

**Public policy, intermediaries and innovation system performance:
A comparative analysis of Quebec and Ontario**

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ABSTRACT

Knowledge has become a fundamental resource of production in the economy; a major element for the innovation and the competitiveness of firms, regions and nations. This knowledge is available through the interactions between firms themselves and also with others organizations and stakeholders. These interactions often occur in places known as clusters and one of the main roles of the public bodies in economic development is to create a favourable environment to foster industrial and social development. Following the growing interest for industrial clusters, many regions have considered it as an interesting tool for public policy but in many cases, public policy has not integrated the knowledge of citizens or other stakeholders. Among these actors, we find what we call intermediary organizations (for example, professional associations, chambers of commerce, community organizations, and various new forms of governance networks), that contribute to the creation and the support of social dynamics within the networks of innovations and could be used more extensively in order to enhance public policy and introduce innovation in the public sector. In this article, we consider the role of the organizations on the meso level and we do a regional comparison in order to investigate the role of the intermediaries. We use the data from the survey of innovation done in 2003 by Statistics Canada in order to compare Ontario and Quebec, centering our analysis on the information and communication technologies (ICT) sector which is one of the most innovative in Canada. Our results show that the innovation performance relies on sources of information and high skilled labour to innovate. Also important are factors such as: The proximity of the universities and research laboratories, the presence of local and regional industrial associations, the presence of venture capital organizations, the presence of governments' organizations, as well as government financial assistance for research and development, but also new rules that meet the firm's needs for intellectual protection. These are elements on which cluster policies should thus be centered. In such a context, cluster policies appear particularly pertinent, as this is one of the possible forms of public intermediation to be considered.

Keywords: Cluster policy, innovation system, intermediary organizations, governance networks.

Introduction

Knowledge has become a fundamental resource of production in the economy; a major element for the innovation and the competitiveness of firms, regions and nations. This knowledge is available through the interactions between firms themselves and also with other organizations and stakeholders that occur in places known as clusters. One of the

main roles of the public bodies in economic development is to create a favourable environment to foster industrial and social development. Following the growing interest for industrial clusters, many regions have considered it as an interesting tool for public policy, and they have been created in various environments, including the City of Montréal (Klein and Tremblay, 2010; Tremblay and Cecilli, 2009; Britton, Tremblay and Smith, 2009). The theoretical contributions that are usually cited in the literature to explain the creation of clusters are based either on the concept of 'industrial districts' introduced by Marshall (1994 [1890]), or on the competitiveness of local industries developed by Porter (1990) with his study on the competitiveness of the nations or on the concept of 'Milieux innovateurs' from the Groupe de Recherche Européen sur les Milieux Innovateurs (GREMI).

For Marshall (1994 [1890]), as the large factories are less effective and less flexible, it is necessary for public policy to try to support firms in adapting to the new economic context, and to try to divide the production process into several parts that can be done by small specialized firms. When these firms are localized in a geographical area, they tend to collaborate together. The result of this agglomeration of firms is the 'cluster' or the 'industrial district' and allows the firms to benefit from externalities like reducing cost of production, availability of the infrastructures, the services and knowledge. Porter explains the cluster phenomenon by the needs for the firms, regions and nation to remain competitive in order to survive in the economy. He argues that clustering is a strategy, which will enable the firm to profit from competitive advantages in particular by increasing their productivity and their ability to innovate. However, this clusterization process often does not occur spontaneously and it is necessary for public policy to intervene to support such developments.

The approach of 'milieu innovateur' is another approach which uses the territory or the 'milieu' to explain the cluster phenomenon. This approach allows a broad understanding of the cluster, which includes not only firms but also different actors from the public sector. The GREMI group defines the 'milieu' as a group of relations that occurs in a geographical area with a system of production, a specifically culture and actors (Maillat, Crevoisier and Lecoq, 1993: 4). In this approach, the cluster is the result of the 'milieu'. It develops because the 'milieu' allows networks that create interdependences and cooperation between the different actors. We integrate the 'milieu innovateur' approach with the the innovation system approach (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Edquist, 2001; Edquist and Jonhson, 1997) in order to analyze the cluster. An innovation system could be analysed at the national, local, sectoral or technological level. Hence, we consider the cluster as a microsystem of innovation or reduced-scale national innovation system (Roelandt and den Hertog, 1999).

The literature on innovation system also shows that the microsystems of innovation or clusters appear particularly in the 'learning regions', which is a concept introduced by Florida (1995, 1998) and Baumfeld (2005) to emphasize the learning process that occurs inside a region but also within a cluster. This learning process occurs due to the diversity of social actors and stakeholders that collaborate together. The actors inside the cluster

come from the private and the public sector. Among the actors that come from the public sector, we find the professional associations, the governmental economic agencies (e.g. Federal Business Development Agency), research institutions and venture capital organizations. At the regional level, these organizations contribute to the creation and the support of dynamics within what can be considered as networks of innovations. These organizations are also called ‘the intermediaries organisations’ defined by Howell (2006: 720) as:

an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties. Such intermediary activities include: Helping to provide information about potential collaborators, brokering a transaction between two or more parties, acting as a mediator, or go between bodies or organizations that are already collaborating and helping find advice, funding and support for the innovation outcomes of such collaborations.

Because it is crucial for public policy to better understand the effectiveness of clusters, our paper centers on the role of these intermediary organizations (or governance networks or bodies). The principal aim of this study is to investigate whether the intermediaries really influence the innovation systems’ performance which we will evaluate qualitatively later on in this paper, by using the theoretical concept of the technological regimes (Nelson and Winter, 1982) and by focusing on the functions fulfilled by the organizations.

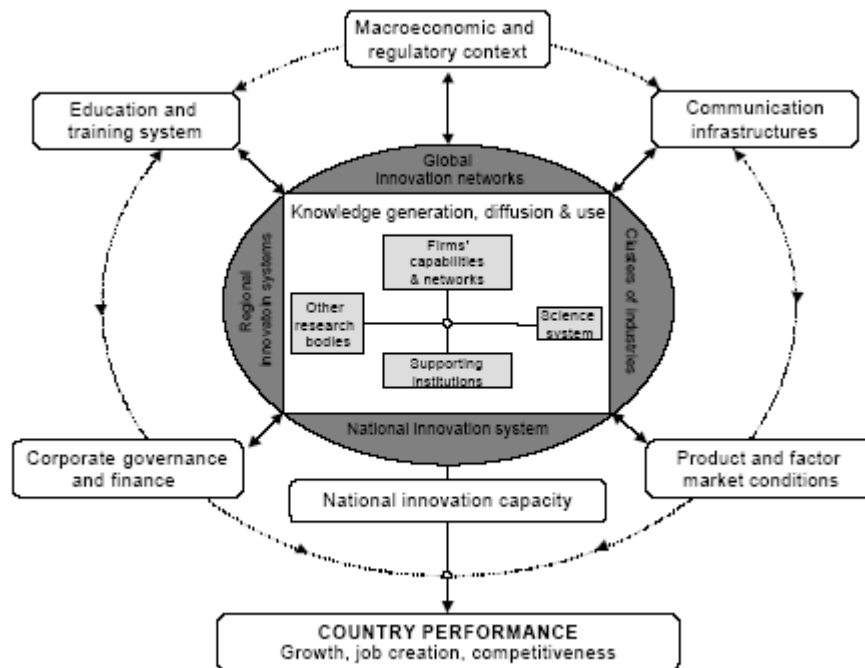
To our knowledge, very little research has been done on the relation between the role of the intermediaries and the performance of innovation in the microsystems or clusters, although some research was done within some sectors (Britton, Tremblay and Smith, 2009). Other authors have been focusing on innovation performance by comparing clusters within different regions (Spencer et al., 2010). One part of this literature has tried to identify these intermediaries and to describe in a theoretical way their role in the process of innovation (Doutriaux, 2003; Howell, 2006), while others have shown that these roles differ according to the macro, meso or micro level (Smedlund, 2006). In this article, we consider the role of the organizations on the meso level and we do a regional comparison between the Canadian provinces of Ontario and Quebec in order to investigate the role of the intermediaries by focusing on the information and communications technology (ICT) cluster. Our aim is also to determine if an innovative collaborative policy such as the cluster policy can be useful to implement and produce innovative results in the process of public policy development. By cluster policy we mean all public initiatives or incentives, that contributes to the development of the cluster (for example subsidies, infrastructure development, incentives for industry-university collaboration, tax credit associated with a particular location, etc.). In order to test this hypothesis, we use the 2003 survey of innovation of Statistics Canada¹ and focus on the information and communication technologies (ICT) sector. In the next section, we will define more precisely our theoretical framework.

¹ The latest innovation survey that focuses on the entire ICT sector

Role of the intermediaries and the performance of the microsystem of innovation

In the literature on innovation systems, the system is either delimited by considering only the organizations, which intervenes directly in the process of innovation or with the integration of all economic and institutional structures, that intervene or influence the process of innovation. The institutions are the common practices, the routines, the established practices, the rules or laws which control the relations and interactions between individuals, groups and actors (Edquist and Johnson, 1997: 47). Wolfe and Gertler (2003) consider that an innovation system at the national level include several elements that are the private firms (R&D performers); the science and technology infrastructure; the government programs; the networks to facilitate knowledge and technology transfer; the education and training system; and the financial system for technology financing (see figure 1).

Figure 1: National innovation system

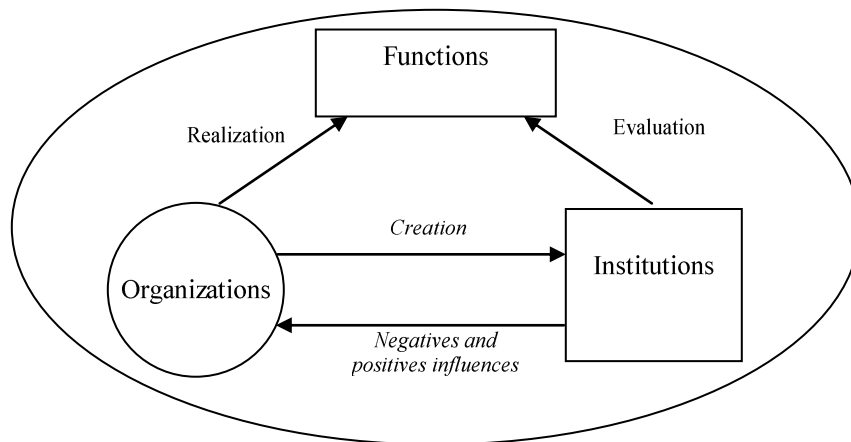


Source: Wolfe, D. and Gertler, M. Policies for Cluster Creation: Lessons from the ISRN Cluster Initiative, ISRN National meeting presentation, Ottawa, 2003, page 5.

In this paper, we consider only the organizations that participate in the innovation process of the firm, going from the idea to the commercialisation of a new product. We consider an

innovation as a new commercialized product or a new manufacturing process. Moreover, as the firms don't innovate alone, we take into account the learning interaction that occurs inside (e.g. learning between employees) and outside (e.g. knowledge transfers with a university) the firm during the process. The organizations and the institutions are the components of the innovation system where three relations (Edquist, 2001) can be observed. These relations can be between the organizations, the organizations and the institutions, or the institutions themselves. Two organizations could have a market or non-market relation. The non-market relation usually allows to exchange for example tacit knowledge that is not available with market transaction. The relations between the organizations and the institutions are another type in the innovation system. The organizations fulfill different functions in the system that can be used by the institutions to evaluate them even if these institutions are created by the organizations (see figure 2). There is also a last type of possible relation, which is between institutions.

Figure 2: Microsystem of innovation



In this paper, we evaluate the microsystem in the ICT sector in two ways: First we base our performance evaluation on the availability of the essential resources for the innovation. For this, we use the theoretical concept of the technological regimes (Nelson and Winter, 1982). A technological regime is based on opportunities and appropriability conditions, the accumulation of knowledge and the characteristics of the knowledge base (Malerba and Orsenigo, 1990, 1993, 1997). The opportunities conditions determine the probability of the firms to innovate. Opportunities include the presence of sources of innovation such as the universities or research laboratory and an intense research and development. The appropriability conditions are the possibilities of protecting the innovation from the imitation. Moreover, we integrate the tacit knowledge, which is particularly essential for the innovation and which is an embodied knowledge. As the competences become also

important for the innovators then the availability and the retention of competences or talents (Florida, 2002) is essential to allow the firms in the microsystem to innovate. To sum up, we consider in this paper that innovation performance in the microsystem or cluster relies on the opportunities and appropriability conditions, on the competences, and the institutional environment. Therefore we make the following proposals:

Proposal 1: The performance of the microsystem of innovation depends on opportunities and appropriability conditions.

Proposal 2: The performance of the microsystem depends on the availability of competences, the interactive learning, and the institutional environment.

As mentioned above, the organizations that are in the microsystem realize some activities, which are the functions of the system. Then, the second way we evaluate the performance of the microsystem is to see whether these functions are fulfilled correctly. The principal activities that are realized by the organizations include the supply of necessary resources for innovation (Johnson and Jacobsson, 2000)² and this is shown in the literature. A first group of researchers consider that these organizations, particularly the intermediaries play the role that consist in information diffusion, technology transfer and giving different kinds of support to the firms, while another group asserts that the principal role of intermediation is to fulfill the function of collecting, analyzing and communication of the information (Howells, 2006). The diffusion and the technology transfer include the following activities: Transmission of information, support in the decision-making, evaluation of new technologies, identification of the partners, technology transfer etc. Finally, the intermediaries support the firms in adapting the innovations to their specific needs, in being able to keep relations between the actors of the technological system.

In relation with this territorial dimension, Smedlund (2006) associates the role of the intermediaries to the regional dynamics, which are defined as: “The networks of production, development and innovation.” Dynamics are based on tangible and intangible flows within the region that would not be possible without the networks or clusters, and their interactions. For Smedlund, the intermediaries contribute to the creation and the support of dynamics within the networks because they help in the formation of strategies of innovations between the actors, the attraction and the retention of large firms with high intensity of Research & Development. The case studies done on the multimedia sector (Britton, Tremblay and Smith, 2009; Tremblay, Chevrier and Rousseau, 2004) illustrate well these roles. Finally, the intermediaries stimulate the social dynamics, which allows the creation, the evolution and the development of the microsystem because they support the diffusion of the information and the improvement of the knowledge base of the firms, the availability of competences and the continuous learning through interactions. We thus put forward the following additional proposals:

² Cited in Edquist, 2001.

Proposal 3: The intermediaries have a positive impact on the opportunities and appropriability conditions.

Proposal 4: The intermediaries have a positive impact on the availability of competences, on the learning and the institutional environment.

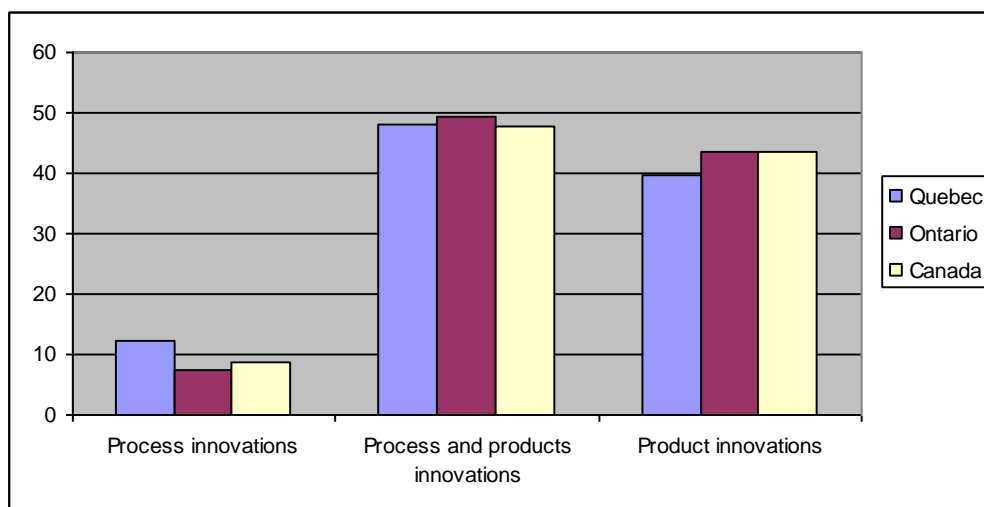
Proposal 5: The intermediaries have a positive impact on the performance of the system (consequence of proposals 3 and 4).

These proposals will be evaluated thereafter in our case study.

Case study: the Comparative Cases of Quebec and Ontario

The ICT sector is one of the most important parts of the Canadian national economy. It contributes significantly to the GDP and is also an important source of jobs. The proof is that during 1977 to 2000, it's part of the GDP increased by 19 % compared to 5.1 % for the whole Canadian companies (Statistics Canada, 2005: 190). Moreover, in 1999, this sector created 3.9 % of the jobs in the whole economy. According to Statistics Canada (2003: 12), the sub-sector of the services is more dynamic than the manufacture one in the ICT industry. The growth of the sector of the ICTs was primarily due to the services during 1997 to 2003 when its part of the GDP passed from 3 % to 4.6 % compared to the manufacture sub-sector, which passed from 1% to 0.8 %. At the provincial level, Ontario and Quebec are the most important contributors in Canada in this sector with the incomes generated (respectively 40.1 % and 24.7 % of the incomes in 1999). That's why we chose these two regions for our comparative study.

Figure 3: Type of innovation by region



Source: Statistics Canada, Survey of innovation 2001-3

Our research is based on the innovation data from the 2003 Survey of Statistics Canada in the ICT services industry, to which we had access. The survey questionnaire is based on the indicators recommended in the Oslo Manual. The sample was built by considering only the establishments, which have 15 employees or more and 250000\$ of incomes. Therefore, out of a population of 4504 companies in the sector of the services, the sample concerned 1359 establishments. In this survey, the establishments, which are defined as innovators, are those that have introduced a new product in the market or have improved their process or built a new one during 2001 to 2003. We do a comparative analysis of Ontario and Quebec in order to try to explain why a microsystem in a particular region may perform more than another one. In our case, the analysis of the performance in product and process innovation shows that Ontario performs slightly better than Quebec when we take together product and process innovations (see figure 3). However, if we consider only process innovations, then Quebec performs better than Ontario. What explains this lag of performance? That's what we will try to explain in the following sections.

To be able to do that, as said before, we will evaluate the microsystem by analyzing mainly the opportunities and appropriability conditions. To these opportunities, we add the availability of competences and possibilities of learning. To the conditions of appropriability, we add the regulation environment. In the next sections, we will test our proposals. In the first part, we will analyze the conditions of innovation in order to support our proposals 1 and 2 and this part will be useful in complement of the second part to support our proposals 3, 4 and 5. In the second part, we will determine the role of the intermediaries on the performance of the microsystem. We will try to find out how the intermediaries realize activities or participate in the innovation process and consequently how they contribute to the innovation performance of the microsystem. This second part will allow us to support our proposals 3, 4 and 5.

Conditions of innovation

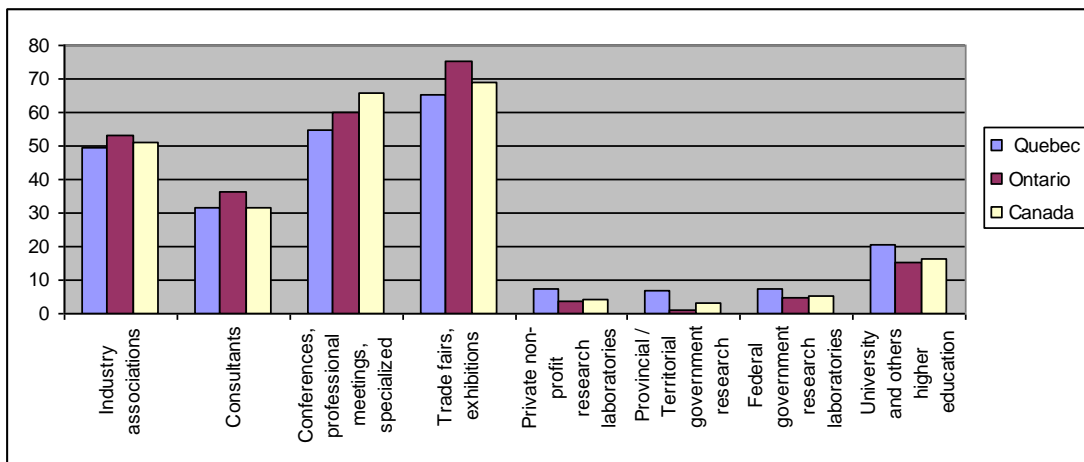
Conditions of opportunities

Figure 4 shows that the sources of information that are most used by the innovators are the trade fairs and exhibitions, the professional congresses and conferences, the business associations, and the consultants. For all these sources of information, figure 4 shows that the percentages are higher in Ontario. Therefore, it is possible to predict that the advantages might be more important in Ontario in terms of the exchanges and the availability of information for the innovation. Consequently, this can be a first explanation of the disparity between Quebec and Ontario in product innovation.

In the knowledge economy, the availability of high level competences and the possibility of improving these competences and of increasing the firm knowledge base in a continuous way with the training is essential for innovation and competitiveness. The regions, which have a quality human infrastructure, have competitive advantages because they are attractive for the firms and in addition because they are a favourable milieu for innovation (Florida, 1995). Figure 5 shows that Ontario has higher competitive advantages than

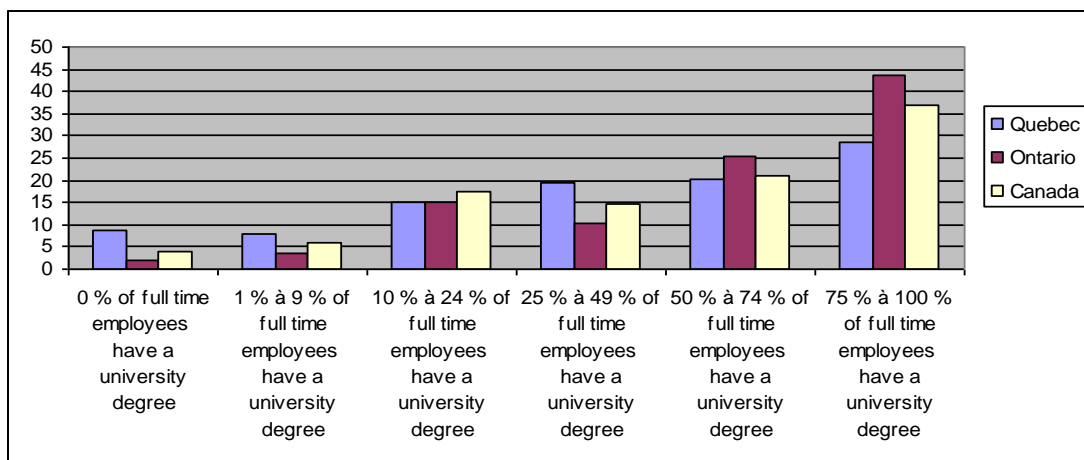
Quebec in term of availability of high quality competences; as the data show there are more employees with a university diploma in Ontario than in Quebec. This can be explained by the fact that Ontario seems to focus more on hiring skilled workers, on the creation of incentives to attract them or to retain them (see figure 6). However, this can also be explained partly by the fact that as it is an English language zone (vs. French for Québec), it is easier to attract qualified workers from abroad; indeed, Toronto is the main destination for immigrants in Canada.

Figure 4: Organizations used as source of information for process and product innovation by innovating firms



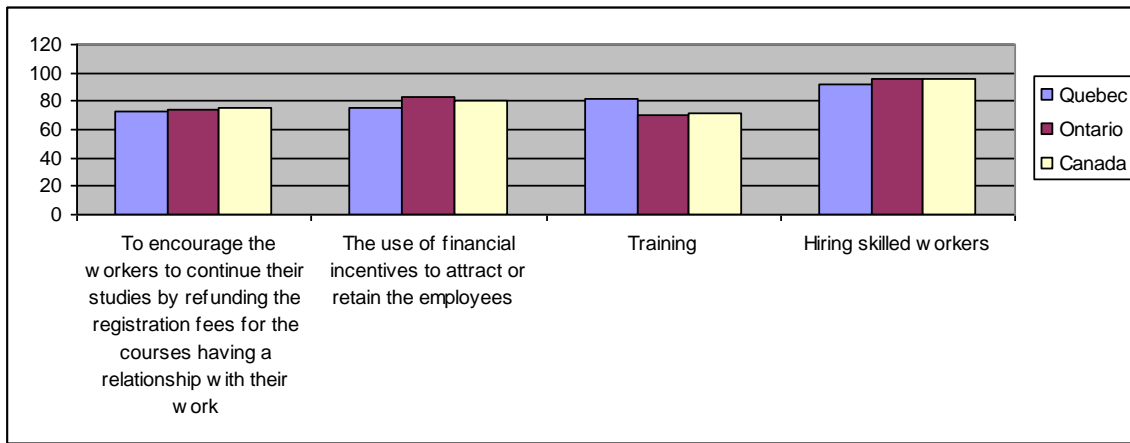
Source: Statistics Canada, Survey of innovation 2001-3

Figure 5: Availability of competences for process and product innovation



Source: Statistics Canada, Survey of innovation 2003

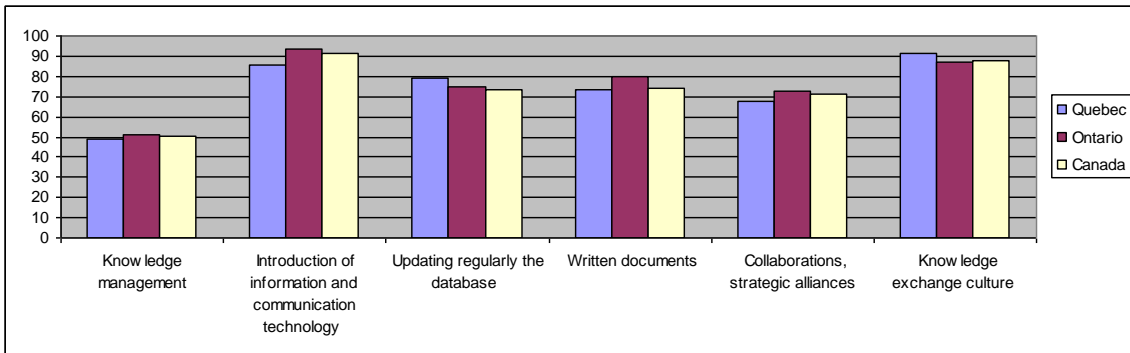
Figure 6: Success factors (medium to high importance) for process and product innovation



Source: Statistics Canada, Survey of innovation 2001-3

This availability of competences helps with the knowledge diffusion through learning, which results in the interactions between employees but also with self-training. From this point of view, figure 7 shows that in Ontario as in Quebec different methods are used for that.

Figure 7: Success factors (medium to high importance) for process and product innovation



Source: Statistics Canada, Survey of innovation 2001-3

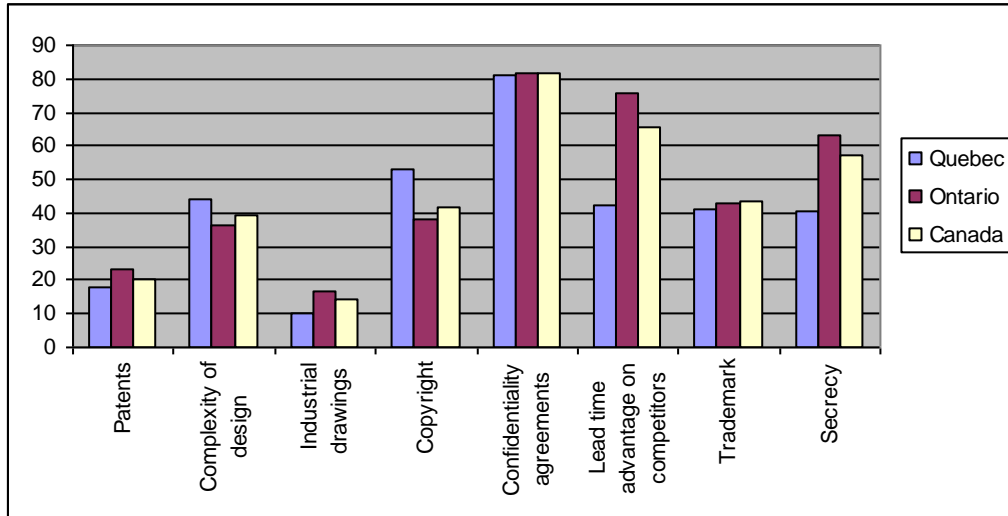
Conditions of appropriability

The method of protection, which is as much cited in Ontario as in Quebec, is the confidentiality agreement. The proportion is slightly higher in Ontario (see figure 8), however, it needs to be stressed that this question stresses more traditional sources of innovation protection, and not so much the new visions on sources of innovation, including

the need for interaction as a means for the diffusion of information. This could be the consequence of a lack of industry wide standards or government standards and regulation. This seems to be the case in Quebec and in Ontario but in a higher proportion in Ontario if we take into account the proportion of innovators, which consider this phenomenon as an barrier or obstacle for innovation (see figure 9).

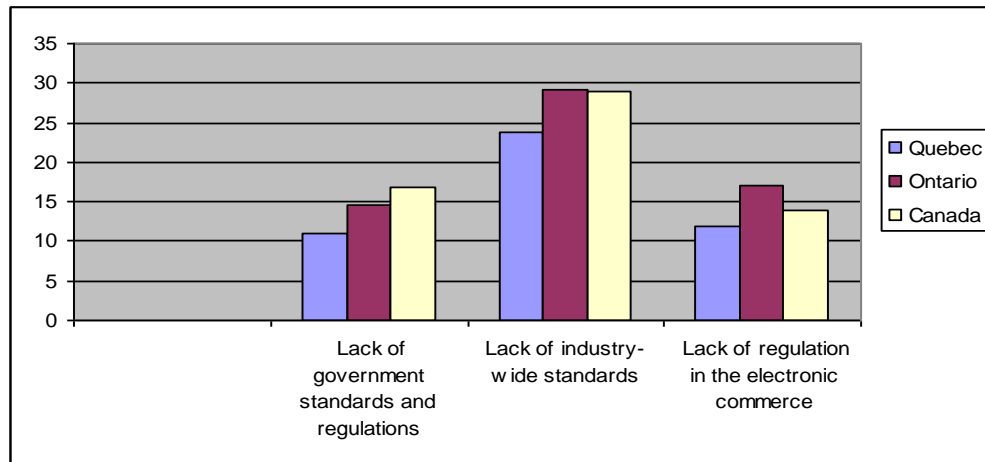
Finally, our analysis shows that the conditions of innovation are more favourable to the performance of the microsystems in Ontario. The opportunities contribute to a better availability of the sources of innovation and competences while the appropriability conditions allow the interaction for the exchange of tacit knowledge; this knowledge, which is more vital for the performance of the microsystem. This analysis seems to show that our proposals 1 and 2 are supported.

Figure 8: Methods of intellectual property protection



Source: Statistics Canada, Survey of innovation 2001-3

Figure 9: Obstacles (medium to high importance) for process and product innovation

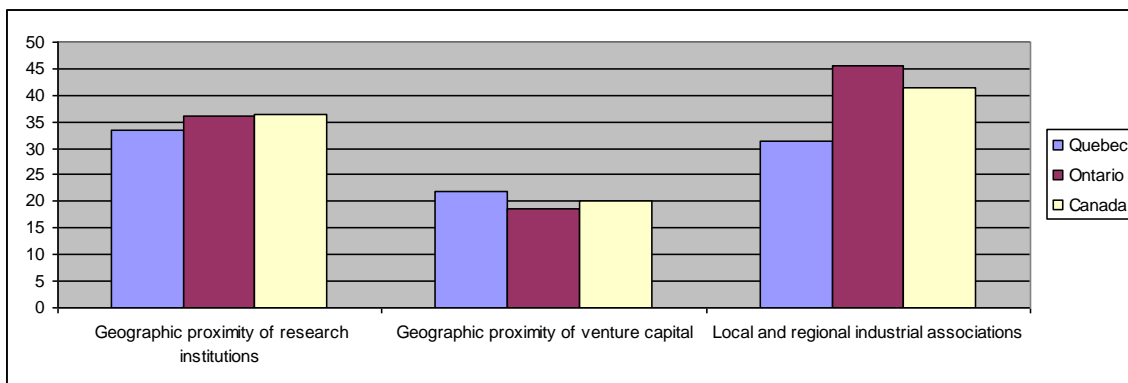


Source: Statistics Canada, Survey of innovation 2001-3

Impact of the intermediaries

Figure 10 shows that the success in innovation is related to the proximity of the universities and research laboratories as well as the presence of local and regional industrial associations. Doutriaux (2003) did an investigation on the role of universities in the development of clusters in Canada in the high technology industry. His study was based on the analysis of 11 clusters that were the most dynamic in Canadian high technology sectors during the 1980s and 1990s. He showed that the universities are important catalysts of the creation and development of firms in the high technology sector. Moreover, they participate in the construction of the local knowledge base that allows the clusters to develop and to grow.

Figure 10: Success factors (medium to high importance) for process and product innovation

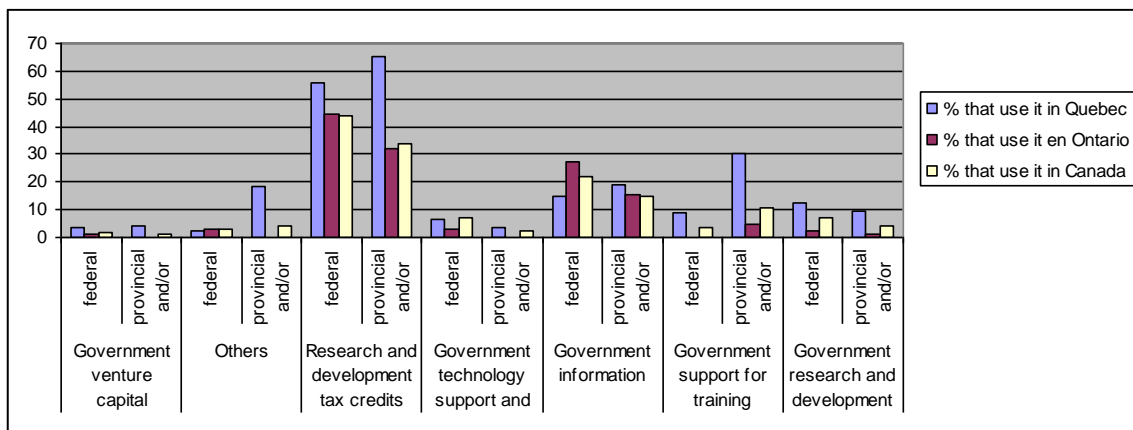


Source: Statistics Canada, Survey of innovation 2003

Here, figure 10 shows us that industrial associations are intermediaries, which contribute more to the success of innovation. By considering the important role of these industrial associations, it seems that Ontario profits from it more than Quebec as the data show in figure 10. The venture capital organizations participate in innovation because they finance the innovation projects. The governmental organizations also take part in the innovation process, but this seems to be more efficient in the research and development tax credits (see figure 11). However, Quebec firms use more governmental assistance than Ontarian firms for research and development.

It appears that the intermediaries take part in the process of innovation in various ways. It seems that industrial associations might have more impact on the performance of the microsystem. If we consider the data it is possible to predict that this impact will be more important in Ontario because of the proportion of innovators, which consider it as a success factor in process and product innovation. Finally, this analysis allows us to support our proposals 3, 4 and as a consequence support also 5. However, it is important to mention that within the role of all intermediaries, the specific role of industrial associations seems to be very important.

Figure 11: Use of governmental assistance



Source: Statistics Canada, Survey of innovation 2001-3

Discussion

Considering the Ontario ICT sector as the most innovative based on the data on the performance in product and process innovation, we can analyze the difference with the ICT sector in Quebec and draw some conclusions on the innovation performance factors associated with the environment of the firms. The success factors are the sources of information; the availability of high skill labour; and the industry regulation.

The innovation performance relies on sources of information, particularly trade fairs and exhibitions, professional congresses and conferences, business associations, and

consultants. Therefore a cluster policy that focuses on these sources of information could be useful for economic development and the competitiveness of firms. In addition, as the firms in the cluster need high skilled labour to innovate, a cluster policy that encompasses this objective would be helpful. An avenue for cluster policy would be also to establish new rules that meet the firm's needs for intellectual protection but also financially accessible protection.

We have also analyzed the impact of the intermediaries in both regions and we have found several differences that also allow us to identify innovation performance factors, that are the proximity of the universities and research laboratories; the presence of local and regional industrial associations; the presence of venture capital organizations; and the presence of governmental organizations and public financial assistance for research and development. Therefore, a cluster policy should also focus on these actors. As our data indicate that the industrial associations, consultants and trade fairs seem determinant factors in innovation performance, these are elements on which cluster policies should thus be centered.

In such a context, the cluster policies appear particularly pertinent, as this is one of the possible forms of public intermediation to be considered. The cluster model developed in Canada by the Innovation Systems Research Network is centered on the performance of firms and attempts to demystify the various factors that might explain this performance. The success or performance of a cluster is seen as being dependent on the performance of the individual firms that are part of the cluster, and this performance is moderated by cluster conditions and the environment of the firms. Amongst the factors, which are seen as having an impact on the firms, there are human and social capital, R&D capacity and infrastructure, information infrastructure, community resources and support, as well as government policies and programs.

Cluster development is obviously a long-term process that is based on the mobilization of key stakeholders in the community, or local or regional territory (Tremblay and Cecilli, 2009). In this context, Cassidy et al. (2005) have identified four stages: Latent, developing, established and transformation. While many writings on clusters are centered on established, long-existing clusters, there is now a recognition that clusters can be at different stages, and particularly that many are in the latent or developing stage in the new media or new creative industries (see for example Britton, Tremblay and Smith, 2009; Smith, McCarthy and Petrusевич, 2004; Tremblay, Chevrier and Rousseau, 2004; Gertler and Wolfe, 2005; Wolfe, Davis and Lucas, 2005). In any case, the interest here is on the role that local actors and stakeholders can play in policy development and economic performance.

The main difference between the cluster view and other views of economic development or growth is the fact that it highlights the social and territorial nature of the innovation process, that we can call socio-territorial capital (Fontan, Klein and Tremblay, 2005). This socio-territorial capital is seen as playing as important a role as economic or financial factors (price, financial support, and so on), although it has necessarily been put forward as much as these more traditional factors. The territory is seen here as being

more than a simple repository for economic activity and the role of social relations of production and interactions is highlighted. This explains that our view of creative clusters is largely centered on the analysis of social relations and interactions between actors and stakeholders.

Conclusion

In this article, we have tried to determine if and how intermediaries can have an impact on innovation and economic development, looking at the sources of innovation in Québec and Ontario, as well as the role of intermediaries on the performance of the microsystem of innovation. Our main objective was to investigate what type of information or resources appear crucial for innovation, and whether the intermediaries can have an impact on the performance in product and process innovation of the microsystem in the ICT sector, all this in order to determine if cluster policies, can be useful from this point of view. Indeed, cluster policies are based on collaboration and while they are often put forward in recent years, it is important to determine if the resources offered by clusters can indeed be useful. The data presented here seems to indicate that organization of trade fairs, exchanges with consultants and industrial associations do appear useful. As these elements are at the core of activities within cluster organizations and other similar intermediaries, it appears that cluster policies can most probably foster innovation and economic development.

We put forward five proposals, which we tried to test with our case study carried out with the survey of innovation done by Statistics Canada. In our research, we concentrated on the ICT sector as it is an important sector for Canadian industry, in Ontario as in Quebec. We showed that many of the functions and roles of intermediaries can have an impact on innovation; they can create the dynamics within the microsystem and support the innovation activities. Therefore, they can influence the opportunities and appropriability conditions, the availability of competences and the learning, and finally the regulation in this environment. This leads to the conclusion that a cluster policy can be interesting to foster innovation in, as much as it favours collaboration between local actors and stakeholders and thus can contribute to create the conditions for innovation and economic development.

Our comparative analysis (Quebec and Ontario) on the role of the intermediaries and their impacts in the process of innovation shows that these organizations can have a positive impact on the performance of the microsystem in product and process innovation. However, for the moment at least, this seems to be more the effect of industrial associations, than other actors. Our analysis of the data allows us to show that in this ICT sector at least the proximity and the exchanges between various actors and stakeholders contribute to the product and process innovation, and thus that collaborative innovation in the context of a cluster can contribute not only to policy innovation, but also to positive economic results.

To sum up, our analysis shows that the intermediaries can have an impact on the performance in product and process innovation in the microsystem, and more globally on a

given industrial sector such as IT, in as much as they do offer elements that contribute to innovation and are seen by firms as important factors of innovation. These elements are considered amongst the factors that can be supported by a cluster policy. It remains to be seen to what extent they are effectively put forward (Britton, Tremblay and Smith, 2009; Tremblay, Chevrier and Rousseau, 2004).

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