterprise introduce any process innovation?

☐ YES ☐ NO ☐ Innovation in progress (Ongoing innovation)

Please, describe briefly this process innovation

If **NO** to 3.1 go to section 4

3.2 Was this process innovation: (please select the most appropriate)

☐ Methods of manufacturing or producing goods or service

☐ Logistics, delivery or distribution methods for your inputs.

☐ Supporting activities (maintenance system, operation for purchasing, accounting or computing)

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

☐ Mainly your enterprise

☐ Mainly your enterprise group

☐ Your enterprise together with other enterprise

☐ Mainly other enterprise

☐ Your enterprise together with third level institution (e.g. university or research centre)

☐ Mainly a third level institution

☐ Your enterprise together with government agency or public institution

☐ Mainly a government agency or public institution

3.4 Were these process innovations:

New to your market ☐ YES ☐ NO

It may have already been available in other markets

New to your firm ☐ YES ☐ NO

It may have already been available from your competitors

4. ORGANIZATIONAL AND MARKETING INNOVATION

An organizational and marketing innovation are **the implementation of new or significant** changes in firms' structure, management or marketing methods that are intended to improve your firm use of knowledge, the quality of your goods and services, product design, distribution, pricing, product promotion or the efficiency of work flows.

4.1 During the years 2007 and 2008 (inclusive), did your enterprise introduce any organizational innovation?

☐ YES ☐ NO ☐ Innovation in progress (Ongoing innovation)

Please, describe briefly this organizational innovation

If **NO** to 4.1 go to Section 5

4.2 Were this organizational and marketing innovation (Please select the most appropriate)

New business practices for organizing work or procedures ☐

New knowledge management systems ☐

New methods of workplace organization ☐

New methods of organizing external relations ☐

Implementation of significant changes in the organizational structure ☐

Implementation of significant changes or new methods in the Marketing strategy ☐

4.3 Who developed these organizational innovations? (Select the most appropriate option only)

☐ Mainly your enterprise

☐ Mainly your enterprise group

☐ Your enterprise together with other enterprise

☐ Mainly other enterprise

☐ Your enterprise together with third level institution (e.g. university or research centre)

☐ Mainly a third level institution

☐ Your enterprise together with government agency or public institution

☐ Mainly a government agency or public institution

5. FACTORS HAMPERING INNOVATION ACTIVITIES

For firms which developed any innovation activities

5.1 During the years 2007 and 2008(inclusive), did your firm have difficulties or obstacles to implement any of innovation activities?

☐ YES ☐ NO

If **YES** go to 5.3

If you answer NO to question 5.1, please answer question 5.2 and 5.3

5.2 What were the reasons for not developing any innovation activities during the period?

☐ 1. Innovation activities were introduced before 2007-2008 - no need for further change

☐ 2. No need for change due to market conditions (no demand for innovations)

☐ 3. Other factors hampered the development and implementation of innovation activities

5.3 How would you rate the following issues in terms of problems they may pose to the development of innovation activities?

	A major problem	A bit of a problem	Not a problem at all
1 Lack of funds	☐	☐	☐
2 Lack of finance	☐	☐	☐
3 Innovation costs too high	☐	☐	☐
4 Lack of qualified personnel	☐	☐	☐
5 Lack of information on Technology	☐	☐	☐
6 Lack of information on markets	☐	☐	☐
7 Difficulty in finding cooperation Partners for innovation	☐	☐	☐
8 Market dominated by established enterprises	☐	☐	☐
9 Uncertain demand for Innovative goods or services	☐	☐	☐

10 Need to meet regulations and norms	☐	☐	☐
11 Excessive perceived economic risks	☐	☐	☐
12 Organizational rigidity	☐	☐	☐
13 Resistance of staff / personnel to innovation	☐	☐	☐
14 Other	☐	☐	☐

☐

6. CO-OPERATION FOR INNOVATION ACTIVITIES

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.

6.1 During the years 2007 and 2008, did your enterprise co-operate on any of your innovation activities with other enterprises or institutions?

☐ YES ☐ NO

If **NO** go to section 7

6.2 Please indicate the type of co-operation partners and location (tick all that apply)

Locations:

1. In the cluster (1)
2. Elsewhere in the city
3. In another part of the region
4. Another region
5. Foreign country

Type of co-operation partners:	LOCATIONS 1	2	3	4	5
1 Other enterprises within your enterprise group	☐	☐	☐	☐	☐
2 Suppliers in general	☐	☐	☐	☐	☐
3 Clients and customers	☐	☐	☐	☐	☐
4 Competitors or other enterprises in your sector	☐	☐	☐	☐	☐
5 Consultants	☐	☐	☐	☐	☐
6 Universities or other higher education institutions	☐	☐	☐	☐	☐
7 Commercial labs or private R&D institutes	☐	☐	☐	☐	☐
8 Government agencies or public research institutes	☐	☐	☐	☐	☐

(1) Cluster is a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions.

7 NETWORKING FOR INNOVATION ACTIVITIES

Networking is the capacity of individuals and/or organizations to collaborate and co-operate in a process of exchanging information, skills, equipments and competencies for mutual benefit.
Business network is any group of firms, who agree to co-operate in certain activities for mutual benefits.

7.1 Does your enterprise belong to any business network arrangement?

☐ YES ☐ NO

If **NO,** please DO NOT answer questions: 7.3, 7.4, 7.5, 7.6 and 7.7 ONLY.

7.2 According to your own experience, do you perceive any advantage as far as innovation is concerned belonging to a business network arrangement?

☐ YES ☐ NO

7.3 Does the business network arrangement your enterprise belongs to, facilitate interactions among members?

☐ YES ☐ NO

7.4 What nature of business interactions has your enterprise experienced in this business network arrangement?

☐ 1. Exchanging ideas and information

☐ 2. Joint projects (including R&D)

☐ 3. Sharing equipment, machinery and software

☐ 4. Training

☐ 5. Exchanging technologies and know-how

6. Other (specify): _____

7.5 What is the frequency of those business interactions?

Regular	Occasional	Rare	Not applied
☐	☐	☐	☐

7.6 How significant is this networking to the development of innovation activities in your enterprise? (Degree of importance)
(Degree of importance)

High	Medium	Low	None
☐	☐	☐	☐

7.7 Indicate the type of interaction partners and location (tick all that apply)

Locations:

1. In the cluster (1)
2. Elsewhere in the city
3. In another part of the region
4. Another region
5. Foreign country

Type of interaction partners	LOCATIONS 1	2	3	4	5
1 Other enterprises within your enterprise group	☐	☐	☐	☐	☐
2 Suppliers in general	☐	☐	☐	☐	☐
3 Clients and customers	☐	☐	☐	☐	☐
4 Competitors or other enterprises in your sector	☐	☐	☐	☐	☐
5 Consultants	☐	☐	☐	☐	☐
6 Universities or other higher education institutions	☐	☐	☐	☐	☐
7 Commercial labs or private R&D institutes	☐	☐	☐	☐	☐
8 Government agencies or public research institutes	☐	☐	☐	☐	☐

(1)Cluster is a form of network that occurs within a geographic location, in which the proximity of firms and institutions ensures certain forms of commonality and increases the frequency and impact of interactions. (Porter, 1998)

7.8 How would you rate the following issues in terms of problems they may pose to the development of business interactions?

	A major problem	A bit of a problem	Not a problem at all
1 Lack of trust	☐	☐	☐
2 Personal resistances to network	☐	☐	☐
3 Organizational culture	☐	☐	☐
4 Competitive sector	☐	☐	☐
5 Lack of a network facilitator	☐	☐	☐
6 Lack of face-to-face Interactions	☐	☐	☐
7 Lack of personal relationship	☐	☐	☐
8 Lack of channels of communication	☐	☐	☐
9 Other	☐	☐	☐

7.9 How important is the contribution of the following institutions below to the success of innovation activities in your enterprise?

	DEGREE OF IMPORTANCE			
	High	**Medium**	**Low**	**Not relevant**
Universities or other higher education institutions	☐	☐	☐	☐
Private research institutes	☐	☐	☐	☐
Public research institutes	☐	☐	☐	☐
Government agencies	☐	☐	☐	☐
Private financial institutions	☐	☐	☐	☐
Public financial institutions	☐	☐	☐	☐
Business network organization	☐	☐	☐	☐
Other Institutions: ☐	☐	☐	☐	☐

8. ADDITIONAL INFORMATION
It would be very helpful to answer the questions below.

8.1 Respondent's position in the enterprise

☐ Owner ☐ Manager ☐ Other ☐

If the respondent is the owner answer questions 8.2, 8.3, 8.4 and 8.5 **only**
If the respondent is not the owner, please answer all questions

8.2 Estimate how much of your working time you spend on:

	Up to 50%	Over 50%
Managerial activities	☐	☐
Entrepreneurial activities	☐	☐

8.3 Owner's education level (qualification) (Tick all which describes your education level)

☐ Primary level ☐ Secondary level ☐ Tertiary level (Degree)

☐ Diploma ☐ Master ☐ Ph.D. If **no** to Third-level education go To question 2.6

8.4 Owner's bachelor degree in: ☐

8.5 Owner's age

☐ 20-30 ☐ 31-40 ☐ 41-50 ☐ over 50

8.6 Respondent's education level (Tick all which describes your education level)

☐ Primary level ☐ Secondary level ☐ Tertiary level (Degree)

☐ Diploma ☐ Master ☐ Ph.D. If **no** to third level education go to 2.8

8.7 Respondent's bachelor degree in:

8.8 Respondent's age

☐ 20-30 ☐ 31-40 ☐ 41-50 ☐ over 50

OBSERVATIONS

Questionário da Pesquisa de Inovação Tecnológica 2005

IBGE
Instituto Brasileiro de Geografia e Estatística

Diretoria de Pesquisas
Coordenação de Indústria

PESQUISA DE INOVAÇÃO TECNOLÓGICA 2005

PROPÓSITO DA PESQUISA - As informações fornecidas por sua empresa são essenciais para o conhecimento das atividades tecnológicas da indústria e dos serviços de telecomunicações, informática e pesquisa e desenvolvimento brasileiros. Os resultados agregados da pesquisa poderão ser usados pelas empresas para análise de mercado, pelas associações de classe para estudos sobre desempenho e outras características de seus setores, e pelo governo para desenvolver políticas nacionais e regionais.

OBRIGATORIEDADE E SIGILO DAS INFORMAÇÕES - A legislação vigente mantém o caráter obrigatório e confidencial atribuído às informações coletadas pelo IBGE, as quais se destinam, exclusivamente, a fins estatísticos e não poderão ser objeto de certidão e nem terão eficácia jurídica como meio de prova.

O TERMO PRODUTO, neste questionário, se utiliza para designar tanto **bens** como **serviços**.

O IBGE AGRADECE A SUA COLABORAÇÃO

Identificação do questionário

01 - Código do entrevistador:

02 - Data da coleta: ___/___/_____

Identificação da empresa

01 - CNPJ: ________/____-___

02 - RAZÃO SOCIAL:

03 - UNIDADE DA FEDERAÇÃO: ___

04 - MUNICÍPIO:

Informações adicionais

01 - Nome do entrevistado:

02 - Cargo do entrevistado:

03 - Telefone do entrevistado: ___/_____

04 - E-mail do entrevistado:

05 - Ano de início de operação: ____

Situação de coleta

___

01 - Em operação / em implantação

02 - Extinta / paralisada com informação

03 - Extinta / paralisada sem informação

04 - Extinta até dezembro de 2004, por fusão total, cisão total ou incorporação

05 - Não exerce atividade no âmbito da pesquisa

06 - Mudança para endereço ignorado ou endereço inexistente

07 - Impossibilitada de prestar informações

08 - Recusa total

Mudança estrutural

___

01 - Fusão ou cisão total

02 - Cisão parcial

03 - Incorporação de/por outra empresa

04 - Alteração de CNPJ por motivos distintos dos anteriores. Justificar no campo de Observações

05 - Não houve mudança

Caso tenha ocorrido mudança estrutural, informe os CNPJs das empresas envolvidas.
CNPJ de ligação da empresa:

________/____-___

________/____-___

________/____-___

Questionário da Pesquisa de Inovação Tecnológica 2005

Características da empresa

A unidade de investigação da pesquisa é a **empresa**, definida como sendo a unidade jurídica caracterizada por uma firma ou razão social, que engloba o conjunto de atividades econômicas exercidas em uma ou mais unidades locais e que responde pelo capital investido nestas atividades.

Capital controlador é aquele que é titular de uma participação no capital social que lhe assegura a maioria dos votos e que, portanto, possui direitos permanentes de eleger os administradores e de preponderar nas deliberações sociais, ainda que não exerça este direito, ausentando-se das assembléias ou nelas se abstendo de votar.

Origem do capital controlador - O capital controlador é nacional quando está sob titularidade direta ou indireta de pessoas físicas ou jurídicas residentes e domiciliadas no país. O capital controlador é estrangeiro quando está sob titularidade direta ou indireta de pessoas físicas ou jurídicas domiciliadas fora do país.

1 - Origem do capital controlador da empresa:

1 Nacional 2 Estrangeiro 3 Nacional e Estrangeiro

2 - No caso do capital controlador estrangeiro, qual a sua localização?

1 Mercosul 4 Outros países da América 7 Oceania ou África

2 Estados Unidos 5 Ásia

3 Canadá e México 6 Europa

Empresa **controladora** - é aquela que exerce, direta ou indiretamente, o poder (exercido nas três últimas assembléias ordinárias) de eleger a maioria dos administradores e de preponderar nas deliberações sociais de outra (s) sociedade (s).

Empresa **controlada** - é aquela na qual a controladora, possui, direta ou indiretamente (por meio de outra controlada), condição considerada permanente de eleger a maioria dos administradores e de preponderar nas deliberações sociais.

Empresa **coligada** - é aquela na qual a investidora participa com pelo menos 10% do seu capital, sem controlá-la.

3 - Sua empresa é:

1 Independente 2 Parte de um grupo

4 - Qual a sua relação com o grupo?

1 Controladora 2 Controlada 3 Coligada

5 - Qual o principal mercado da empresa entre **2003** e **2005**?

1 Estadual 4 Mercosul 7 Outros Países

2 Regional 5 Estados Unidos

3 Nacional 6 Europa

6 - Breve descrição do produto (bem ou serviço) mais importante da sua empresa em termos de faturamento:

7 - Assinale o tempo que o produto (bem ou serviço) mais importante da empresa permanece no mercado com as mesmas especificações, ou seja, até que o mesmo seja substituído ou substancialmente aperfeiçoado/ modificado.

1 Menos de 1 ano 3 4 a 6 anos 5 Mais de 9 anos

2 1 a 3 anos 4 7 a 9 anos 6 Impossível responder

8 - Qual era o número de pessoas ocupadas na sua empresa em **31/12/2005**?

9 - Qual a receita líquida de vendas (declarada no balanço da empresa ou no simples, se for o caso) da sua empresa no ano de **2005**?

Produtos e processos tecnologicamente novos ou substancialmente aperfeiçoados

Nesta pesquisa, uma Inovação Tecnológica é definida pela introdução no mercado de um produto (bem ou serviço) tecnologicamente novo ou substancialmente aprimorado ou pela introdução na empresa de um processo produtivo tecnologicamente novo ou substancialmente aprimorado.

A inovação tecnológica se refere a produto e/ou processo novo (ou substancialmente aprimorado) para a empresa, não sendo, necessariamente, novo para o mercado/setor de atuação, podendo ter sido desenvolvida pela empresa ou por outra empresa/instituição.

A inovação pode resultar de novos desenvolvimentos tecnológicos, de novas combinações de tecnologias existentes ou da utilização de outros conhecimentos adquiridos pela empresa.

Inovação de produto

Produto tecnologicamente novo (bem ou serviço) é um produto cujas características fundamentais (especificações técnicas, componentes e materiais, *software* incorporado, *user friendliness*, funções ou usos pretendidos) diferem significativamente de todos os produtos previamente produzidos pela empresa.

Significativo aperfeiçoamento tecnológico de produto (bem ou serviço) refere-se a um produto previamente existente, cujo desempenho foi substancialmente aumentado ou aperfeiçoado. Um produto simples pode ser aperfeiçoado (no sentido de obter um melhor desempenho ou um menor custo) através da utilização de matérias-primas ou componentes de maior rendimento. Um produto complexo, com vários componentes ou subsistemas integrados, pode ser aperfeiçoado via mudanças parciais em um dos componentes ou subsistemas. Um serviço também pode ser substancialmente aperfeiçoado por meio da adição de nova função ou de mudanças nas características de como ele é oferecido, que resultem em maior eficiência, velocidade ou facilidade de uso do produto, por exemplo.

Não são incluídas: as mudanças puramente estéticas ou de estilo e a comercialização de produtos novos integralmente desenvolvidos e produzidos por outra empresa.

10 - Entre **2003** e **2005**, a empresa introduziu produto (bem ou serviço) tecnologicamente novo ou significativamente aperfeiçoado para a empresa, mas já existente no mercado nacional?

1 Sim 2 Não

11 - Entre **2003** e **2005**, a empresa introduziu produto (bem ou serviço) tecnologicamente novo ou significativamente aperfeiçoado para o mercado nacional?

1 Sim 2 Não

12 - Descreva brevemente o principal produto (bem ou serviço) tecnologicamente novo ou substancialmente aperfeiçoado, lançado por sua empresa no mercado entre **2003** e **2005**:

13 - Este produto é:

2 Novo para a empresa, mas já existente no mercado nacional

3 Novo para o mercado nacional, mas já existente no mercado mundial

4 Novo para o mercado mundial

13.1 - Em termos técnicos este produto é:

1 Aprimoramento de um já existente

2 Completamente novo para a empresa

14 - Quem desenvolveu esta inovação e onde se localiza?

		Brasil (UF)	Exterior
1	Principalmente a empresa	☐☐	
2	Principalmente outra empresa do grupo	☐☐	☐☐
3	Principalmente a empresa em cooperação com outras empresas ou institutos	☐☐	☐☐
4	Principalmente outras empresas ou institutos	☐☐	☐☐

Inovação de processo

Processo tecnologicamente novo ou substancialmente aprimorado envolve a introdução de tecnologia de produção nova ou significativamente aperfeiçoada, assim como de métodos novos ou substancialmente aprimorados de oferta de serviços ou para manuseio e entrega de produtos. O resultado da adoção de processo tecnologicamente novo ou substancialmente aprimorado deve ser significativo em termos: do nível de produto, qualidade do produto (bem/serviço) ou custos de produção e entrega. A introdução deste processo pode ter por objetivo a produção ou entrega de produtos tecnologicamente novos ou substancialmente aprimorados, que não possam utilizar os processos previamente existentes, ou simplesmente aumentar a eficiência da produção e da entrega de produtos já existentes.

Não são incluídas: mudanças pequenas ou rotineiras nos processos produtivos existentes e mudanças puramente administrativas ou organizacionais.

16 - Entre **2003** e **2005**, a empresa introduziu processo tecnologicamente novo ou significativamente aperfeiçoado para a empresa, mas já existente no setor no Brasil?

1 Sim 2 Não

17 - Entre **2003** e **2005**, a empresa introduziu processo tecnológicamente novo ou significativamente aperfeiçoado para o setor no Brasil?

1 Sim 2 Não

18 - Descreva brevemente o principal processo tecnologicamente novo ou substancialmente aperfeiçoado introduzido por sua empresa entre **2003** e **2005**:

19 - Este processo é:

2 Novo para a empresa, mas já existente no setor no Brasil

3 Novo para o setor no Brasil, mas já existente em outro(s) país(es)

4 Novo para o setor em termos mundiais

19.1 - Em termos técnicos este processo é:

1 Aprimoramento de um já existente

2 Completamente novo para a empresa

20 - Quem desenvolveu esta inovação e onde se localiza?

		Brasil	Exterior
1	Principalmente a empresa		
2	Principalmente outra empresa do grupo		
3	Principalmente a empresa em cooperação com outras empresas ou institutos		
4	Principalmente outras empresas ou institutos		

Projetos incompletos ou abandonados

22 - No final de **2005**, a empresa tinha algum projeto ainda **incompleto** para desenvolver ou introduzir produto ou processo tecnologicamente novo ou aprimorado?

1 Sim 2 Não tinha

23 - Durante o período entre **2003** e **2005**, a empresa realizou algum projeto para desenvolver ou introduzir produto ou processo tecnologicamente novo ou aprimorado, mas que foi **abandonado?**

1 Sim 2 Não realizou

ATENÇÃO!

Caso a empresa não tenha introduzido alguma inovação de processo ou produto, não tenha algum projeto incompleto ou mesmo abandonado (respondeu NÃO nas questões 10, 11, 16, 17, 22 e 23) passe para a questão 175 "Problemas e Obstáculos à Inovação".

Caso contrário, preencha as questões a seguir.

Atividades inovativas

Atividades inovativas - são atividades representativas dos esforços da empresa voltados para a melhoria do seu acervo tecnológico e, conseqüentemente, para o desenvolvimento e implementação de produtos (bens ou serviços) ou processos tecnologicamente novos ou significativamente aperfeiçoados.

Assinale a importância das atividades desenvolvidas pela empresa, para a implementação de produtos e/ou processos novos ou significativamente aperfeiçoados, no período entre **2003** e **2005**. Informe a seguir o valor dos dispêndios relacionados às atividades inovativas desenvolvidas em **2005**.

Pesquisa e Desenvolvimento (P&D)

Compreende o trabalho criativo, empreendido de forma sistemática, com o objetivo de aumentar o acervo de conhecimentos e o uso destes conhecimentos para desenvolver novas aplicações, tais como produtos ou processos novos ou tecnologicamente aprimorados. O desenho, a construção e o teste de protótipos e de instalações piloto constituem muitas vezes a fase mais importante das atividades de P&D. Inclui também o desenvolvimento de software, desde que este envolva um avanço tecnológico ou científico.

24 - Qual a importância da atividade de P&D realizada entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

31 - Valor dos dispêndios em **2005** (R$ 1 000)

.000,00

24.1 - Descreva brevemente a atividade INTERNA de P&D realizada entre **2003** e **2005**:

Aquisição externa de Pesquisa e Desenvolvimento (P&D)
As atividades de P&D (descritas acima) realizadas por outra organização (empresas ou instituições tecnológicas) e adquiridas pela empresa.

25 - Qual a importância da aquisição externa de P&D realizada entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

32 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

25.1 - Descreva brevemente a atividade EXTERNA de P&D adquirida por sua empresa entre **2003** e **2005**:

Aquisição de outros conhecimentos externos, exclusive software
Acordos de transferência de tecnologia originados da compra de licença de direitos de exploração de patentes e uso de marcas, aquisição de *know how* e outros tipos de conhecimentos técnico-científicos de terceiros, para que a empresa desenvolva ou implemente inovações.

26 - Qual a importância da aquisição de outros conhecimentos externos realizada entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

33 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

Aquisição de software
Aquisição de software (de desenho, engenharia, de processamento e transmissão de dados, voz, gráficos, vídeos, para automatização de processos, etc.), especificamente comprados para a implementação de produtos ou processos novos ou tecnologicamente aperfeiçoados. Não incluir aqueles registrados no P&D, item 24.

26.1 - Qual a importância da aquisição de software realizada entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

33.1 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

Aquisição de máquinas e equipamentos
Aquisição de máquinas, equipamentos, hardware, especificamente comprados para a implementação de produtos ou processos novos ou tecnologicamente aperfeiçoados.

27 - Qual a importância da aquisição de máquinas e equipamentos realizada entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

34 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

Treinamento
Treinamento orientado ao desenvolvimento de produtos/processos tecnologicamente novos ou significativamente aperfeiçoados e relacionados às atividades inovativas da empresa, podendo incluir aquisição de serviços técnicos especializados externos.

28 - Qual a importância do treinamento realizado entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

35 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

Introdução das inovações tecnológicas no mercado
Atividades (internas ou externas) de comercialização, diretamente ligadas ao lançamento de um produto tecnologicamente novo ou aperfeiçoado, podendo incluir: pesquisa de mercado, teste de mercado e publicidade para o lançamento. Exclui a construção de redes de distribuição de mercado para as inovações.

29 - Qual a importância da introdução das inovações tecnológicas no mercado entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

36 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

Projeto industrial e outras preparações técnicas para a produção e distribuição

Refere-se aos procedimentos e preparações técnicas para efetivar a implementação de inovações de produto ou processo. Inclui plantas e desenhos orientados para definir procedimentos, especificações técnicas e características operacionais necessárias à implementação de inovações de processo ou de produto. Inclui mudanças nos procedimentos de produção e controle de qualidade, métodos e padrões de trabalho e software, requeridos para a implementação de produtos ou processos tecnologicamente novos ou aperfeiçoados. Assim como as atividades de tecnologia industrial básica (metrologia, normalização e avaliação de conformidade), os ensaios e testes (que não são incluídos em P&D) para registro final do produto e para o início efetivo da produção.

30 - Qual a importância do projeto industrial e outras preparações técnicas para a produção e distribuição realizada entre **2003** e **2005**?

1 Alta 2 Média 3 Baixa 4 Não desenvolveu

37 - Valor dos dispêndios em **2005** (R$ 1 000)

|_|_|_|_|_|_| .000,00

Fontes de financiamento das atividades inovativas

Distribua percentualmente o valor dos dispêndios de acordo com as fontes de financiamento utilizadas.

Fontes de financiamento	P&D (inclusive aquisição)	Outras atividades
Próprias	38 ___ %	41 ___ %
De terceiros		
Privado	39 ___ % = ___ % (39.1 Nacional) + ___ % (39.2 Estrangeiro)	42 ___ % = ___ % (42.1 Nacional) + ___ % (42.2 Estrangeiro)
Público (FINEP, BNDES, SEBRAE, BB, etc.)	40 ___ %	43 ___ %
Total	100%	100%

Atividades internas de Pesquisa e Desenvolvimento (P&D)

44 - As atividades de Pesquisa e Desenvolvimento, realizadas no período entre **2003 e 2005**, foram:

1 Contínuas 2 Ocasionais

45 - Indique a localização do Departamento de P&D da empresa ou, no caso de não haver uma unidade formal ou existir mais de uma, onde se concentram predominantemente as atividades de P&D da empresa.

Unidade da Federação: ___

Informe o número de pessoas, do quadro da empresa, normalmente ocupadas nas atividades de P&D em **2005**, segundo o nível de qualificação e o tempo de dedicação a estas atividades.

Nível de qualificação	Número de pessoas em dedicação exclusiva	Número de pessoas em dedicação parcial	Percentual médio de dedicação (apenas para as pessoas em dedicação parcial) %
Técnicos de nível superior			
Doutores	46 ___	51 ___	56 ___
Mestres	47 ___	52 ___	57 ___
Graduados	48 ___	53 ___	58 ___
Técnicos de nível médio	49 ___	54 ___	59 ___
Outros de suporte	50 ___	55 ___	60 ___

Informe o número de técnicos de nível superior (soma de 46 + 47 + 48 e soma de 51 + 52 + 53), do quadro da empresa, normalmente ocupados nas atividades de P&D, segundo as ocupações especificadas e o tempo de dedicação a estas atividades.

Formação básica	Número de pessoas com Pós-graduação	Número de pessoas em dedicação exclusiva	Número de pessoas em dedicação parcial	Percentual médio de dedicação (apenas para as pessoas em dedicação parcial) %
Químicos, físicos e assemelhados	61 ___	67 ___	73 ___	79 ___
Engenheiros, arquitetos e assemelhados	62 ___	68 ___	74 ___	80 ___
Médicos, cirurgiões dentistas, veterinários, enfermeiros e assemelhados	63 ___	69 ___	75 ___	81 ___
Biologistas, bacteriologistas, farmacologistas e assemelhados	64 ___	70 ___	76 ___	82 ___
Estatísticos, matemáticos, analistas de sistemas e assemelhados	65 ___	71 ___	77 ___	83 ___
Outros	66 ___	72 ___	78 ___	84 ___

Impactos das inovações

Distribua percentualmente o valor das vendas e das exportações de **2005**, segundo o grau de novidade das inovações de produto (bem ou serviço), implementadas entre **2003 e 2005**.

Produtos	Vendas líquidas internas	Exportações
Produto tecnologicamente novo ou significativamente aprimorado para a empresa, mas já existente no mercado nacional	85 ___ %	89 ___ %
Produto tecnologicamente novo ou significativamente aprimorado para o mercado nacional, mas já existente no mercado mundial	86 ___ %	90 ___ %
Produto tecnologicamente novo para o mercado mundial	87 ___ %	91 ___ %
Produtos que não foram alterados ou foram modificados apenas marginalmente	88 ___ %	92 ___ %
Total	100%	100%

Indique a importância dos impactos das inovações de produto (bem ou serviço) e processo, implementadas durante o período entre **2003 e 2005**.

Impactos	Importância			
	Alta	Média	Baixa	Não relevante
Produto				
93 - Melhorou a qualidade dos bens ou serviços				
94 - Ampliou a gama de bens ou serviços ofertados				
Mercado				
95 - Permitiu manter a participação da empresa no mercado				
96 - Ampliou a participação da empresa no mercado				
97 - Permitiu abrir novos mercados				
Processo				
98 - Aumentou a capacidade de produção ou de prestação de serviços				
99 - Aumentou a flexibilidade da produção ou da prestação de serviços				
100 - Reduziu os custos de produção				
101 - Reduziu os custos do trabalho				
102 - Reduziu o consumo de matérias-primas				
103 - Reduziu o consumo de energia				
104 - Reduziu o consumo de água				
Outros impactos				
105 - Permitiu reduzir o impacto sobre o meio ambiente e controlar aspectos ligados à saúde e segurança				
Enquadramento em regulações e normas padrão relativas ao:				
106 - mercado interno				
107 - mercado externo				

Fontes de informação

Indique a importância atribuída a cada categoria de fonte de informação empregada entre **2003** e **2005**, para o desenvolvimento de produtos (bens ou serviços) e/ou processos tecnologicamente novos ou substancialmente aprimorados.

Fontes	Importância			
	Alta	Média	Baixa	Não relevante
Fontes internas à empresa				
108 - Departamento de P&D				
109 - Outros				
Fontes externas à empresa				
110 - Outra empresa do grupo				
111 - Fornecedores de máquinas, equipamentos, materiais, componentes ou softwares				
112 - Clientes ou consumidores				
113 - Concorrentes				
114 - Empresas de consultoria e consultores independentes				
Centros educacionais e de pesquisa				
115 - Universidades e institutos de pesquisa				
116 - Centros de capacitação profissional e assistência técnica				
117 - Instituições de testes, ensaios e certificações				
Outras fontes de informação				
118 - Aquisição de licenças, patentes e *know how*				
119 - Conferências, encontros e publicações especializadas				
120 - Feiras e exposições				
121 - Redes de informações informatizadas				

Qual a localização da principal fonte de informação, para cada categoria de fonte empregada entre **2003** e **2005**?

Fontes	Localização	
	Brasil	Exterior
Fontes externas à empresa		
122 - Outra empresa do grupo		
123 - Fornecedores de máquinas, equipamentos, materiais, componentes ou softwares		
124 - Clientes ou consumidores		
125 - Concorrentes		
126 - Empresas de consultoria e consultores independentes		
Centros educacionais e de pesquisa		
127 - Universidades e institutos de pesquisa		
128 - Centros de capacitação profissional e assistência técnica		
129 - Instituições de testes, ensaios e certificações		
Outras fontes de informação		
130 - Aquisição de licenças, patentes e *know how*		
131 - Conferências, encontros e publicações especializadas		
132 - Feiras e exposições		
133 - Redes de informações informatizadas		

Cooperação para inovação

Cooperação para inovação significa a participação ativa em projetos conjuntos de P&D e outros projetos de inovação com outra organização (empresa ou instituição). Isto não implica, necessariamente, que as partes envolvidas obtêm benefícios comerciais imediatos. A simples contratação de serviços de outra organização, sem a sua colaboração ativa, não é considerada cooperação.

134 - Entre **2003** e **2005**, a empresa esteve envolvida em arranjos cooperativos com outra (s) organização (ões) com vistas a desenvolver atividades inovativas?

1 Sim 2 Não

Indique a importância de cada categoria de parceiro e a localização do principal parceiro em cada categoria.

Parceiro		Importância				Localização						
		Alta	Média	Baixa	Não relevante		Mesmo estado	Brasil (outros estados)	Mercosul	Estados Unidos	Europa	Outros países
Clientes ou consumidores	135					142						
Fornecedores	136					143						
Concorrentes	137					144						
Outra empresa do grupo	138					145						
Empresas de consultoria	139					146						
Universidades e institutos de pesquisa	140					147						
Centros de capacitação profissional e assistência técnica	141					148						

Para as categorias de parceiro que mantiveram cooperação, indique o objeto da cooperação estabelecida.

Parceiro	Objeto da cooperação					
	P&D	Assistência técnica	Treinamento	Desenho industrial	Ensaios para teste de produto	Outras atividades de cooperação
149 - Clientes ou consumidores						
150 - Fornecedores						
151 - Concorrentes						
152 - Outra empresa do grupo						
153 - Empresas de consultoria						
154 - Universidades e institutos de pesquisa						
155 - Centros de capacitação profissional e assistência técnica						

Apoio do governo

Entre **2003** e **2005**, a empresa utilizou algum dos programas, relacionados a seguir, de apoio do governo para as suas atividades inovativas?

	1 - Sim	2 - Não
156 - Incentivos fiscais à P&D e inovação tecnológica (Lei nº. 8.661, Lei nº. 10.332, Lei nº. 11.196)		
157 - Incentivo fiscal Lei de Informática (Lei nº. 10.176, Lei nº. 10.664, Lei nº. 11.077)		
158 - Participação em projetos de P&D e inovação tecnológica em parceria com universidades e institutos de pesquisa, com apoio financeiro público		
159 - Financiamento à projetos de P&D e inovação tecnológica, inclusive à compra de máquinas e equipamentos utilizados para inovar		
160 - Bolsas oferecidas pelas fundações de amparo à pesquisa e RHAE/CNPq para pesquisadores em empresas		
161 - Aporte de capital de risco		
162 - Outros (favor especificar)		

Patentes e outros métodos de proteção

Entre **2003** e **2005**, a empresa utilizou algum dos métodos, descritos a seguir, para proteger as inovações de produto e/ou processo desenvolvidas?

		1 - Sim	2 - Não
Métodos de proteção por escrito	163 - Patente de invenção		
	164 - Patente de modelo de utilidade		
	165 - Registro de desenho industrial		
	166 - Marcas		
	167 - Direitos de autor		
Métodos de proteção estratégicos	168 - Complexidade no desenho		
	169 - Segredo industrial		
	170 - Tempo de liderança sobre os competidores		
	171 - Outros (favor descrever)		

172 - Durante o período entre **2003** e **2005**, a empresa solicitou depósito de patente?

1 Sim, no Brasil

2 Sim, no exterior

3 Sim, no Brasil e no exterior

4 Não

173 - No final de **2005** a empresa dispunha de alguma patente em vigor?

1 Sim, no Brasil

2 Sim, no exterior

3 Sim, no Brasil e no exterior

4 Não

Problemas e obstáculos à inovação

Para as empresas que **desenvolveram** algum projeto entre **2003 e 2005**

174 - No período entre **2003 e 2005**, a empresa encontrou dificuldades ou obstáculos que podem ter tornado mais lenta a implementação de determinados projetos ou que os tenha inviabilizado?

1 Sim

2 Não

ATENÇÃO!

Se a resposta for Não, passe para o bloco "Outras importantes mudanças estratégicas e organizacionais", questão 188.
Se a resposta for Sim, passe para a questão 176.

Para as empresas que **NÃO desenvolveram** algum projeto entre **2003 e 2005**

175 - Qual das razões, listadas a seguir, justifica o fato da empresa não ter realizado nenhuma atividade inovativa durante o período entre **2003 e 2005**?

1 Não necessitou, devido às inovações prévias

2 Não necessitou, devido às condições de mercado

3 Outros fatores impediram o desenvolvimento, implementação de inovação

ATENÇÃO!

Caso tenha assinalado 3, passe para a questão 176.
Caso contrário, passe para o bloco "Outras importantes mudanças estratégicas e organizacionais", questão 188.

Assinale a importância dos fatores que prejudicaram as atividades inovativas da empresa.

Fatores	Importância			
	Alta	Média	Baixa	Não relevante
176 - Riscos econômicos excessivos				
177 - Elevados custos da inovação				
178 - Escassez de fontes apropriadas de financiamento				
179 - Rigidez organizacional				
180 - Falta de pessoal qualificado				
181 - Falta de informação sobre tecnologia				
182 - Falta de informação sobre mercados				
183 - Escassas possibilidades de cooperação com outras empresas/instituições				
184 - Dificuldade para se adequar a padrões, normas e regulamentações				
185 - Fraca resposta dos consumidores quanto a novos produtos				
186 - Escassez de serviços técnicos externos adequados				
187 - Centralização da atividade inovativa em outra empresa do grupo				

Outras importantes mudanças estratégicas e organizacionais

Durante o período entre **2003** e **2005**, realizou alguma das atividades relacionadas a seguir?

	1 - Sim	2 - Não
188 - Implementação de significativas mudanças na estratégia corporativa		
189 - Implementação de técnicas avançadas de gestão (da produção, da informação e ambiental)		
190 - Implementação de significativas mudanças na estrutura organizacional		
191 - Mudanças significativas nos conceitos/estratégias de marketing		
192 - Mudanças significativas na estética, desenho ou outras mudanças subjetivas em pelo menos um dos produtos		
193 - Implementação de novos métodos de controle e gerenciamento, visando a atender normas de certificação (ISO9000, ISO14000, QS, TS, OHSAS18001, SA800, etc.)		

Detalhe se as técnicas avançadas de gestão introduzidas diziam respeito a:

	1 - Sim	2 - Não
194 - Novos dispositivos e ferramentas de gestão da produção		
195 - Novos dispositivos e ferramentas de gestão da informação		
196 - Gestão ambiental		

Uso da biotecnologia

A Biotecnologia é a aplicação da ciência e da tecnologia aos organismos vivos, assim como à suas partes, produtos ou modelos, para alterar o material vivo ou inerte, com a finalidade de produzir conhecimentos, bens e/ou serviços.

197 - A sua empresa realiza alguma atividade relacionada com a biotecnologia?

1 ☐ Sim 2 ☐ Não

Empresas de pesquisa e desenvolvimento (P&D)

Somente para as empresas cuja a atividade principal é a realização de Pesquisa e Desenvolvimento (P&D) - CNAE 73

197 - Indique a atividade principal (campo de atuação principal) das empresas que se beneficiam das atividades de P&D realizadas por sua empresa. Caso a tecnologia desenvolvida por sua empresa seja utilizada, indistintamente, em várias atividades econômicas, indique a sua principal área de especialização.

Observações

The Fourth Community Innovation Survey
(CIS IV)

THE HARMONISED SURVEY QUESTIONNAIRE

The Fourth Community Innovation Survey (Final Version: October 20 2004)

This survey collects information about product and process innovation as well as organisational and marketing innovation during the three-year period 2002 to 2004 inclusive. Most questions cover new or significantly improved goods or services or the implementation of new or significantly improved processes, logistics or distribution methods. Organisational and marketing innovations are only covered in section 10. In order to be able to compare enterprises with and without innovation activities, we request all enterprises to respond to **all** questions, unless otherwise instructed.

Person we should contact if there are any queries regarding the form:

Name: _____
Job title: _____
Organisation: _____
Phone: _____
Fax: _____
E-mail: _____

General information about the enterprise

Name of enterprise _____
Address _____
Postal code _____ **Main activity**[2] _____

1.1 Is your enterprise part of an enterprise group? (A group consists of two or more legally defined enterprises under common ownership. Each enterprise in the group may serve different markets, as with national or regional subsidiaries, or serve different product markets. The head office is also part of an enterprise group.)

Yes ☐ In which country is the head office of your group located?[3] _____

No ☐

If your enterprise is part of an enterprise group, please answer all further questions only for your enterprise in [your country]. Do not include results for subsidiaries or parent enterprises outside of [your country]

1.2 In which geographic markets did your enterprise sell goods or services during the three years 2002 to 2004?

	Yes	No
Local / regional within [your country]	☐	☐
National	☐	☐
Other European Union (EU) countries, EFTA, or EU candidate countries*	☐	☐
All other countries	☐	☐

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

[1] NUTS 2 code
[2] NACE 4 digit code
[3] Country code according to ISO standard

2. Product (good or service) innovation

A product innovation is the market introduction of a **new** good or service or a **significantly** improved good or service with respect to its capabilities, such as improved software, user friendliness, components or sub-systems. The innovation (new or improved) must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises.

2.1 During the three years 2002 to 2004, did your enterprise introduce:

	Yes	No
New or significantly improved goods. (Exclude the simple resale of new goods purchased from other enterprises and changes of a solely aesthetic nature.)	☐	☐
New or significantly improved services.	☐	☐

If no to both options, go to question 3.1, otherwise:

2.2 Who developed these product innovations?

	Select the most appropriate option only
Mainly your enterprise or enterprise group	☐
Your enterprise together with other enterprises or institutions	☐
Mainly other enterprises or institutions	☐

2.3 Were any of your goods and service innovations during the three years 2002 to 2004:

		Yes	No
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)	☐	☐
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	☐	☐

Using the definitions above, please give the percentage of your total turnover[4] in 2004 from:

Goods and service innovations introduced during 2002 to 2004 that were **new to your market**	☐☐☐ %
Goods and service innovations introduced during 2002 to 2004 that were **only new to your firm**	☐☐☐ %
Goods and services that were **unchanged or only marginally modified** during 2002 to 2004 (include the resale of new goods or services purchased from other enterprises)	☐☐☐ %
Total turnover in 2004	1 0 0 %

[4] For Credit institutions: Interests receivable and similar income, for insurance services: Gross premiums written

3. Process innovation

A process innovation is the implementation of a **new** or **significantly** improved production process, distribution method, or support activity for your goods or services. The innovation (new or improved) must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises. Exclude purely organisational innovations.

3.1 During the three years 2002 to 2004, did your enterprise introduce:

	Yes	No
New or significantly improved methods of manufacturing or producing goods or services	☐	☐
New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services	☐	☐
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing	☐	☐

If no to all options, go to section 4, otherwise:

3.2 Who developed these process innovations?

Select the most appropriate option only

Mainly your enterprise or enterprise group	☐
Your enterprise together with other enterprises or institutions	☐
Mainly other enterprises or institutions	☐

4. Ongoing or abandoned innovation activities

Innovation activities include the acquisition of machinery, equipment, software, and licenses; engineering and development work, training, marketing and R&D[5] when they are *specifically* undertaken to develop and/or implement a product or process innovation.

4.1 Did your enterprise have any innovation activities to develop product or process innovations that were abandoned during 2002 to 2004 or still ongoing by the end of 2004?

Yes ☐

No ☐

If your enterprise had no product or process innovations or innovation activity during 2002 to 2004 (no to all options in questions 2.1, 3.1, and 4.1), go to question 8.2.

Otherwise, go to question 5.1

[5] Include basic R&D as an innovation activity even if not specifically related to a product and/or process innovation

5. Innovation activities and expenditures

5.1 During the three years 2002 to 2004, did your enterprise engage in the following innovation activities:

		Yes	No
Intramural (in-house) R&D	Creative work undertaken within your enterprise to increase the stock of knowledge and its use to devise new and improved products and processes (including software development) If yes, did your firm perform R&D during 2002 to 2004: Continuously? ☐ Occasionally? ☐	☐	☐
Extramural R&D	Same activities as above, but performed by other companies (including other enterprises within your group) or by public or private research organisations and purchased by your enterprise	☐	☐
Acquisition of machinery, equipment and software	Acquisition of advanced machinery, equipment and computer hardware or software to produce new or significantly improved products and processes	☐	☐
Acquisition of other external knowledge	Purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other enterprises or organisations	☐	☐
Training	Internal or external training for your personnel specifically for the development and/or introduction of new or significantly improved products and processes	☐	☐
Market introduction of innovations	Activities for the market introduction of your new or significantly improved goods and services, including market research and launch advertising	☐	☐
Other preparations	Procedures and technical preparations to implement new or significantly improved products and processes that are not covered elsewhere.	☐	☐

5.2 Please estimate the amount of expenditure for each of the following four innovation activities in 2004 only. (Include personnel and related costs)[6]

	Tick 'nil' if your enterprise had no expenditures in 2004	Nil
Intramural (in-house) R&D (Include capital expenditures on buildings and equipment specifically for R&D)		☐
Acquisition of R&D (extramural R&D)		☐
Acquisition of machinery, equipment and software (Exclude expenditures on equipment for R&D)		☐
Acquisition of other external knowledge		☐
Total of these four innovation expenditure categories		☐

[6] Give expenditure data in 000's of national currency units to eight digits.

5.3 During the three years 2002 to 2004, 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
Local or regional authorities	☐	☐
Central government (including central government agencies or ministries)	☐	☐
The European Union (EU)	☐	☐
If yes, did your firm participate in the EU's 5th (1998-2002) or 6th (2003-2006) Framework Programme for Research and Technical Development	☐	☐

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

6.1 During the three years 2002 to 2004, 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 projects.

		Degree of importance *Tick 'not used' if no information was obtained from a source.*			
	Information source	**High**	**Medium**	**Low**	**Not used**
Internal	Within your enterprise or enterprise group	☐	☐	☐	☐
Market sources	Suppliers of equipment, materials, components, or software	☐	☐	☐	☐
	Clients or customers	☐	☐	☐	☐
	Competitors or other enterprises in your sector	☐	☐	☐	☐
	Consultants, commercial labs, or private R&D institutes	☐	☐	☐	☐
Institutional sources	Universities or other higher education institutions	☐	☐	☐	☐
	Government or public research institutes	☐	☐	☐	☐
Other sources	Conferences, trade fairs, exhibitions	☐	☐	☐	☐
	Scientific journals and trade/technical publications	☐	☐	☐	☐
	Professional and industry associations	☐	☐	☐	☐

6.2 During the three years 2002 to 2004, 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 ☐
No ☐ **(Please go to question 7.1)**

6.3 Please indicate the type of co-operation partner and location *(Tick all that apply)*

Type of co-operation partner	[Your country]	Other Europe*	United States	All other countries
A. Other enterprises within your enterprise group	☐	☐	☐	☐
B. Suppliers of equipment, materials, components, or software	☐	☐	☐	☐
C. Clients or customers	☐	☐	☐	☐
D. Competitors or other enterprises in your sector	☐	☐	☐	☐
E. Consultants, commercial labs, or private R&D institutes	☐	☐	☐	☐
F. Universities or other higher education institutions	☐	☐	☐	☐
G. Government or public research institutes	☐	☐	☐	☐

*: 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, 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? (Give corresponding letter) _____

7. Effects of innovation during 2002-2004

7.1 How important were each of the following effects of your product (good or service) and process innovations introduced during the three years 2002 to 2004?

		Degree of observed effect			
		High	Medium	Low	Not relevant
Product oriented effects	Increased range of goods or services	☐	☐	☐	☐
	Entered new markets or increased market share	☐	☐	☐	☐
	Improved quality of goods or services	☐	☐	☐	☐
Process oriented effects	Improved flexibility of production or service provision	☐	☐	☐	☐
	Increased capacity of production or service provision	☐	☐	☐	☐
	Reduced labour costs per unit output	☐	☐	☐	☐
	Reduced materials and energy per unit output	☐	☐	☐	☐
Other effects	Reduced environmental impacts or improved health and safety	☐	☐	☐	☐
	Met regulatory requirements	☐	☐	☐	☐

8. Factors hampering innovation activities

8.1 During the three years 2002 to 2004, were any of your innovation activities or projects:

	Yes	No
Abandoned in the concept stage	☐	☐
Abandoned after the activity or project was begun	☐	☐
Seriously delayed	☐	☐

TO BE ANSWERED BY ALL ENTERPRISES:

8.2 During the three years 2002 to 2004, how important were the following factors for hampering your innovation activities or projects or influencing a decision not to innovate?

		Degree of importance			
		High	Medium	Low	Factor not experienced
Cost factors	Lack of funds within your enterprise or group	☐	☐	☐	☐
	Lack of finance from sources outside your enterprise	☐	☐	☐	☐
	Innovation costs too high	☐	☐	☐	☐
Knowledge factors	Lack of qualified personnel	☐	☐	☐	☐
	Lack of information on technology	☐	☐	☐	☐
	Lack of information on markets	☐	☐	☐	☐
	Difficulty in finding cooperation partners for innovation	☐	☐	☐	☐
Market factors	Market dominated by established enterprises	☐	☐	☐	☐
	Uncertain demand for innovative goods or services	☐	☐	☐	☐
Reasons not to innovate	No need due to prior innovations	☐	☐	☐	☐
	No need because of no demand for innovations	☐	☐	☐	☐

9. Intellectual property rights

9.1 During the three years 2002 to 2004, did your enterprise:

	Yes	No
Apply for a patent	☐	☐
Register an industrial design	☐	☐
Register a trademark	☐	☐
Claim copyright	☐	☐

10. Organisational and marketing innovations

An organisational innovation is the implementation of new or significant changes in firm structure or management methods that are intended to improve your firm's use of knowledge, the quality of your goods and services, or the efficiency of work flows. A marketing innovation is the implementation of new or significantly improved designs or sales methods to increase the appeal of your goods and services or to enter new markets.

10.1 During the three years 2002 to 2004, did your enterprise introduce:

		Yes	No
Organisational innovations	New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within your enterprise	☐	☐
	A major change to the organisation of work within your enterprise, such as changes in the management structure or integrating different departments or activities	☐	☐
	New or significant changes in your relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting	☐	☐
Marketing innovations	Significant changes to the design or packaging of a good or service (Exclude routine/ seasonal changes such as clothing fashions)	☐	☐
	New or significantly changed sales or distribution methods, such as internet sales, franchising, direct sales or distribution licenses.	☐	☐

10.2 If your enterprise introduced an organisational innovation during the three years 2002 to 2004, how important were each of the following effects?

	Degree of observed effect			
	High	Medium	Low	Not relevant
Reduced time to respond to customer or supplier needs	☐	☐	☐	☐
Improved quality of your goods or services	☐	☐	☐	☐
Reduced costs per unit output	☐	☐	☐	☐
Improved employee satisfaction and/or reduced rates of employee turnover	☐	☐	☐	☐

11. Basic economic information on your enterprise

11.1 What was your enterprise's total turnover for 2002 and 2004?[7] Turnover is defined as the market sales of goods and services (Include all taxes except VAT[8]).

2002	2004
☐☐☐☐☐☐☐☐	☐☐☐☐☐☐☐☐

11.2 What was your enterprise's total number of employees in 2002 and 2004?[9]

2002	2004

[7] Give turnover in '000 of national currency units to nine digits.

[8] For Credit institutions: Interests receivable and similar income; for Insurance services: Gross premiums written

[9] Annual average. If not available, give the number of employees at the end of each year. Give figures to six digits.

The CIS pilot modules on organisational and marketing innovation

Module on Organisational Innovation

An organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.

1. Compared to other European enterprises of a similar size and sector, how close was your enterprise's organisational structure in 2004 to best practice in Europe? **Best practice is defined as an organisational structure in 2004 that maximized productivity, quality, and customer service.**

- ☐ Close to or at best practice
- ☐ Above average
- ☐ Average
- ☐ Below average
- ☐ Well below average

2. During the three years 2004 to 2006, did your enterprise introduce:

	Yes	*No*
2.1 New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within your enterprise[1]	☐	☐
2.2 New management systems for the production and/or supply operations of your enterprise[2]	☐	☐
2.3 Significant changes to the organisation of work in your enterprise that (tick all that apply):		
Increased employee decision making and responsibility for their work	☐	☐
Decreased employee decision making and responsibility for their work	☐	☐
Had no effect on employee decision making and responsibilities	☐	☐
2.4 A significant change to the management structure of your enterprise, such as creating new divisions or departments, integrating different departments or activities, adoption of a networked structure, etc[3]	☐	☐
2.5 New or significant changes in your relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting	☐	☐

Go to question 3 if your enterprise introduced at least one organisational innovation between 2004 and 2006. Otherwise go to question 7.

3. What was the source of the ideas for your enterprise's organisational innovations?[4]

	Select the most appropriate option only
3.1 Mainly your enterprise or enterprise group	☐

3.2 Both your enterprise and other enterprises, institutions, publications, etc.	☐
3.3 Mainly other enterprises, institutions, publications, etc.	☐

4. How important were each of the following effects of your enterprise's organisational innovations between 2004 and 2006?

(If your enterprise introduced several organisational innovations, make an overall evaluation)				
	High	**Medium**	**Low**	**None / Not relevant**
4.1 Reduced time to respond to customer or supplier needs	☐	☐	☐	☐
4.2 Improved quality of your goods or services	☐	☐	☐	☐
4.3 Reduced costs per unit output	☐	☐	☐	☐
4.4 Improved employee satisfaction and/or lower employee turnover	☐	☐	☐	☐
4.5 Improved communication or information sharing	☐	☐	☐	☐
4.6 Increased ability to develop new products or processes	☐	☐	☐	☐

5. Approximately what percent of your employees were directly affected by your enterprise's organisational innovations between 2004 and 2006?[5]

_____%

6. Were any of these organisational innovations essential to the implementation of other types of innovations introduced by your enterprise between 2004 and 2006?

(Tick not relevant if your enterprise did not introduce one of the following innovations)	**Yes**	**No**	**Not relevant**
6.1 Process innovation	☐	☐	☐
6.2 Product innovation for a new or improved service	☐	☐	☐
6.3 Product innovation for a new or improved good	☐	☐	☐

Go to question ...

7. Why did your enterprise not introduce an organisational innovation between 2004 and 2006?

	Yes	*No*

7.1 Organisational innovations were introduced before 2004 and no need for further change	☐	☐
7.2 Lack of funds or staff to implement an organisational innovation	☐	☐
7.3 Resistance of staff or management to organisational change	☐	☐

Module on marketing innovation

A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

1. During the three years 2004 to 2006, did your enterprise introduce the following marketing innovations:

		Yes	No
Design	1.1 Introduce significant changes to the **design** of a good or service (Exclude routine/ seasonal changes such as clothing fashions)	☐	☐
	1.2 Introduce significant changes to the **packaging** of a good	☐	☐
Promotion	1.3 Implement a new marketing strategy to **target new customer groups or market segments**	☐	☐
	1.4 Use **new media or techniques to promote products**, such as new advertising concepts, a new brand image or new techniques to customize promotion to individual customers or groups	☐	☐
Placement	1. 5 Use **new sales channels**, such as direct selling, internet sales, or product licensing	☐	☐
	1. 6 Introduce new concepts for **product presentation** in sales outlets (e.g. sales rooms, websites, other types of outlets)	☐	☐
Pricing	1. 7 Use **new pricing methods** to market goods or services	☐	☐

Go to question 2 if your enterprise introduced at least one marketing innovation between 2004 and 2006. Otherwise go to question ...

2. Who developed these marketing innovations?

	Select the most appropriate option only
2.1 Mainly your enterprise or enterprise group	☐
2.2 Your enterprise together with other enterprises or institutions	☐
2.3 Mainly other enterprises or institutions	☐

3. How important were each of the following effects of your enterprise's marketing innovations between 2004 and 2006?

(If your enterprise introduced several marketing innovations, make an overall evaluation)				
	High	**Medium**	**Low**	**None/ Not relevant**
1. Sales growth for your goods and services[1]	☐	☐	☐	☐
2. Introduced products to new markets or customer groups	☐	☐	☐	☐
3. Increased visibility of products or business	☐	☐	☐	☐
4. Strengthened relationships with customers	☐	☐	☐	☐
5. Improved customer satisfaction	☐	☐	☐	☐

4. How important were the following market-related activities for your enterprise's innovation projects between 2004 and 2006?[2]

	High	**Medium**	**Low**	**None/ Not used**
4.1 Maintaining close links between your marketing department and departments or groups involved in developing or implementing your innovations	☐	☐	☐	☐
4.2 Systematic analysis of your customer's needs by your marketing division	☐	☐	☐	☐
4.3 Systematic analysis of the effectiveness of your marketing techniques	☐	☐	☐	☐

5. If your firm introduced a marketing innovation <u>and</u> introduced a product innovation between 2004 and 2006:

	Yes	**No**
5.1 Were any of these marketing innovations an integral part of any of your enterprise's product innovations? (For example, a design change was an essential part of a technical innovation, or a new marketing method was part of a process innovation) [3]	☐	☐
5.2 Were any of these marketing innovations <u>necessary</u> for the successful introduction of your enterprise's product innovation(s)?	☐	☐

Module on Knowledge Management

1. Is your firm currently using each of the following knowledge management practices?[1]

If yes, please indicate if your firm first introduced or made a significant change to each practice between 2004 and 2006 inclusive

	No	*Yes (tick both if relevant)*
1.1 A written knowledge management policy	☐	☐ *Introduced/changed 2004-2006* ☐ *Introduced/changed before 2004*
1.2 Incentives for employees to share knowledge within your enterprise	☐	☐ *Introduced/changed 2004-2006* ☐ *Introduced/changed before 2004*
1.3 Dedicated resources to monitor and obtain knowledge from outside your enterprise	☐	☐ *Introduced/changed 2004-2006* ☐ *Introduced/changed before 2004*
1.4 A policy to bring in external experts from universities, research institutes, or other firms to participate in project teams, as needed[2]	☐	☐ *Introduced/changed 2004-2006* ☐ *Introduced/changed before 2004*
1.5 Regular updates of internal databases or manuals of good work practices, lessons learned, or expert advice	☐	☐ *Introduced/changed 2004-2006* ☐ *Introduced/changed before 2004*