1. Introduction

The OECD\(^1\) (1996) introduced the term "knowledge-based economy," defining it as an economy directly based on the production, distribution and use of knowledge and information. Based on this, many countries have started to design and implement policies that can lead them to compete in this new business arena based on the creation and transfer of knowledge. It is also of common wisdom among policy makers that a dynamic new technology based firm sector is a key element to assure innovation and the creation of new jobs in the economic system (Colombo and Delmastro, 2001). One promising approach to enable economic development is promoting the formation of innovative clusters focused on high tech sectors. Clustering seems to enable firms, specially small and medium sized enterprises, to grow and upgrade more easily. An innovative cluster can be defined as an organizational structure that creates new products and enterprises by means of collective industrial production within restricted geographical boundaries, based on high concentrations of knowledge exchange, interactive learning and shared social values (Bortagaray et al, 2000).

On the other hand, the environment surrounding the companies also impacts their innovative capability. Several concepts have emerged to analyse the importance of elements and actors that are present at the national, regional, local and metropolitan levels that support innovation in a spatial context. Understanding how the innovation system supports the creation of new knowledge, learning and thus the formation of new high tech clusters is one of the main motivations to carry out this research. This report

\(^1\) OECD – Organization for Economic Cooperation and Development
will present the concepts, the objectives, research questions to be answered and the methodologies to be used to carry out the research.

2.1 Current needs in Mexico for the development of Innovative Clusters

During 1970 to 2000 Mexico lacked long term policies and goals regarding Science and Technology; very low investment from both public and private sectors was provided for Research and Development (Parada, CONACYT’s\(^2\) director, 2002). The public sector currently invests 0.40% of the GDP in R&D, positioning Mexico in lowest ladder in comparison with other OECD countries. At the industrial level, Mexico has 2.8 million enterprises, 99.7 of them are SME’s and less than 500 invest regularly in R&D. Regarding Mexico's industrial production, 39.1% of the GDP in is based on low value commodities such as textiles, agro industry, cement, steel and oil. On the contrary, intensive research and development sectors such as biotechnology, aeronautics, ICT, advanced materials, only count for 7.3% of GDP. As a consequence, the Mexican government has designed a new model for growth. The main activities are to reinforce the scientific infrastructure and the competitiveness of its industry to create high value added enterprises. The main research and development priorities are: 1) Information Technologies and Communications, 2) Biotechnology, 3) Advanced Materials, 4) Advanced product design and manufacturing technologies (focused on SME’s) and 5) Cost Effective Solutions to Infrastructure Social Needs and Sustainable Development. In order to accomplish this, Mexico is planning to increment the expenditure of GDP from 0.40% to 2 % for 2020 in R&D.

2.2 Current needs in Italy for the development of Innovative Clusters

In the case of Italy, Beccattini (1998) suggests that the Italian productive system is historically characterised by the competitive advantage of its industrial production system. This is based on territorial systems of small and medium enterprises, which are particularly strong in so called light sectors (such as textiles, clothing, footwear, furniture,

\(^2\) CONACYT – National Council for Science and Technology in Mexico
tiles, etc) or in niches of instrumental goods (such as utensil machinery, packaging machinery, etc). By analysing these advantages, he concludes that they reveal a common logic, based on technological and merchandise peculiarities, which unites the above-mentioned types of consumer goods. The innovative dynamism of Italian businesses and of their design system is not linked so much to radical innovations, which could be quantified in terms of the number of patents developed, research and sustained development costs, etc (Maffei and Zurlo, 2000). Italy shows low performance in high technologies industries, with the ratio of less than 1% of GDP that is less than half the value of France, Germany, the UK and other northern European countries. Creation of new companies is concentrated in low technologies mature sectors (Colombo and Delmastro 2001). Thus, one cannot talk about Italian success relative to today’s key sectors for economic development, such as telecommunications, information technologies and biotechnology.

2.3 The latent need to evolve into learning regions

After analyzing these facts, it can be concluded that both Mexico and Italy require to upgrade the current industrial base to deliver added value products. The formation of innovative clusters can be an instrument for industrial upgrading, implementing measures to stimulate cooperation and networking with local and foreign partners. As the real need is to upgrade the current industrial fabric from a low value commodities production to a more knowledge intensive, the term innovative cluster will be focused on the development of high tech clusters.

Innovation is then mandatory; by innovation it is meant not only product and processes but also organizational innovation: a new way to organize the current industrial base in order to evolve into a knowledge based economy. Thus, a new business environment should be created, enabling the adequate conditions for companies to innovate in a successful and networked way. This new business environment should also address entrepreneurship, as the emergence of new knowledge and spatial proximity of the cluster members are determinants for new start ups to develop, providing new jobs, economic growth and regional development.
But how can regions should evolve into learning regions and environments for innovation? This new business environment should take in consideration the innovation systems concept and the milieu concept where different actors network to learn collectively towards innovation. Since the 1980s there as been a well-documented resurgence of interest in the understanding of the region as a ‘learning’ site of economic and innovation (David Doloreux, Charles Edquist, Leif Hommen, 2003). A general consensus exists in the debate of innovation and regional development, in which clusters and geographical proximity are seem as loci of knowledge development and exchange, critical to higher levels of innovation and regional growth. Among others, Cooke (2001) argue that regional development ensues as competitiveness evolves in places where localized capabilities exist – institutional endowments, built structures, knowledge and skills, while Porter (1998) stresses that the enduring sources of competitive advantage in a global economy are often extremely local, arising from a concentration of highly specialised skills and knowledge, institutions, related businesses and ‘demanding’ customers in a particular region, where, in most cases, innovation is less the product of individual firms than of the assembled resources, knowledge, and other inputs and capabilities that are localized in specific places (Maskell and Malmberg, 1999). Still, as argued by Maillat (1991), the creation of new knowledge presupposes that the environment becomes an essential component of the innovation process.

Thus, a learning region may represent the final outcome of the evolution of an industrial district, which undergoes and ongoing evolution thanks to the active role of the process learning, adaptation and innovation (Cappellin, 2002). Defining a region as a learning region means to contend that the actors of the system are committed to an interactive learning process, which allows the development of knowledge, know how and other capabilities required from creating innovation and keeping the regional competitiveness (Maillat and Kebir, 1999). The objective of a learning region is that of integrating the tacit and implicit traditional knowledge, which is bound to the local context, with the codified knowledge available at the world level, in order to stimulate the region endogenous potential (Nonaka and Konno 1998). Nevertheless, some questions that could be made at this point are:

- How does proximity (in a milieu/regional cluster) contribute to knowledge transfer?
- How do short distances favour information contacts and exchange among actors?
- How can proximity be measured in terms of its impact to innovation?
3 Literature Review

In order to develop a theoretical framework and define the research questions, a literature review was carried out. This section will define the different key concepts that will be used for the research.

3.1 Industrial Clusters

There has been an explosion of interest in cluster development in recent years across North America, Europe and newly industrialized countries. This interest has been prompted, in part, by fascination with the success of Silicon Valley at reinventing itself through successive waves of new technology; and, in part, by the efforts of other regions to emulate the Silicon Valley model. Saxenian’s case study of Silicon Valley undertaken in the early 1990s and the comparison she provided with Route 128 in Massachusetts was one of the initial case studies analysing Silicon Valley success. Saxenian drew upon the growing body of literature on the dynamics of regional network-based industrial systems to highlight the similarities and the differences between the two regions (Wolfe, 2003).

The distinguishing aspect in the economic performance of the two regions in the downturn of the 1980s was the change in the character of their respective industrial systems. The new firms in Silicon Valley responded to the crisis by building their production networks from the bottom up. They concentrated their efforts on their core competencies, particularly the design and assembly of the final system, and purchased the remainder of their inputs from specialized suppliers. In the process, they created a supply network that spread the costs of development over a range of firms and reduced product development times. The new form of partnerships that emerged as a result broke with the tradition of adversarial supplier relations that predominated in the mass production companies. “They came to view their relations with suppliers as long-term partnerships rather than short-term procurement arrangements. They saw collaboration as a way to speed the pace of introduction of new products and to improve product quality and performance” (Saxenian 1994). This could mean that the intrinsic success of a cluster is related to the performance of each on of the companies
that conform it; nevertheless, going back to systems theory, the performance of the cluster as a whole should be more than the sum of its parts.

### 3.1.1 Clusters Research in the United States

In the United States (and around the world) clusters analysis started to be of interest to policy makers and consulting companies for regional development after Porter’s publications: *The Competitive Advantage of Nations* published in 1990 and *Clusters and the new economics of competition* published in 1998. He defined clusters to be geographic concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or a region.

Recently, Porter also developed the study *Clusters of Innovation: Regional Foundations of U.S. Competitiveness* as regional economies are the building blocks of U.S. competitiveness. The nation’s ability to produce high value products and services depends on the creation and strengthening of regional clusters of industries that become hubs of innovation. Understanding how these clusters enhance productivity and spur innovation by bringing together technology, information, specialized talent, competing companies, academic institutions, and other organizations is a key element for sustainable development.

The Initiative studied five regions around the country: Atlanta, Pittsburgh, the Research Triangle, San Diego and Wichita. These regions were selected to provide a diversity of size, geography, economic maturity, and perceived economic success. The regions were similar enough to allow interesting comparisons, yet diverse enough to encompass a wide variety of challenges and opportunities in regional economic development. Data for the study were drawn from a number of sources, but the principal sources of data were the Cluster Mapping Project of the Institute for Strategy and Competitiveness, the Clusters of Innovation Initiative Regional Surveys, and in-depth interviews of business and government leaders in each region. The Cluster Mapping Project is perhaps the most detailed data set related to economic composition and performance ever compiled. Comparing regional economies has historically been difficult because clusters have not been systematically defined and their incidence charted across all U.S. regions. The Cluster Mapping Project created a detailed statistical
analysis using county-level business data, including detailed metrics on regional economic performance, and data defining 41 types of clusters (e.g., information technology, automotive, business services) that are found in regions throughout the U.S. economy. The Cluster Mapping Data also mapped regional economies by cluster and constituent industry and compared regions to others on various indicators of economic vitality and future competitiveness. One of the goals of the Cluster Mapping Project is to disseminate this data widely to practitioners.

Another interesting article “Innovation: Location Matters” written by Porter and Stern (2001), highlights the importance three key elements to enable innovation capacity at a national level: 1) common innovation infrastructure, 2) the quality of linkages and 3) the cluster specific environment of innovation. Even though these three elements are relevant for the successful innovation in a country, it is clearly mentioned that it is ultimately companies that introduce and commercialize innovations. In this article, it is clearly identified how Asian emergent countries such as China, Singapore, South Korea and Taiwan have surpassed Latin American innovation in terms of patents performance in the last decade as the Latin American national innovative capabilities are much lower. As a result, this has a tremendous effect in the investment of foreign R&D to countries with a low national innovative capacity. The article also proposes the usage of the diamond to understand what drives innovation in an industrial cluster. According to the Governor’s Guide to Cluster-Cased Economic Development, developed by the National Governors Association in USA, the best known model for describing the various elements of an industrial cluster is the four pointed “diamond”, which was developed by Porter and a team in the Harvard Business School. The model includes 1) context for firm structure and rivalry, 2) local demand conditions, 3) related and supporting industries and 4) factor (input) conditions (defined as skills, infrastructure, R&D, capital, etc).

3.1.2 Clusters Research in Canada

In Canada the Programme Innovation Systems Research Network developed by the Centre for International Studies located at the University of Toronto is currently carrying out twenty seven cases in five main regions in Canada: Alberta, Ontario, Ottawa,
Quebec, Atlantic. The clusters under study are: Biotech/Biomedical, Culture/Multimedia, Photonics/Wireless, Wood Products, Food and beverage (including wine), Information Technology and Auto/Steel/Aerospace. The project started in 2001 and will last until 2005. Two methodological approaches were proposed: 1) a survey to 6000 firms in 31 manufacturing industries and 800 firms in natural resources industries and 2) Interview based case studies to analyse in detail the dynamics of the cluster emergence and the historical evolution (Saxenian study confirms that interviews are the best research method for this type of research). As the analysis of cluster formation, structure and dynamics is on its early stages, there is not a single universally accepted methodological approach.

Therefore, the main strength of the current project is the usage of the same framework to integrate, compare, analyse and disseminate results of the different clusters. Central questions in each case are: (i) what role do local institutions and actors play in fostering this transition, (ii) how important is interaction with non-local actors in this process, (iii) how dependent are local firms on unique local knowledge assets, and what is the relative importance of local versus non-local knowledge flows between economic actors, (iv) how did each local industrial concentration evolve over time to reach its present state, and what key events and decisions shaped its path, and finally, (v) to what extent do these processes, relationships and local capabilities constitute a true cluster, and how would we recognize a cluster if we saw one?. A total of 50-60 undergraduate and graduate students participate in the project to perform the interviews (Wolfe, 2003).

3.1.3 Clusters Research in Europe

In Europe innovation is a priority of all Member States and the European Commission. Throughout Europe hundreds of policy measures and support schemes aimed at innovation have been implemented or under preparation. On May, 2003 a policy workshop took place in Luxemburg with the participation of 45 policy makers and experts from 17 European countries and well as from the European Commission. The workshop aimed to examine the trends in national and regional clusters policies, as firms do not innovate in isolation, therefore a co-operative environment is likely to stimulate innovative practices.
One main challenge for regional policy makers in Europe should not be seen as one of attracting factories to create jobs, but as one of attracting businesses in those areas where the region can develop competitive advantage through connections with foreign investors and local businesses. Multinational corporations can open the boarders of regional clusters and connect them to the global world (Zourek, 2003). Some relevant conclusions were: 1) that clusters are usually analyzed by different methods, so it is difficult to compare findings, 2) currently there is not a unique cluster policy model in Europe, every State follows its own policy, 3) there is a latent requirement to evaluate both quantitatively and qualitatively clusters to ascertain their real benefits and 4) the availability of a cluster harmonized data is required for carrying out comparative/benchmarking studies which can lead to the identification of strengths and weakness and thus to develop continuous assessment of cluster policies.

A comparative survey of 34 regional clusters in 17 European countries has been carried out by the European Commission published by the European Network for SME Research. The aim of the survey was to compare European regional clusters, characterizing the nature, working, performance and developments of the clusters. The cluster survey points to the fact that regional resources and collaborators are of major importance in stimulating the growth of regional clusters. Many of the activities along the value chain in the industries dominating the cluster take place inside the clusters. In many clusters, firms also increasingly find relevant research activities and other supporting services inside the cluster boundary. Besides, the survey includes some evidence of social institutions that help to co-ordinate activities in the clusters. Long term relationships and temporary coalitions are, for example, becoming more important ways of managing transactions. Different place-specific, socio-cultural factors are seen to be of continued importance for the knowledge creation and the efficient working of regional clusters in the globalising economy. One important point in the report are the definitions shown in table 1, which clearly differentiate the European interest of forming Regional innovation systems which involve co-operation in innovation activity between firms and knowledge creating and diffusing organisations, such as universities, colleges, training organisations, R&D institutes, technology transfer agencies, business associations, and finance institutions against only regional clusters (as defined by Porter).
Table 1. Regional cluster, Regional innovation network and Regional innovation system definitions

<table>
<thead>
<tr>
<th>Regional cluster</th>
<th>A concentration of ‘interdependent’ firms within the same or adjacent industrial sectors in a small geographical area</th>
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<tr>
<td>Regional innovation network</td>
<td>More organised co-operation (agreement) between firms, stimulated by trust, norms and conventions, which encourages firms’ innovation activity</td>
</tr>
<tr>
<td>Regional innovation system</td>
<td>Co-operation also between firms and different organisations for knowledge development and diffusion</td>
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3.1.4 Research of Italian Industrial Districts (Clusters)

The role of small firm systems, specially in the form of industrial districts has attracted the attention as a distinctive feature of Italian Economic development. Industrial Districts are very important, specially in the regions of the central and north-east Italy. During the 1970 a serious crisis of the Fordist model occurred, the diffusion of new flexible, low cost technologies, along with other factors, undetermined the foundations of a model characterized by limited flexibilities and high volumes of production. Following these changes, intensive restructuring of large scale enterprises began and new opportunities emerged for the development of competitive models other than Fordism, capable of combining considerable flexibility with diversification of products and with a different price-quality relationship. Systems of small and medium enterprises (SME’s) developed stronger inter-firm linkages, while large enterprises reorganized into networks of small firms. **Italy was a privileged point from which to observe these new trends based on flexible specialization.** This form of economic organization had already developed in Italy while Fordism was in its golden age, and continued to grow when this model showed the first signs of crisis. A strong link with the local institutional context characterized the areas of flexible organization. They were mainly concentrated in central regions (Emilia-Romagna, Toscana, Marche and Umbria) and in the North-East (Friuli, Trentino, Veneto) The Italian districts main characteristics are:

- The productive structure of industrial districts is based on a highly specialized division of labour among SME’s.
- Only a limited number of firms have access to final markets
- Most of them are specialized in a single stage of production
Districts are specialized in the production of particular kinds of goods: the most represented sectors are the traditional ones (textiles, clothing, footwear, furniture, ceramics, and so on), but there were also significant developments in the more “modern” sectors, particularly mechanical engineering and the machine tools sectors. An industrial district can be defined as the network of firms model: it is characterized by a low level of hierarchy, by horizontal linkages among small firms, by inter-organizational networks (Bellandi, 1987). **External economies support this model of productive organization specially in two ways: on the one hand, the high density of firms and a widespread interpersonal trust favour the spreading of information about technological innovation, organizational problems and the production of specific know how (tacit knowledge).**

Marshall referred to this kind of collective competition of goods when he emphasized the role of the “industrial atmosphere” as a peculiar component of the industrial district model (Becattini 1987, 1989). On the other hand, as is well known, these firms as not large enough to produce internally the services they need. Thus, successful production of collective goods (training, technological information, export promotion, information on market trends, and so on). This production is supported by the complex institutional setting and by the particular governance structures of this kind of local economy.

The combination of three institutional elements has been crucial for the growth of a social system of production based on districts of small firms:

1) A network of SME’s exists which can be traced back to medieval communes. They enjoyed widespread traditions of crafts and commerce, which were not eroded by industrialization, urbanization and immigration, The entrepreneurship of small firms came mainly from these centres.

2) The presence of self-employment in agriculture (sharecroppers or small peasants) was also important in supporting the formation of a flexible, low cost workforce with appropriate training and particular work ethic

3) The strong influence of both local political traditions and institutions tied to the Catholic Church or to the socialist and communist movements. Thus these regions where characterized by a “white” or “red” regional political structure

The research on industrial districts showed the existence of competitive models that are an alternative to Fordism. Attention was focused on networks of small firms strongly
rooted in local context, and able to adjust rapidly and respond in a flexible way to the demands of increasingly unstable final markets. From the beginning of the 1990s, research interests have gradually shifted to other directions, seeking to respond to new questions, such as how local networks deal with global pressures (Pyke, Sengenberger and Cossentino, 1996). In particular, it is important to assess whether globalization is bringing about a de-regionalization of productive activities. (Burroni and Trigia, 2001).

One key point to mention is that belonging to an industrial district, diminishes the lack of resources to obtain new knowledge and skills, specially from SME’s taking in consideration the fact that in a district information will be transferred faster. Some collective activities that could be done within the district to improve the competitiveness of companies belonging to it are:

- To share resources for research and development
- To acquire information on marketing in new foreign markets
- To find employees of satisfactory quality
- To acquire information on changes in products and demand
- To articulate a policy concern of local or/and central government
- To acquire information on new developments in production methods or work organization.

It has always been considered that Italian industrial districts are often taken as the archetype of a successful, though very particular, cluster model. This Italian “anomaly” is progressively fading out (Micelli, 2003). According to Micelli, hot spots are those clusters that show both intensive external linkages and a high degree of internal connectivity. Currently most Italian clusters lack external linkages. As a result few hot spots in Italy are found in Italy. These latter are more often market leaders, with high export rates and which make better use of ICT applications. Currently only few hot spots are found in the north and northeast of Italy. It can be then said that although Italy has a strong history and experience of SME’s agglomerations focused on specific products, currently there is a need to evolve to “hot spots” or innovative clusters focused also on high tech industries.
3.1.5 Clusters Research in Latin America

Regarding Latin America, Bortagaray and Tiffin presented at the 4th conference on Technology Policy and Innovation in 2000, the results of a study carried out by the Canadian International Development Research Centre regarding innovative clusters in 6 Latin American Countries: Argentina, Brazil, Uruguay, Costa Rica, Cuba and Mexico. The main findings of the study pointed out that finance comes up as the weakest element overall, followed by weak integration, a probable lack of support from specialized consulting services and lack of market support, both local and access to global. On the positive side, some cities have a respectable quality of life. This of course is measured in terms of the amenities available to those with jobs and education, as many of these cities suffer from extreme income disparities in different neighbourhoods. As well, knowledge inputs score high, reflecting the mature and significant investments the public sector has made in education and research over the past decades. One of the key useful inputs of this paper towards the current research is the development of a practical model for an innovation cluster which incorporates and defines a set of proposed intangible and tangible elements that conform an innovative cluster. It highlights the elements that are problematic for Latin America, as well as the basic elements found in a mature cluster in a developed country; this model could be used as a base to develop the regional or metropolitan innovation system model.

3.1.6 Clusters Research in Mexico

In Mexico a project developed by the Universidad Nacional Autónoma de Coahuila, in charge of Dr. Alejandro Davila Flores, was realized to develop a system with geographical information about the different clusters in Mexico. The project had the following objectives:

1) To identify the industrial clusters in the 56 most important metropolitan areas and the definition of indicators to evaluate their economic performance.

2) Develop the same analysis mentioned in point one for the five main geographical areas in which Mexico is divided.
3) Develop an information system to be able to capture, track and analyse industrial clusters at: 1) the country level, 2) the five regions in which Mexico is divided, 3) the 32 States and 4) the 56 most important metropolitan areas.

The development of this information system is linked with the Plan for Business Development (2001-2006) developed by the government to strength the productive value chains in the country. The development of this IT system can answer the following questions:

1) Which are the main existing industrial clusters in Mexico?
2) How are the value chains integrated?
3) Which is their performance?
4) Where are they located?
5) How to identify opportunities for their development?

Another study was realized by the Universidad Nacional Autónoma de Mexico (UNAM) in 1998, to assess the effectiveness of present industrial and technological policies and prepare recommendations to adjust them to the needs of companies, specially SME’s. In this study, nine workshops were done in 9 different states, where entrepreneurs were invited to analyze their main needs for support instruments for the government. Any particular cluster was analyzed, nevertheless the main results definitely affect in a negative way the possible formation of innovative clusters: 1) lack of linkage between educational systems and the enterprise, 2) lack of training, 3) lack of entrepreneurial culture, 4) excessive tax burden, 5) tax incentives are virtually not existent, 6) fiscal procedures are long a bureaucratic, 7) lack of information about SME’s support instruments, 8) lack of information about private and public markets needs, 9) Very high interest rates, 10) no specific infrastructure and industrial policy for different sectors, 11) lack of clarity of economic programmes and problems with technological assistance, among others. On December 2002 the OECD together with the Mexican government organized a joint conference named “International Public Private Partnerships for Innovation”. During this conference the Director of the Mexican National Council for Science and Technology (CONACYT), Jaime Parada, stressed that Mexico requires strong public private partnerships in order to fund and develop high tech enterprises and industrial clusters.
3.1.7 Cluster Analysis done by the OECD, UNIDO and World Bank

Other organizations such as the OECD, United Nations Industrial Development Organization (UNIDO) and the World Bank carry out research and studies about innovation clusters. Since 1993, UNIDO, through its Private Sector Development Branch, has developed an approach to help government and the private sector to cooperate in the design and implementation of programmes to promote the organisation and development of clusters and networks of SMEs. The programme draws lessons from the experience of successful clusters and it implements them through technical cooperation projects in various developing countries. Some of the countries where this approach has been introduced are India, Indonesia, Malaysia, Mexico, Nicaragua, Honduras, Jamaica, Bolivia, Madagascar, Morocco and Tunisia.

3.2 The Importance of Innovation Systems

Technologies are the product of interdependent choices that generate uncertainty. Besides uncertainty there are several technological spillovers derived from informal non-codified knowledge and competencies. The spillovers and the connections they come from the territory; the spatial agglomerations produce advantages for the actors working along winning technological trajectories. Conversion and transfer of knowledge have become critical to both the survival and the advancement of firms and the territorial system of production and innovation (Bramanti and Ratti, 1991). Research institutions, whether within or independent of universities also play a role in transferring technology to existing firms and to generate spin-offs. Proximity is important in the relationship between industry and local research institutions; the ties wear off with distance. It is therefore identified the importance of well established innovation systems for the generation of networks based on the interaction of different institutions and companies for collective learning and generation of new knowledge that can therefore enable the formation of new high tech clusters. This section will define the different levels of innovation systems depending on its spatial context.
3.2.1 National Innovation Systems

The rate of technological change in any country and the effectiveness of companies in the global competition of goods and services does not depend simply on the scale of their R&D. It depends on the way in which the available resources are managed and organized, both at the enterprise and national levels. The national system of innovation (NIS) may enable a country with limited resources, to make progress through appropriate combination of imported technology and local adaptation and improvement. The network of institutions in the public and private sectors, whose activities and interactions initiate, import, modify and diffuse new technologies (Freeman, 1987).

The elements and relationships which interact in the production, diffusion and use of new and economically useful knowledge and are either located within or rooted inside the boarders of a nation’s state. A National Innovation Systems regards the set of institutions, whose interactions determine the innovative performance of national firms (Lundvall, 1992). The national institutions determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country. The characteristics of a national innovation system of (NIS) can be summarized as:

- Firms are part of a network of public and private sector institutions whose activities and interactions initiate, import, modify and diffuse new technologies
- A NIS consists of linkages (both formal and informal) between institutions
- A NIS includes flows of intellectual resources between institutions
- Analysis of NIS emphasizes learning as a key economic resource and that geography and location still matter

The national innovation systems approach has been introduced in the late 1980s (see Freeman (1987), Dosi et al. (1988)) and further elaborated in the years thereafter (see Lundvall (1992), Nelson (1993), Edquist (1997)). A national innovation system can be perceived as a historically grown subsystem of the national economy in which various organizations and institutions interact and influence each other in the carrying out of innovative activity. In the NIS approach, innovative activity is usually analyzed in a broader sense: Instead of focusing solely on the number of introduced
product and process innovations in a country, it encompasses also research and development efforts by business firms and public actors as well as the determinants of innovation like, for instance, learning processes, incentive mechanisms or the availability of skilled labour.

The national innovation systems approach reflects the increasing attention given to the economic role of knowledge. Here, the emphasis is on mapping knowledge flows as a complement to measuring knowledge investments. These flows, particularly of knowledge “codified” in publications, patents and other sources, are both increasing and becoming easier to detect due largely to information technology. The intent is to evaluate and compare the main channels for knowledge flows at the national level, to identify bottlenecks and to suggest policies and approaches to improve their fluidity. Put simply, this involves tracing the links and relationships among industry, government and academia in the development of science and technology (Markus Balzat, Horst Hanusch, 2002).

3.2.2 Regional Innovation Systems

On the other hand, a Regional Innovation System is the set of economic, political and institutional relationships occurring in a given geographical area which generates a collective learning process leading to the rapid diffusion of knowledge and best practices (Nauwelaers and Reid 1995). In a learning economy innovation is basically understood as an interactive learning process, which is socially and territorially embedded and culturally and institutionally contextualized. This conceptualisation of innovation means an extension of the range of branches, firm sizes and regions that can be viewed as innovative, also to include traditional, non R&D intensive branches.

In a learning economy, which indeed also is a knowledge based economy, competitive advantage is based on exploitation of unique competencies and resources. A firm or a region competes on the basis of what they have which is unique in relation to their competitors. A strategic perspective in the contemporary global economy is, thus, how to develop such unique competencies and resources in order to foster competitiveness based on competitive advantage.
The concept of regional innovation system (RIS) is an important tool for analysing the regional performance in the learning economy which appeared in the early 1990s (Cooke, 1992, 1998, 2001), a few years after Chris Freeman first used the national innovation system concept –originally developed by Bengt Åke Lundvall in his analysis of Japan’s blooming economy (Freeman, 1987). **Characteristic for a systems approach to innovation is the acknowledgement that innovations are carried out through a network of various actors underpinned by an institutional framework.** This dynamic and complex interaction constitutes what is commonly labelled systems of innovation (Edquist, 1997), i.e. systems understood as interaction networks (Kaufmann and Tödtling, 2001). A set of variations on this approach have been developed over time, either taking territories as their point of departure (national and regional) or specific sectors or technologies (Fagerberg et al., forthcoming).

Here clusters come into the picture. **Industrial clusters and RIS are indeed closely related.** In order to delineate the concepts Bjørn, 2004 argues that it is essential to acknowledge the sector specificity of clusters as well as the high density of functionally related firms as a necessary cluster condition. It is commonly argued that clustered firms enjoy advantages in terms of innovation performance through processes of localised learning. A RIS can in principle stretch across several sectors in the regional economy and is more lenient in terms of necessary conditions: as long as there are firms and knowledge organisations that interact systematically, a RIS can be identified. This means that clusters and RIS may coexist in the same territory and the regional innovation system may in fact contain several clusters. **Thus, one hypothesis to be analyzed and tested during the research is the possible generation of new high tech clusters, whose members generate new knowledge and learn in a collaborative environment, is highly related to the current regional innovation system setting.**

### 3.2.3 Metropolitan Systems of Innovation

Another important innovation system to be taken in consideration is the city. There is increasing evidence that metropolitan regions tend to be the principal engines of industrial innovation and growth in national economies (Manfred M. Fisher, Javier Revilla Diez, Folke Snickars, 2001). These territories tend to bring about a large share of
outcomes that are considered as accomplishments of national systems of innovation (see, for example, Oinas and Malecki 1999). Indeed they offer firms spatial, technological and instrumental proximity as well as specific resources whose exploitation generates significant externalities. The opportunities offered by metropolitan regions essentially fall under two headings:

1) Supply of factors of production infrastructure: Such factors include the quality of available labour (existence of pools of labour with agglomeration specific skills and forms of habituation), the availability of capital (for example, the existence of venture capital institutions), communications and research infrastructures (for example universities and research institutes), or socio-cultural infrastructures that are often crucial to the effective operation of the entire economic system.

2) Quality of the regional industrial fabric in terms of subcontractors and suppliers of input: Full exploitation of technological opportunities requires a satisfactory division of labour between small and large enterprises as well as the co-presence of many different kinds of producers offering specialized inputs and services in timely and flexible response to needs as when they arise.

As it will be defined in the next sessions, the two systems under study are Monterrey in Mexico and Milan in Italy, thus the most precise innovation system to be taken in consideration will be the Metropolitan System of Innovation.

3.3 Learning and Proximity, the Innovative Milieu Concept

One main motivation of the research is to understand how the different actors in an innovation system interact towards collective learning and knowledge transfer. This need to understand how can an innovation system provoke, motivate and enable collective learning needs the definition of another important concept: The innovative milieu. According to the GREMI group, an innovative milieu is the set of relationships that occur within a given geographical area that bring unity to a production system, economic actors, and an industrial culture, that generate a localised dynamic process of collective learning and that act as an uncertainty-reducing mechanism in the innovation process’ (Camagni, 1995, p. 320).

In the case of the City, another relevant situation may emerge: the presence of the Urban Milieu, a network of informal or selected linkages developed around a
specialization sector or filière, developing inside the Urban Context or Urban Production System. Empirical evidence suggests that many cases exist of those Milieus or Innovative Milieux which characteristically exploit an urban atmosphere (and therefore an urban location), without implying that the entire city behaves like a Milieu.

Still adopting a dynamic approach and the aim of interpreting innovation processes, existing literature attributes to the city some characteristics that may assign to it a dynamic comparative advantage. In fact, urban competitiveness and its continuous recreation in time may be linked to the following elements:

a) The city is the natural location site of production services, a sector which is responsible for the level of the efficiency of the local industrial sector. According to Thompson (1968): the economic base of the larger metropolitan area is the creativity of its universities and research parks, the sophistication of its engineering firms and financial institutions, the persuasiveness of its public relations ad advertising agencies, the flexibility of its transportation networks and utility systems, and all the other dimensions of infrastructure that facilitate the quick and orderly transfer from old dying bases to new growing ones.

b) The city is a natural location site of SMEs which are by definition the Schumpeterian innovation agents.

c) The city is a natural location site of industries and products in the early, pioneering phases of their life cycle.

d) Metropolitan areas play a major role in the phases of radical reconversion and rejuvenation of products, when a strict interaction is demanded among different functions of the firm, usually spatially dispersed: engineering (mastering of technologies), R&D (mastering of products), marketing (mastering of demand) (CAMAGNI, 1988): the city supplies a location for all these functions.

But more generally, the Milieu paradigm suggests a new approach to urban development policies, linked to new forms of urban governance: the creation of synergy networks among the main actors and the building of a shared vision for the future. Utilising a metaphor coming from the big company, the city should engage:

a) In the development of strong linkages with its customers (residents and firms) enhancing their participation in the planning and programming process inquiring about their explicit or implicit demands.
b) In the development of strong and transparent linkages with its stockholders, professionals, building societies developers, etc.

c) In the development of cooperative agreements with other relevant partners, like the national of the regional governments, the universities, the research centres, engaging in different forms of contacts.

**The learning city is on fact a studying city or a knowledge city but a city experiencing:**

a) Processes of administrative and organisational learning, mainly in the field of management of complex urban projects (continuity is required in offices and civil servants)

b) Learning processes in the management of citizens participation and in consensus building

c) The building of a sense of trust mainly between the public and the private sphere;

d) The construction of a memory of the city regarding:

e) The stock of accumulated knowledge

f) The conception and implementation of big planning and economic schemes

**4 Motivation for the Research**

One of the key insights of modern innovation theory is that innovation is systemic, in the sense that firm-level innovation processes are generated and sustained by inter-firm relations, and by a wide variety of inter-institutional relationships. Innovation and the creation of technology involve systemic interactions between firms and their environments: central links include those with customers and suppliers, science and technology infrastructures, finance institutions and so on. Such ideas have been central to the 'national innovation systems' literature which can be extended to the regional case (Wiig and Wood 1995). So the following questions were the main motivations for the research:

- What type of business ecosystem enables innovation at a metropolitan level? Which are the critical factors / elements for success?
- How can a new high tech cluster of companies be seeded in a current low commodity manufacturing city?
• How strong is the relationship between the current metropolitan innovation system and the firms' innovation capacity?
• Which are the current business practices in individual firms that can enable their evolution into high tech sectors?
• How is knowledge created and shared among actors in a metropolitan innovation system?
• How do relationships within a cluster among companies and other institutions (network) increase the innovation capacity and the emergence of new high tech sectors in the metropolitan innovation system?
• How can we measure the potential of a specific metropolitan innovation system to evolve into a high tech region? Is there a “metropolitan cockpit” for innovation to identify trends and draw new policies?
• How to universities impact the current metropolitan system?
• How the Metropolitan Innovation Systems attract high educated people whose talent can enable the development of high tech clusters?
• Could the cities under analysis be considered an urban milieu?

5 Research Framework

One main concept for the PhD proposed research to be carried out is that innovation at a regional/metropolitan level is achieved from:
1) The internal capacity of companies to innovate based on their strategies and internal performance.
2) The way in which the network of suppliers-clients within the metropolitan system of innovation share and generate together new knowledge to facilitate innovation and
3) The set-up of the common innovation infrastructure, that provokes and sustains the innovation environment facilitating the collective learning infrastructure, culture, knowledge and financial means to innovate in a continuous and successful way. The metropolitan system of innovation aggregates the group of interconnected companies and associated institutes into a geographical delimited area, in this case the city. Thus, the main insight obtained after the literature review performed is that to understand why innovation is carried out more successfully at a regional or metropolitan level, the research should integrate a four layer assessment analysis on how innovation is obtained and how performances are linked among them: company, urban
milieu, metropolitan innovation system and global arena. **One hypothesis to be tested in the research is that performance at each level will impact the innovation output of the system as a whole.** The proposed four level assessment be developed in the current thesis is shown in figure 1.

![Figure 1 Framework for Metropolitan Systems assessment](image)

As it can be observed, the concept of Metropolitan System of Innovation provides the governance element that takes in consideration the different actors that need to interact to enable innovation. On the other hand, the Urban Milieu concept focalizes on the processes to enable the collective learning of these actors for the creation of new knowledge and thus later innovation. For the researcher perspective, the presence of these two elements within a city, will therefore provoke the possible formation of new innovative high tech clusters.

### 6 Research Objectives

Under the researcher perspective, there is a need of a common framework/methodology to compare findings of different studies to evaluate both quantitatively and qualitatively the current business environment to identify barriers and strengths towards the formation of new high tech clusters (HTC) in metropolitan innovation systems. Thus the research objectives are to:

1. Propose and validate a metropolitan innovation system model to enable the comparison and analysis of different cities to understand how the synergy of the
actors can increase the innovation success of new and current high tech cluster development. The model will be used and validated to analyse and compare the metropolitan areas of Monterrey and Milan (case studies).

2. Build an understanding and relationship of the issues related to internal company performance, inter-firm co-operation, collective learning and the metropolitan innovation system to increase the innovation capability of the city (survey analysis).

3. Evaluate a sample of high tech companies in Monterrey and Milan.

4. Define which input variables are relevant to describe the innovation capacity defining an econometric model (multiple regression).

5. Analyse and benchmark results.

6. Provide a systematic bottom up approach/methodology based to evaluate and benchmark metropolitan innovation systems to support their upgrading and the development of new high tech clusters, industrial and technology policies. The methodology will provide a survey questionnaire for data gathering and the definition of a metropolitan innovation cockpit based on a set of key performance indicators to measure the current capacity to develop innovative high tech clusters in a city.

7. Propose recommendations for industrial and technologies policies for Monterrey and Milan.

8. Disseminate results to participating companies and

9. Publish findings in an international journal

7 Proposed Research Model

The proposed research will incorporate four different levels of assessments as follows:

1) **The company:** – As it was mentioned before, one of the hypothesis to be validated in this research is that the intrinsic success of an innovation system is related to the performance of each one of the companies that conform it. So, at this assessment level is important to identify the current technologies (processes and skills) and business practices used by companies. Special attention will be taken to 1) the new product development process and it is a key for delivering high tech products and 2) the financing of its current aR&D projects and 3) the formal and informal processes to transfer knowledge internally and externally. It is also important to understand if different companies in the metropolitan innovation system have the similar or
different levels of skilled employees, usage of technology, etc. A basic set of KPIs\(^3\) will be selected to facilitate the assessment and benchmarking analysis at the company level.

2) The Urban Milieu: the objective to assess the network level is to identify how companies interact vertically (buyer/supplier) or horizontally (common customers, competitors, R&D centres) to learn and share information and knowledge in a collective way. Key features of clusters are internal networking, linkages and formal and informal interactions. It is important to identify if the company is part of one or several value chains. It should be also analyzed in what type of collaboration network or alliance does the company participates: supply chain, extended enterprise, virtual enterprise. The methodology should also evaluate the company readiness to join different global value networks in a successful way and how tacit knowledge is exchanged in the network.

3) The metropolitan innovation system (MIS): For this level a metropolitan innovation system model will be defined to identify the key actors that play an important role to enable the formation of high tech clusters. An interesting aspect to study and analyse is how tacit knowledge is shared among members. On the other hand, to identify the cluster impact at a regional level based on the synergetic integration of the identified actors performance, it is required to carry out a measurement of the macro economical indicators that impact the city. In 2002, the American governors association developed a Benchmarking Guide for Clusters. This guide proposes the measurement of 14 macro factors, each with a set of related measures. Some factors to be measured in this guide are: R&D capacity, workforce skills and availability, education and training, social capital, entrepreneurial climate, innovation and imitation and specialized services, among others. Also, the Harvard Cluster Mapping Project proposes several measurements to map clusters innovation performance.

4) The global arena: It is not big news that the world is global. Products are traded from one extreme of the planet to another as an every day practice. So, it is important to include and assess how external elements or actors impact in both the evolution of both the innovation system and the milieu.

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\(^3\) KPI – Key performance indicators
8 Research hypothesis and relevant variables

The variables to be measured will be related to **innovation capacity** at the

1) company level,

2) the milieu level and

3) the metropolitan innovation system level

The theoretical proposition of the thesis is based on the idea that **the performance of the three levels is highly correlated**. It should not be a surprise that a metropolitan system with many high tech companies employing a highly educated pool of people, applying, for instance, just in time, six sigma and concurrent engineering concepts with its customers and suppliers, using a clear new product process with defined milestones and goals, doing projects with universities and using available industrial policies that enable innovation, will have a higher possibility to be successful. The other interesting point to analyze is that once a several companies located in an specific product/service are successful, this innovation system will tend to become a pole and attract other companies interested to deliver and compete in the same sector. At the same time, the metropolitan innovation system is determinant for the innovative cluster growth and development. Thus, the research will identify the main similarities and differences of innovation results between high tech clusters in Monterrey and Milan. Table 2 shows the main research hypothesis to be validated during the study and some identified variables to be measured in each level.
1) Company Level

Hypothesis 1: high tech companies that employ an educated pool of human resources dedicated to R&D, invest in research and development, benefit from existing public subsidiaries and use a formalized new product development process and scorecard, are expected to accomplish a higher innovation success.

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>COMPANY INNOVATION OUTPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Total no. of employees</td>
<td>• New Patents and Copyrights</td>
</tr>
<tr>
<td>• Number of Employees in R&amp;D</td>
<td>• Number of new high tech products developed</td>
</tr>
<tr>
<td>• Level of education of employees working in the company</td>
<td>• Number of processes improved (Business Process Re-engineering)</td>
</tr>
<tr>
<td>• Current investment in R&amp;D as percentage of sales</td>
<td>• Total Sales</td>
</tr>
<tr>
<td>• Current Lean practices (TQM, JIT, Concurrent Eng)</td>
<td>• Innovation Sales (new high tech products in the 5 years)</td>
</tr>
<tr>
<td>• Public Subsidiaries (taxes, resources of R&amp;D projects)</td>
<td>• New Jobs Generated</td>
</tr>
<tr>
<td>• Formalized New Product Development process &amp; scorecard</td>
<td>• Markets: No. of customers in:</td>
</tr>
<tr>
<td>• No. of times specialized training is provided to R&amp;D employees per year.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Region &lt; 50 Km</td>
</tr>
<tr>
<td></td>
<td>• Nation &gt; 50 km</td>
</tr>
<tr>
<td></td>
<td>• International (outside country)</td>
</tr>
</tbody>
</table>

2) Urban Milieu Level

Hypothesis 2: high tech companies that develop projects with a network of suppliers-customers-institutions and develop a collective learning processes are expected to have higher innovation success and develop new knowledge that will impact the metropolitan innovation system and the formation of new high tech clusters.

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>NETWORK INNOVATION OUTPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Number of R&amp;D projects done with external partners in the cluster and outside the cluster:</td>
<td>• New Patents and Copyrights</td>
</tr>
<tr>
<td>• Suppliers</td>
<td>• Number of new high tech products developed</td>
</tr>
<tr>
<td>• Clients</td>
<td>• Number of processes improved</td>
</tr>
<tr>
<td>• Research Institutes/Labs</td>
<td>• Total Sales</td>
</tr>
<tr>
<td>• Average number of different partners participating in the innovation</td>
<td>• Innovation Sales</td>
</tr>
<tr>
<td>• Level of education of persons participating in joint projects</td>
<td>• New Jobs Generated</td>
</tr>
<tr>
<td>• Usage of communication technologies to enable collaboration (ERP, web based platform, other)</td>
<td>• Markets: No. of customers in:</td>
</tr>
<tr>
<td>• Usage of concurrent engineering concepts</td>
<td></td>
</tr>
<tr>
<td>• Type of alliance (SCM⁴, EE⁵, VE⁶)</td>
<td>• Region &lt; 50 Km</td>
</tr>
<tr>
<td>• Number of competitors in the cluster</td>
<td>• Nation &gt; 50 km</td>
</tr>
<tr>
<td>• Current investment in R&amp;D joint projects</td>
<td>• International (outside country)</td>
</tr>
<tr>
<td>• Practices in which new knowledge is developed and distributed</td>
<td>All these indicators relate to networked projects:</td>
</tr>
</tbody>
</table>

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⁴ SCM = Supply Chain Management, that could be seen as the basic type of collaboration among companies

⁵ EE = Extended Enterprise, is a more advanced level of collaboration, suppliers and customer are more integrated and in many cases share strategies and goals
3) Metropolitan Innovation System

**Hypothesis 3:** The availability and synchronization of different activities developed by different key actors in the Metropolitan Innovation System, will increase the development of new high tech start ups and jobs supporting the development of new high tech clusters in a region

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>METROPOLITAN INNOVATION SYSTEM OUTPUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Number of universities</td>
<td>Note: All these indicators relate to region under analysis</td>
</tr>
<tr>
<td>• Number of public R&amp;D centres</td>
<td>• Number of High Tech companies in the region</td>
</tr>
<tr>
<td>• Number of incubators and Science parks</td>
<td>• Number of new High Tech companies per year</td>
</tr>
<tr>
<td>• Number of specialized consulting</td>
<td>• Total employment by high-tech industries in the region</td>
</tr>
<tr>
<td>• Regional public expenditure on innovation projects</td>
<td></td>
</tr>
<tr>
<td>• Interest rates</td>
<td>Note: This level of information will be obtained at the case study research, where as level 1 and 2 at the survey analysis.</td>
</tr>
<tr>
<td>• Number of SME’s in the region supplying high tech inputs to OEMs (national or international)</td>
<td></td>
</tr>
</tbody>
</table>

| Qualitative description                                                |                                                                                                        |
| • Tax Incentives                                                       |                                                                                                        |
| • Intellectual Property Laws                                           |                                                                                                        |
| • Level of quality of life                                             |                                                                                                        |
| • Industrial Policies                                                  |                                                                                                        |

**Table 2.** Proposed input and output variables of each assessment level and the corresponding research propositions

9 Identifying relationships among variables of the Multilayer Innovative Cluster Assessment

At a simple glance it can be said that trying to understand how the three levels are interrelated and how to measure this is not an easy task. Thus, there is a need to define a unique output variable that can be the main result of having on place a metropolitan innovation system supporting the development of new high tech companies and enabling the networking among them. The main proposed output result is: **Successful High Tech New Products launched in the global marketplace done in networked projects with partners within the metropolitan system and also external that create an innovative milieu for the collective learning process.** Some inputs to be considered are: **knowledge, capital, networking and policies.** An initial model realized as a first insight to understand the three levels linkage is shown in figure 2.

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6 VE = Virtual Enterprise, this type of collaboration focuses on temporal relationships, where partners share their core competencies to exploit a business opportunity, usually a new product development.
Figure 2. Proposed main input and output variables to be analyzed to understand the innovation loop within a region to enable the formation of high tech clusters

10 Research Methodologies and Research Agenda

The core final output of the research is to provide a new systematic bottom up approach/methodology based on a three level analysis to assess and benchmark metropolitan innovation systems to support the development of new high tech clusters. The development of such method requires a clear understanding of the proposed three levels in the proposed research model. The selected methodologies will be:

1) Case Studies: one proposed initial task is the development of a metropolitan innovation system model that can facilitate the understanding of the actors needed to enable the formation of new high tech clusters in a region. Once the model is finished, it will be used and validated by developing two case studies (based on interviews) in Monterrey and Milan.

2) Survey: During the development of the case studies a survey questionnaire will be developed. The survey will be created to obtain quantitative information and be able to analyse the current business practices and performances at the company level and how
do they interact with other companies and institutes in the city (the metropolitan
innovation system). Thus this survey intends to support the research of the company
and milieu levels. Due to costs and times, surveys will be only focused in 1 city in Mexico
and 1 city in Italy, and the expected sample will be of at least 50-60 enterprises. Surveys
will be carried out with face to face interviews.

3) **Econometric Model:** This research method will be used to develop a multiple
regression model which will try to explain how key inputs and outputs variables at the
three levels of the proposed assessment model interact to obtain as a main result:
Successful High Tech New Products developed by high tech clusters in the metropolitan
areas selected. Some inputs to be considered are: knowledge, capital, networking and
policies. So, a multi regression model will be developed, tested and analyzed. The data
obtained from the surveys realized will be used for this analysis. The dependent variable
Y will be related to k interdependent variables capable to determine the innovation
capability of a company in relation to variables related to the milieu (knowledge transfer
and collective learning) and the current metropolitan innovation system in which it is
located. The information to develop this model will also be obtained from the information
obtained from the surveys.

The Case Studies to analyse the Metropolitan Innovation Systems in Monterrey and
Milan will be developed approximately in six months. Face to face interviews will be
carried out with the different key actors identified of the Metropolitan Innovation System
(universities, chamber of commerce, consulting companies, banks, etc).

Regarding the survey method, the questionnaire design will be started in June 2004, the
survey questionnaire to start the interviews should be finished by October 2004.
Companies will be contacted (a letter, executive summary of the project and a letter for
confidentiality agreement will be sent to companies) by November 2004. As in the case
of the case studies, a 4-6 weeks trip is planned to the city of Monterrey for the survey
face to face interviews with the randomly selected high tech companies. The plan is to
finish the survey face to face interviews at the latest by April 2005, to start the data
analysis and deliver the survey reports. The PhD written thesis is planned to be
delivered by the end of March 2006.
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