

The Quebec's coastal maritime cluster: innovative and locally embedded?¹

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Abstract

Studies on clusters in peripheral regions are limited, although such regions are encouraged to promote clustering and local collaboration in order to become more competitive and innovative. In contrast to urbanized regions, there is some previous empirical evidence for expecting 'a priori' that peripheral regions represent unfavorable locations for cluster development and growth. In this paper, I investigate of an industry cluster in Quebec's peripheral region, the maritime cluster. I examine the activities that constitute the maritime cluster and the innovation activities, collaborative relationships and the nature and extent of local embeddedness in a sample of maritime firms. The results stress that maritime industry comprising in the cluster represent a vulnerable sector which mainly comprising small firms with a low export base and a low propensity to innovate. In addition, these firms are not intensively engaged in innovation-related collaboration with external partners and they are lacking of extra-local connections to facilitate longer term and more sustainable growth. The research cast doubts on the viability of a cluster oriented approach to the development of the maritime industry in Quebec's coastal region.

Key-words: clusters; innovation; collaboration, embeddedness, maritime industry; Quebec's coastal region

'The principal shortcomings inherent in a cluster strategy relate to the difficulty of establishing a cluster in a location where an industry agglomeration is not present' (Barkley and Henry, 1997: 321).

Introduction

Today, it is widely accepted that innovation in firms is embedded within collaborative networks and the regional economy (Asheim and Gertler, 2005; Asheim and Coenen, 2005; Cooke et al, 2004; Cumbers et al., 2003; Doloreux, 2004a; Freel, 2003; Tödtling and Kaufmann, 2001; wolfe and Gertler, 2004). These authors, among others, generally concede that innovation can be improved when firms interact with private and public organizations and with various kinds of support organizations in their regions. In this sense, the institutional characteristics, the knowledge infrastructures and knowledge transfer systems, as

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well as the individual strategy and performance of firms, represent significant basic conditions defining regional competitiveness.

There is also a resurgence of interest in understanding spatial clustering of economic activity and its relation to the spatiality of knowledge creation in various sorts of interactive learning processes experienced by diverse industries and regions (Gordon and McCann, 2005; Malmberg and Maskell, 1997; Porter, 1998). The prevailing interest asserts that regional development ensues as competitiveness evolves in places where localized capabilities exist – institutional endowments, built structures, knowledge and skills (Cooke, 2001). Furthermore, Porter (1998) stresses that the enduring sources of competitive advantage in a global economy are often extremely local, arising from a concentration of highly specialized 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).

Contemporary studies on industrial and regional clusters commonly focus on densely populated and urbanized regions, and on knowledge-intensive industries. In particular, studies have centered attention on growth regions, including not only capital regions, but also major university centers, and knowledge-intensive sectors (Britton, 2003; Harrison et al., 2003; Henry and Pinch, 2000; Isaksen, 2004; Leibovitz, 2004; van der Berg et al., 2001). Indeed, most of the examples to theoretically-based empirical study of clusters are taken from well connected cities or from densely populated areas: one of the underlying conditions for successful cluster development is the presence of agglomeration economies stemming both from the co-location of networked firms and from economies associated with knowledge spillovers, a shared workforce and common infrastructure.

At the same time, research on clusters in peripheral regions is limited, although such regions are encouraged to promote clustering and local collaboration in order to become more competitive and innovative. Indeed, few attempts have been made so far to analyze regional clustering and examine the specific factors influencing the development and competitiveness of industries in such areas.

In this paper, motivated by a gap in the literature on the relationship between clustering and economic prosperity in peripheral regions, I investigate a specific example of an industry cluster in Quebec's peripheral region, the maritime cluster. Building on a survey data from 46 maritime firms, I investigate the activities that constitute the maritime cluster and research their innovation activities, collaborative relationships and the nature and extent of local embeddedness. This study was considered exploratory in this field in Canada as there has been no previous examination in Canada on the maritime cluster and on the nature of innovation activities and collaborative relationships in maritime firms.

Theorizing Regional Clusters

This section first introduces the concept of cluster. Secondly, it discusses theoretical insights about the nature of innovation and collaboration and the role of embeddedness in a regional cluster. Thirdly, it presents a discussion of what may characterize cluster dynamic in peripheral regions. Finally, it briefly present studies having previously dealt with maritime industries and regional clusters.

Introducing the notion of cluster

In the literature, we find several definitions of the term cluster (Cooke, 2001; Enright, 2003; Isaksen, 2005; Martin and Sunley, 2003; Sterberg and Litzenberg, 2004). A general definition is proposed by Porter (1998) who defined a cluster as:

A geographic concentration of inter-connected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. Clusters also often extend downstream to channels and customers and laterally to manufacturers of complementary products and to companies in industries related by skills, technologies or common inputs. Finally, many clusters include governmental and other institutions - such as universities, standard-setting agencies, think tanks, vocational training providers, and trade associations - that provide specialized training, education, information, research, and technical support.

Porter's definition stresses the significance of interconnected firms complementing each other within a common value chain and enjoying a helpful institutional environment that includes public institutions, government educational institutions, and support services all of which foster both competitiveness and innovativeness in a particular field. Local rivalry, collaboration, specialized factors and demanding customers are also significant factors promoting competitiveness and innovativeness.

A more narrow and precise definition is proposed in the literature. The term *regional cluster* has emerged in order to highlight the importance of the region as the best environment for stimulating innovation and competitiveness of firms (Asheim and Isaksen, 2002). A *regional cluster* is defined as a 'group of firms in the same industry, or in closely related industries that are in close geographical proximity' (Enright, 2003). Isaksen (2005) distinguishes between three levels of regional clusters:

- *Regional cluster*: a concentration of 'interdependent' firms within the same industry or adjacent industrial sectors in a small geographical area;
- *Regional innovation network*: collaboration between firms is stimulated by trust, norms and convention, which encourage a firm's innovation activities;
- *Regional innovation system*: collaboration between firms and other public organizations is more organized within a broader set of civil organizations and public authorities that are embedded in social and regional structures. The idea embodies the notion of proximity, networks, and a complex set of institutions and local relationships that support innovation.

These three definitions underscore the importance of specific and regional resources in stimulating a firms' innovation capability and competitiveness along with institutional framework in accounting for the success - or failure- of regional clusters. Norms and trust that facilitate localized interactions and mutual understanding during the process of transmitting information and exchanging knowledge are seen as factors of a cluster's spatial binding (Lorenzen, 1998).

Regional cluster dynamics depend greatly on both economic occurrences; such as agglomerations and localization economies, but also on socio-cultural realities: the internal dynamic of regional, socio-cultural, and political assets; the informal flow of knowledge between the various parties that generate the bulk of territorialized externalities; and the opportunities for the cluster to build and maintain its distinctive competence (Storper, 1997). Thus, the development of these assets is important to building regional innovation capability and strengthening learning capacities within the cluster and ensures its competitiveness (Landry et al., 2002).

Innovation, collaboration and proximity in regional clusters

The starting point of the debate on clusters and clustering is that firms do not innovate and grow in isolation. Innovation is defined as the process whereby 'firms master and get to practice product designs

and manufacturing processes that are new to them (Nelson and Rosenberg, 1993) and corresponds to 'the search for, and discovery, experimentation, development, imitation and adoption of new products, new production processes and new organizational set-ups' (Dosi, 1988). The emphasis now lies on innovation as a dynamic social process that evolves most successfully in a network of intensive interaction between those producing innovation and those purchasing and using knowledge.

Collaboration formed with other producers, suppliers, universities, research institutes and local support organizations can be the source of new ideas for innovation and technological productivity, more specifically for SMEs where collaboration represents a complementary response to insecurity arising from internally limited resources and uncertainties in innovation and technological development (Pittaway et al., 2004).

Another key dimension related to cluster is the embedded character of innovation. According to Breschi and Malerba (2001) 'a key feature of successful high-technology clusters is related to the high level of embeddedness of local firms in a very thick network of knowledge sharing, which is supported by close social interactions and by institutional building trust and encouraging informal relations among actors'. The essential argument is that the effective transmission of uncodified or tacit knowledge depends critically on spatial proximity. Owing to the unique set of conditions required to generate and communicate such knowledge – including, of course, the institutional framework which shelters these highly interactive processes – tacit knowledge is strongly context-bound and in this sense sticky (von Hippel, 1988).

According to some authors, close proximity is increasingly seen as a vital determinant of knowledge dissemination. Here, proximity does not merely relate to immediate benefits of a concentration of economic activities; such as, access to markets, suppliers, a varied and qualified workforce, formal and informal networks, specialized service industries, and a high-quality technological infrastructure Malmberg and Maskell (1997). More importantly, tacit knowledge also depends on social interaction for its transfer and dissemination that can be greatly assisted by geographic proximity. In this respect, an appropriate institutional framework is crucial. It enables actors to attract, create, and disseminate information by providing the common cultural and social values which ease (or impede) social interaction among the different actors involved in knowledge dissemination (Cooke et al., 2000).

The case for spatial proximity depends, therefore on establishing an identity between the geographical location and the institutional conditions of knowledge creation and transmission. This step is accomplished by referring to region-specific, untraded interdependencies that are friendly to innovative activity, including not only common languages and formal institutions, but also customs, understandings and values and taken-for-granted rules and routines Storper (1997). On this basis it can be argued that 'the path dependent character of ... localised capabilities makes them difficult to imitate and they thereby establish the basis of competitive advantage' (Maskell and Malmberg, 1999: 181). The localized learning thesis also anticipates and counters the objection that in order to constitute truly social or collective assets, the capabilities generated in this way would have to be both highly codified and vested primarily in individuals rather than organizations. The counter-argument here is that such capabilities are not simply produced internally by local organizations, but rather through their interactions – which implies that only localized firms can reap their full benefit.

While geographical proximity facilitates processes of interactive learning and innovation, more recently, a number of authors have also pointed out the need to address the role of extra-regional networks as mechanisms of knowledge generation and circulation, in addition to processes within clusters and regions (Bathel et al., 2004; Bunnell and Coe, 2001; MacKinnon et al., 2002; Oinas and Malecki, 2002; Wolfe and Gertler, 2004). According to these authors, it is important to more systematically clarify the relationship between spatial scales – in particular, the relative importance of sub-national, national, and international

forces in economic and innovation processes in order to get a more complete picture on relational networks.

Furthermore, while many authors assume that local networks and proximity are conducive to enhanced competitiveness, there is also increasing research in industries as diverse as biotech or the footwear industry (Sorensen and Audia, 2000; Stuart and Sorensen, 2003) shows that firms mortality rates within clusters may be higher than outside and that local connectivity may lead to regional entrenchment and lack of vision rather than competitive advantage Grabher (1993). Also other studies offer a much more cautious appraisal of the proximity-dynamism relationship. Studies failing to demonstrate the link include Grotz and Braun's (1997) work on the German mechanical engineering industry, Kalafsky and MacPherson's (2002) study on U.S. machine tool companies, and both Harrison et al., (1996) and Wood et al. (2004) studies of Sheffield metalworking firms. Indeed the last of these studies found that innovation partners, in the guise of new product development with a principal customer, tended to be located at greater distances than other firms. Angel's (2002) recent study of technology partnerships within the chemicals, electronics, and instruments sectors also finds that 'establishments located in 'specialized' industrial agglomerations... do not demonstrate a greater propensity toward establishing technology partnership with customers, suppliers or other firms than do other sample establishment (Angel, 2002; 341).

The evidence for a generalized link between clustering and performance is ambiguous. Bathelt et al. (2004) argue that localized and extra-localized networks confer advantages on firms engaged in innovation and knowledge creation by generating two types of opportunities: localized networks generated opportunities for somewhat more spontaneous and unanticipated situations; the advantages of extra-localized networks are instead associated with the integration of multiple selection environments that open different potentialities. Both sets of networks – local and global - thus provide a variety of knowledge sources that not only supply inputs to firms themselves, but also sustain their economic activity, because contacts in both types of place 'make connections' with other clusters and regional innovation systems (Malecki and Oinas, 1999).

Clustering dynamics in peripheral regions

Theoretical attempts to contextualize what may characteristics peripherals clusters as compared with clusters in more urbanized areas is somewhat neglected in the literature. One reason could be that cluster dynamics do not develop in peripheral regions because of the lack of relevant regional actors, the absence of sectors with technological complementarities, or a lack of critical mass and density (Isaksen, 2001). These regions may further have few prospects for growth and development due to a lack of capacity to build organizations to stimulate a firm's innovation and technological activity (Tödtling and Kaufmann, 1999). Another reason could simply be related to the fact that most studies on clusters are based on the analysis of success stories and well-know cases of urbanized regions Asheim and Isaksen (2002), and therefore few researchers have explored the implications –and possibilities- of cluster development in peripheral regions.

In contrast to urbanized regions, there is some previous empirical evidence for expecting 'a priori' that peripheral regions represent unfavorable locations for cluster development and growth. The explanation that are most probably relevant for peripheral regions are:

- There is a lack of dynamics actors and of support organizations conducive to innovation and technological change. These regions are less developed in terms of the necessary innovation interface backed by resources and support to networking, training, technological transfer and other knowledge supports in general (Asheim et al., 2003; Isaksen, 2001);

- In these areas, there is an imbalance in the science and technology system in favor of the public sectors, and the academic part in particular (Landabaso and Reid, 1999);
- Levels of innovation in the private sector, which is dominant by small enterprises in traditional industries with little R&D and low absorption capacity, are frequently lower in comparison to metropolitan regions Tödtling and Trippel, 2005);
- The scope of the innovations found are small-scale, incremental in nature, and take place mainly through the application of existing knowledge or through new combinations of knowledge (Asheim and Coenen, 2005);
- These regions often lack of specialized services while there is often a mismatch of the regional supply of innovation with demand (Asheim et al., 2003);
- Networks and technology transfer between public R&D centers, universities and the private sector are weakly developed (Doloreux, 2003);
- They have difficulty to increase human capital and attract high-skill jobs due mainly to the lack of agglomerations economics which has an effect on productivity and accumulation of human capital (Alasia, 2005);
- There is limited possibility of entrepreneurial growth due to the relative absence of local competition in product markets, the limited scale and scope of local market opportunities, combined with the distance from the largest markets (North and Smallbone, 2000).

Empirical studies on maritime industrial and national clusters

While a large international maritime industry exists, there is little systematic information available on the dynamics of both regional specialization and maritime regional clusters. Empirical studies of such maritime industry concentrate mainly on the structure of the industry and its economic impacts on certain nations and sectors – shipbuilding for example-. Studies analyzing maritime industry and the determinants of the dynamics of maritime clusters seem to neglect the wider context of the social organization of production and the specific regional factors undermining this industry's clustering activities and influencing its development and competitiveness. These studies have mainly focused on assessing the impact of maritime clusters at the national level, without providing detailed insights into the regional dynamics between the cluster; supportive infrastructures of economic and social institutions; and key public and private interventions that have stimulated the growth of maritime clusters.

Studies on European maritime clusters in The Netherlands, Norway and Finland by Wijnolst et al. (2003) and Vittanen et al. (2003) come to interesting conclusions regarding the structure and the economic significance of the industry and the global trends that affect its competitiveness as far as development and growth. They conclude that to enable strong and viable maritime clusters in the context of globalization, all sectors related to maritime industries should be committed firstly, to increasing synergies between the entire maritime sector, and secondly, to creating new opportunities for joint research and innovation between industries.

Benito et al. (2003) in their studies, attempt to analyse the interdependencies between various actors to provide valuable information on cluster characteristics and dynamics in the Norwegian maritime sector. The findings suggest that the sector is dynamic when compared to other parts of the national economy and complies with most characteristics observed in strong clusters, while the low intensity of innovation

and the erosion of the linkages between different groups of industries related to maritime constitute this industry's main weaknesses.

In a similar exercise, Jenssen (2003) and Jenssen and Randoy (2002) have examined ways the maritime industry can develop and maintain innovativeness and international competitiveness in different sectors and contexts. The first study concludes that shipping companies must improve their skills and be more competitive participating in a stronger interplay between organizations both in side and outside of the maritime cluster. The second study highlights the importance of agglomeration economies and the benefits of the cluster structure in the overall performance of the maritime cluster. Orstavik (2005) attempts to address a similar question to aquaculture industry in Norway and concludes that the innovation processes of these firms are by and large based on interactive development and use of external knowledge, of either a practical or a scientific variety. These studies, emphasize the cluster as an industry, abstracting somewhat from the geo-economic context in which the sector is located.

Before presenting the empirical results, the research design and methodology is described in the next section.

Research Design and Methodology

The study reported on here was small and was addressed to the known population of Quebec's coastal maritime industries ($n=96$). Firm listings taken from the *Scott's Directories* and the *Centre de Recherche Industrielle du Québec* provided the sample framework for our questionnaire. Information was collected on firm's characteristics, level and nature of innovation activities, contacts with other firms and organizations, and the influence of the regional, national, and global context.

Since it is not possible to classify firms into industry segments or sub-sectors based on NAICS codes, Quebec's coastal maritime industries were categorized under six sectors: Aquaculture (NAICS 1125), Seafood product preparation and packaging (NAICS 3117), Maritime products (NAICS 332) Machinery, equipment and supplies (NAICS 417), Ship and boat building (NAICS 3366), marine science and technology (NAICS 541 and 334). The choice of these six sectors in representing the maritime industry reflects existing classifications of the maritime industry (Benito et al., 2003; de Langen, 2002; Kwak et al., 2005; Wijnost et al., 2003).

Table 1, identifies a total of 46 maritime firms participating in the survey, giving a response rate of 47.9%. Although the sample is small, it compares in scale to other studies (Hyland et al., 2006; Britton, 2006; Doloreux, 2004a; Tödtling et al., 2004; Romijn and Albaladejo, 2002). The sample reflects the population distribution with respect to sector and region, with the exceptions of maritime firms in Côte-Nord which are under-represented (4.3%) and firms in Bas Saint-Laurent which are over-represented (45.7%).

Table 1. Composition of the survey according to industrial branches and regions

SECTORS	Total population		Sample	
	No of firms	Percent	No of firms	Percent
Aquaculture	5	5,2%	3	6,5%
Fish and marine products	43	44,8%	14	30,4%
Shipbuilding and marine transportation	16	16,7%	12	26,1%
Marine fabricated metal product and machinery equipment	8	8,3%	4	8,7%
Marine technology products and services	14	14,6%	8	17,4%
Other maritime related industries	10	10,4%	5	10,9%

TOTAL	96	100,0%	46	100,0%
REGIONS				
Bas Saint-Laurent	33	24,0%	21	45,7%
Côte-Nord	10	16,0%	2	4,3%
Gaspésie/Îles de la Madeleine	53	60,0%	23	50,0%
TOTAL	96	100,0%	46	100,0%

Source: Maritime Survey, 2005.

The maritime cluster in Quebec's coastal region

Quebec's coastal region

Quebec's coastal region may be considered, in many respects, the most peripheral region in the province of Quebec. This region comprises three administrative regions: Bas Saint-Laurent, Gaspésie/Îles-de-la-Madeleine and Côte-Nord. The entire area extends over 1800km of coastline and contains several small cities like Rimouski, Gaspé, Sept-Îles and Baie-Comeau. The region is so vast that statistics pertaining to its physical size are almost irrelevant, since settlements are principally strung along the St. Lawrence estuary and (for Gaspésie) the Baie des Chaleurs (Figure 1). This represents about 1800 km of coastline along which 395 562 inhabitants could be found in 2004, half of whom are in Bas St. Laurent (Table 2). Moreover, statistics about population growth, activity and unemployment rates are all markedly lower than their Quebec counterparts.

As with most peripheral regions, Quebec's coastal region has many jobs in resource-based sectors and traditional industries. In 2003, the manufacturing industry accounted for 18.3% of all jobs, compared to 22.9% in the province of Quebec. The industrial distribution of manufacturing activity (within Quebec's coastal region) is skewed towards the low value-added sector and sectors with minimal R&D intensity (see also Table 2).

Moreover, expenditures on research and development, average R&D per person, and the number of patents are remarkably lower than elsewhere in Quebec. When compared with the province of Quebec as a whole, several aspects of its coastal region are under-performing, particularly where employment, population growth, and technological development are concerned.

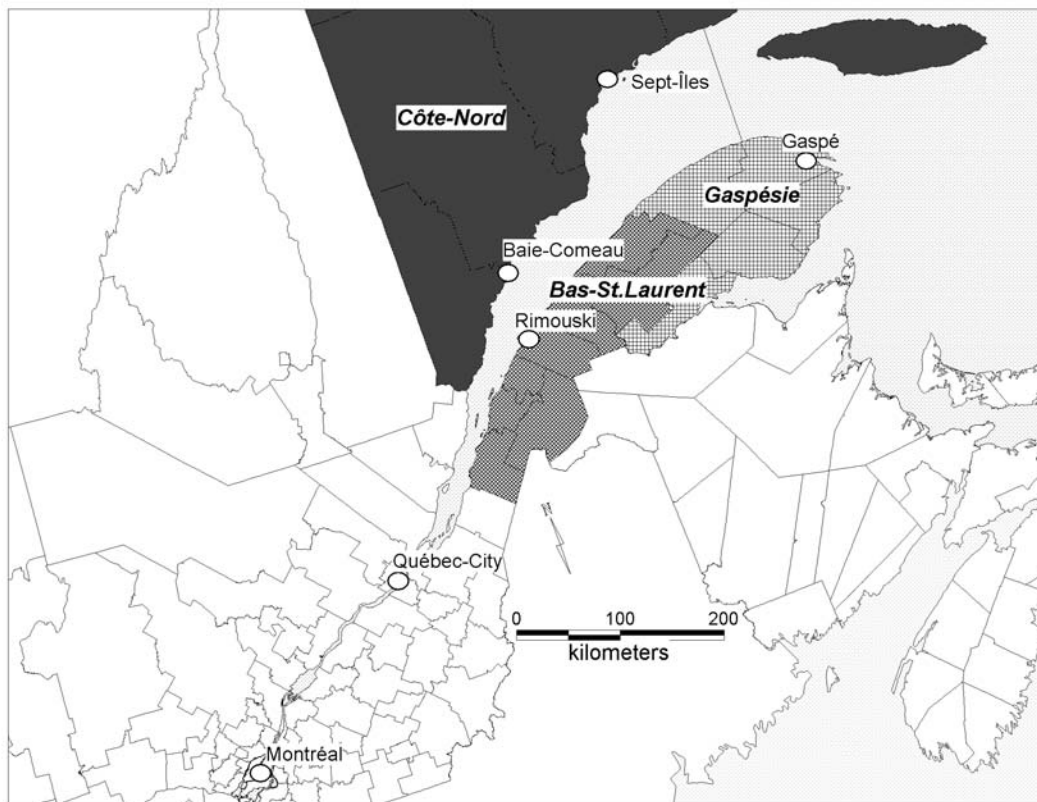
Table 2. Socio-economic characteristics of Quebec's coastal region

	Bas St.Laure nt	Côte Nord	Gaspésie/ Îles-de- la- Madelein e	Quebec
Area (km ²)	22 185	351 523	78 172	1 667 441
Population, 2004	202 122	96 497	96 943	7 542 760
Population growth, 1991-2004	-2,5	-6,0	-9,5	4,5
Activity rate (%), 2003	58,5	60,1	54,5	66,0
Unemployment rate in 2003 (%)	10,1	13,7	17,5	9,1
Employment in 2003	88 k	50 k	37 k	3 650 k
Primary (%)	10,9	6,1	8,6	2,7
Manufacture (%)	17,8	22,9	9,2	22,9
Services (%)	71,3	71,0	78,3	74,4
<u>Total industrial 2001</u>	345	94	131	15,191
High-value-added sectors (%)	1,3	0	1,0	2,4

Medium value-added sectors (%)	33,7	44,4	28,6	41,3
Low value-added sectors (%)	65,0	55,6	70,4	56,3
Average R&D expenditures/habitant in 2001 (CAN\$)	8 \$	3 \$	1 \$	3 897 \$
Number of patents between 1999-2001 (per 100 000 inhabitant)	2	1	-	2 005

Source: Institut de la statistique du Québec, various years.

Figure 1. Quebec's coastal region



Despite the fact that this region has been in stagnation or decline since the early 1980s, it has undergone some substantial structural change. Recently, Quebec's coastal region has attracted considerable attention from provincial and federal governments in order to diversify its economy and reverse the trends just described. Since the mid-1990s, as part federal and provincial government priorities, the sector of ocean and marine technologies was identified as one of the key technological sector to make a significant contribution to innovation; and this sector is being targeted as a strategic mandate to develop Quebec's coastal areas. Institutional structures and facilities in this region include a federal government institute (Institut Maurice-Lamontagne de Pêches et Océans Canada), one college (Institut Maritime du Québec) and two university institutions (Université du Québec à Rimouski and Institut des sciences de la mer). All told, the activities of these institutions represent about two thirds of all R&D expenditures in the region and involve more than half of local researchers (Avery, 1999). These institutions play some prerequisite role in the initial stages of the cluster building.

Since 2000, new institutional structures have evolved to support the growth of maritime industry and help it be more productive and innovative. Overall, a dense network of institutional support is taking root in the region, contributing to the actual or potential development and sustenance of maritime industry.

Three types of organizations form this network: (1) research institutions like Université du Québec à Rimouski, Institut des sciences de la mer and Institut Maurice Lamontagne which are mainly pre-occupied with basic (fundamental and/or applied) research and technology transfer; (2) R&D organizations created to fulfill the functions of technology transfer, consulting in innovation activities, etc.; that are also involved in the development and diffusion of knowledge. These include organizations like Innovation Maritime, Centre interdisciplinaire de recherche sur les océans, Centre de recherche sur les biotechnologies marines, etc.; (3) local agencies such as Technopole Maritime du Québec, that basically dedicates itself to public management of common resources and encourage regional development of the maritime industry.

In sum, Quebec's coastal region is developing an institutional setting favorable to developing and strengthening the maritime industry. These institutions will also establish a basis for further firm formation and growth in the maritime industry. This will likely foster the maritime cluster's regional take-off.

The maritime industry in Quebec's coastal region

Firms were first asked to provide information about themselves in terms of employment, turnover, activities, and so on.

Results in Table 3 show that firms of the maritime cluster are relatively young: close to half of the firms were created in the 1990s or after, and the average age of firms in 2005 was about 16 years. The sector experienced rapid expansion until the 1980s: 32.9% of the firm were established between 1982 and 1989. In terms of legal status, forty (86.9%) of the 46 responding firms are independent – that is, owned and operated by persons resident in Quebec. Five (10.9% of the total) are subsidiaries, and only one firm (2.2%) is a branch.

Revenues and employees are highly concentrated in small and medium sized enterprises. The total number of employees in the 46 firms located in Quebec's maritime is 3873, ranging from small companies with 2 employees to large work forces totaling 532 workers. The average number of employees per company is 84, a figure which is distorted by the presence of few large companies. Of the 46 responding firms, 78.2% of the firms employ less than 50 employees and 4.4% have more than 500 employees. The firms had a mean turnover of 1.3 million CAN\$ and a median of 1.45 million CAN\$. The range of turnover varies from 12.000 CAN\$ for firms with the lowest turnover to more than 20 million CAN\$ for the largest firm. Despite the large number of small firms, more than half of them have turnover sales of over a million Canadian dollars. There are 18 exporting firms and only 8 firms export more than 50% of their sales outside of Canada. In total, these exports represent only 18% of total sales of firms, whilst sales in maritime region represent 52.4% of firms' revenues and sales elsewhere in Quebec amount to 27.9%.

Table 3. Characteristics of the surveyed firms (n=46)

Characteristic	Number	Percent
<i>(a) Year firm started</i>		
Before 1980	11	23.9
1980-1989	15	32.6
1990-1999	11	23.9
In 2000 or after	9	15.6
<i>(b) Type of firm</i>		
Private firm	40	86.9
Subsidiaries	5	10.9

Branches	1	2.2
<i>(c) Size of the firm</i>		
1-10 employees	18	39.1
11-49 employees	18	39.1
50-499 employees	8	17.4
> 500 employees	2	4.4
<i>(d) Sales (n=36)</i>		
< \$250,000	5	13.9
\$250,000 – \$999,999	9	25
\$1,000,000 – \$5,000,000	14	38.9
> \$5,000,000	8	22.2
<i>(e) Exportation outside Canada</i>		
Yes	18	39.1
> 50% of their sales outside Canada	8	18.2

Source: Maritime Survey, 2005.

Innovation activities

Firms were asked to report on their innovation activities. The survey addressed indicators for innovation inputs (R&D, external R&D, acquisition of machinery and equipment, acquisition of external competences, and employee training) as well as innovation outputs (new or significantly improved product and process innovation in the past three years). An innovative firm is one that has introduced or implemented a new or significantly innovative product or process during the period under review. Table 4 summarizes the results.

In terms of innovation inputs, a large proportion of firms are highly active in terms of employee training (71.1%) and the acquisition of new machinery and equipment (67.4%). In addition, 58.7% of firms claim to be undertaking R&D, a figure that appears relatively high considering the type of industries investigated. Firms are clearly less active with respect to the acquisition of external competence and the outsourcing of R&D.

In terms of innovation outputs, the results clearly point out that the majority of the firms have not been successful in introducing new products or processes. The number of firms reporting innovation products and services is higher than those reporting process innovations. By and large, these advances were highly novel to the sector. Some 52.4% were new to the sector and a further 19.0% were new to the world. These results might be partially explained by the fact that many firms are heavily dependent on a small set of few customers and therefore they do not see the importance of innovating to sustain their competitive advantage. In addition, this result can be linked to the fact that the sample firms mainly operate in the domestic market. This situation certainly impacts on the intensity of innovation of these firms, which tends to be low compared to other sectors operating in open and diversified markets.

Finally, 35.6% of firms had innovation projects that were incomplete (either ongoing, abandoned or planned but not started) during the period. This demonstrates however the continuous nature of innovation, not necessarily resulting in new goods, services or processes in the sample period.

These results clearly demonstrate that the majority of firms have been unsuccessful in introducing new products or processes, and that maritime firms within Quebec's coastal region are not highly innovative.

Table 4. Characteristics of innovation

	Number	Percentage
<i>Innovation activities</i>		
Innovation inputs		
Internal R&D	26	58.7
External R&D	11	23.9
Acquisition of machinery and equipment	31	67.4
Acquisition of external competences	10	21.7
Employee training	33	71.7
Innovation outputs		
Product innovation	16	34.8
Process innovation	10	21.7

Source: Maritime Survey, 2005

In view of these results, the question of which obstacles impede the actual process of innovation in the surveyed firms arises. Table 5 presents the type of barriers confronting SMEs in maritime industry. These are scored according to their relative importance for innovation on a scale ranging from: 1 = not important; to 5 = very important. Overall, it is interesting to note that none of these potential obstacles is considered to be of no or low importance (which would have been revealed by averages equal to or less than 2.0). On this basis, the most important obstacles hampering innovation in this sample were: the high cost of products or equipment (3.6), followed by industry regulations (3.4), weak demand from clients (3.0), and a lack of qualified workers (3.0). Obstacles related to firms' access to collaborative exchanges with external sources, technological support, and advice from a wide range of organizations, scored low. Two general types of obstacles stand out from these figures. The first one is concerned with the basic conditions needed to produce the innovation in the maritime industry; specifically the high cost of products and equipment, and industry specific regulations that firms must respect to undertake innovation projects. Access to appropriate levels of knowledge and experience needed to produce innovation is the second type of hindrance. This is likely to require scientific, technological and production skills.

Table 5. Type of obstacles confronting innovators

Obstacles to innovation	Mean score	Standard Deviation
High costs of products or equipments	3.6	1.2
Lack of interest from clients	3.0	1.3
Industry regulations	3.4	1.4
Lack of qualified workers	3.0	1.4
Lack of skills from employees	2.8	1.3
Lack of technical support from suppliers	2.5	1.5
Lack technical and scientific support from consultants	2.5	1.4
Lack of capacity to evaluate new technology	2.9	1.3
Few opportunities to collaborate with public research centers	2.9	1.5
Few opportunities to collaborate with university or other higher education institutions	2.8	1.6
Few opportunities to collaborate with technology transfer technology organizations	2.7	1.3

Few opportunities to collaborate with Economic development agencies	3.0	1.3
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Note: Score bases on range 1 = Not important to 5 =Very important

Source: Maritime Survey, 2005.

Innovation, collaboration and proximity

In this section we examine the issue of innovation-related collaboration and assess the relative importance of local linkages as opposed to global linkages in supporting the innovation activity of SMEs. The survey asked SMEs whether they had collaborated with other firms and institutions in the context of their innovation activities, and if they were located in Quebec's coastal region or elsewhere (Quebec, Canada, elsewhere in the world). Drawing comparisons between local and geographically more extensive links is meaningful as they reveal which regional and national/global resources are most important in furthering innovation activities of SMEs in the maritime cluster.

Table 6 shows the formal collaborations by types of firms and location and reveals that a large proportion of firms with innovation-related, formal external linkages are weak, and a great number of firms were not engaging in any innovation-related external formal collaboration during the period investigated by the survey. Yet, many surveyed firms appear to have successfully innovated nonetheless: 56.2 % of firms with no external links recorded introducing a product or a process innovation; compared to 43.7% of firms with at least one innovation-related collaboration. In other words, networking cannot be considered a basic, average condition, much less necessary for innovation. This result might be reasonably explained by the small fraction of firms who declared having introduced a new product or process innovation while external innovative linkages are very common particularly in innovative firms (Doloreux, 2004b; Freel, 2003; Sternberg, 2000). Another explanation might be that most of the participating firms are relatively mature industries and engaged in technologically incremental innovations. In this case, the information shared, or exchanged in relationships with external partners, mainly customers and suppliers, is relatively simple, generic and codified knowledge.

Among innovation-related cooperative relationships of maritime firms, the picture is not clear cut. Collaboration with business-related services are predominant: relationships of this kind are maintained by 46.6 % of the firms. Collaboration with customers and suppliers, universities, and venture-capital organizations are equally important: on average, 33.3% of firms cooperate with these different organizations. Furthermore, 26.6% of the maritime firms cooperate with competitors and local agencies, while cooperation with technology transfer organizations and public and private research is of least importance. As a matter of fact, compared to the average rating of other regions studied in the literature (Cooke et al., 2000; Diez, 2002; Doloreux, 2004a; Edquist et al., 2002; Freel, 2002), innovation-related collaborations are not highly valued by the maritime firms. This is not to say that collaboration is not important, but this is in contrast with the expectations of much of the cluster and innovation system literature, which clearly stresses the importance for firms of innovation-related linkages to absorb new knowledge towards being innovative.

The regional distribution of maritime firms' cooperative partners are indicative of the particular geography of these exchanges, as well as the extent of their reach. Collaborations are mainly confined to the local level and only a few firms are inserted into various connections with international collaborators. The case of the maritime cluster clearly illustrates the importance of local connections as a source of innovativeness in this industry. The fact that firms in the maritime cluster orient themselves towards the immediate region may be explained by the fact that firms do not successfully operate within various niches of global markets: as much as 78.0% of total turnover in maritime firms comes from local and regional trade. As a result, home markets remain particularly important to these firms.

Table 6. Formal collaborators: type and location

Formal Collaborations		
	Number	%
Use of external collaborators (N=46)		
Yes	15	32.6
No	31	67.4
Types of collaborators (N=15)		
<i>Market sources</i>		
Customers	5	33.3
Suppliers	5	33.3
Competitors	4	26.6
Business related-services	7	46.6
<i>Knowledge support organizations</i>		
Universities and higher education institutes	5	33.3
Technological transfer organizations	2	13.3
Public and private research centers	3	20.0
Governmental agencies	4	26.6
Venture-capital and other financial organizations	5	33.3
Location of formal collaborators (N= 25)		
Within the maritime region	12	48.0
Rest of Quebec	8	32.0
Rest of Canada	1	4.0
Rest of the world	4	16.0

* Mean percentage score

Source: Maritime Survey, 2005.

If we look more closely at the location of maritime firms' formal collaborators, as shown in Table 7, we observe they vary substantially according to their type. While the low number of firms that entertain such collaboration prevent us from drawing definitive conclusions, some tendencies are observed nonetheless. Customer-oriented relations are dominated by supra-regional contacts, whereas business related services are almost equally apportioned to close vicinity and far distances. Regarding horizontal collaboration with institutions, there is a preference for the closer spatial environment, which is particularly true for colleges and technology transfer organizations. The organizations supply specialized competence in research, technology and experimental development as well as human capital –the knowledge and competence of those that work in the sector- are mainly supplied by such organizations. This result is not surprising considering that the different colleges of Quebec's maritime offer courses related to maritime activity, and that technology transfer organizations supply specialized services adapted to the needs of industries such as aquaculture in Gaspésie and marine technology and biotechnology in the Bas Saint-Laurent.

Table 7. The geographical scale of formal collaborations

	Total	Maritime region	Rest of Quebec	Rest of Canada	Rest of the world
Market collaborations (n=15 firms)					
Number of collaborations					
Customers	5	1	2	-	2
Suppliers	5	1	1	1	2
Competitors	4	-	1	2	1

Business related-services	7	3	2	-	2
Other collaborations (n=15 firms)					
University	2	-	1	-	1
Colleges	5	3	1	-	1
Technology transfer center	4	2	1	-	1
Research centres	2	1	1	-	-

Source: Maritime Survey, 2005.

Innovation and local embeddedness

The final set of questions concerned aspects of local embeddedness of innovation activities– the aim being to establish the extent to which local linkages exist among firms, and with public and private innovation support organizations. In the survey, questions were posed to firms about the nature and intensity of local collaboration and the use they made of the innovation support infrastructure within the region. The firms' local embeddedness is one possible explanation for innovation activities being clustered in the region.

Table 8 presents local collaborations within the Quebec maritime cluster. The results highlight the importance of the local milieu in supporting the exchange and circulation of general information and new ideas as well knowledge on design and commercialization. This is particularly true with maritime firms' customers, suppliers and competitors. The majority of responding firms underscore the value of local partners and that these contacts are quite intense; revealed by a mean equal or higher to 3.5. However, if the firms share general information and new ideas with their competitors, they are much less likely to have intense collaboration when it comes to design and commercialization, prototype development, or tooling and pilot tests, which makes sense, firms needing to preserve their competitive advantage.

As shown in Table 9, although local collaborations with universities in the Quebec maritime cluster are important, they are of least importance when compared to local private collaborators. Linkages with universities are mainly for maintaining informal contact and to acquire technical expertise. These linkages do not seem to lead to formal research contracts in most cases; only 7 firms out of 46, having established such contracts, and with a low intensity of collaboration on average.

Table 8. Local collaborators with in the Quebec maritime cluster (n=46)

	Number of firms	Percentage	Intensity of collaboration	
			Mean*	Standard deviation
<i>Local customers (n=22)</i>				
General information	22	47.8	3.45	1.224
New ideas	22	47.8	3.41	1.098
Conception/commercialization	22	45.7	3.41	1.368
Prototype development	19	41.3	3.55	1.535
Tooling and pilot test	17	37.0	4.09	1.659
<i>Local suppliers (n=15)</i>				
General information	14	30.4	3.53	1.302
New ideas	14	30.4	3.47	1.407
Conception/commercialization	15	32.6	3.40	1.056
Prototype development	13	28.3	4.07	1.387
Tooling and pilot test	13	28.3	3.73	1.486

<i>Local competitors (n=9)</i>				
General information	9	19.6	3.33	0.866
New ideas	8	17.4	3.44	1.236
Conception/commercialization	8	17.4	3.00	1.581
Prototype development	8	17.1	2.67	1.936
Tooling and pilot test	9	19.6	2.89	1.537

*Note: Score bases on range 1 = Not intense to 5 =Very intense

Source: Maritime Survey, 2005.

Table 9. Local collaborations with universities in the Quebec maritime cluster (n=46)

	Number of firms	Percentage	Intensity of collaboration	
			Mean*	Standard deviation
<i>Universities (n=11)</i>				
Informal contacts	11	42.3	3.73	1.489
Technical expertise	11	42.3	3.36	1.502
Use of scientific equipment and/or lab only	10	38.5	2.82	1.888
Formal research contracts				
Ph.D Students	7	26.9	3.55	2.252
Other research contracts	7	26.9	3.82	1.888

*Note: Score bases on range 1 = Not intense to 5 =Very intense

Source: Maritime Survey, 2005.

Table 10 shows local collaboration with support organizations in the maritime cluster. Around a third of the responding firms had established contacts with such organizations. Generally technical advice and research and development were the impetus behind most of these contacts. As for our firms requiring knowledge-intensive business services; only a very small fraction of 7 out of 46 utilize them in a very traditional way, by hiring various professionals like lawyers and accountants (Table 11).

Table 10. Local collaboration with support organizations in the maritime cluster (n=46)

	Number of firms	Percentage	Intensity of collaboration	
			Mean*	Standard deviation
<i>Innovative support organization (n=13)</i>				
Financial advise	13	28.2	2.62	1.502
Technical advise	13	28.2	3.00	1.080
Management	13	28.2	1.92	1.038
Marketing	13	28.2	1.77	1.166
R&D	12	26.0	3.46	1.506
Exportation	12	26.0	2.31	1.601
Recruitment/training	12	26.0	2.31	1.494

*Note: Score bases on range 1 = Not intense to 5 =Very intense

Source: Maritime Survey, 2005.

Table 11. Local collaborations with knowledge intensive business services in the maritime cluster (N=46)

	Number of firms	Percentage	Intensity of collaboration	
			Mean*	Standard deviation
<i>KIBS (n=8)</i>				
Professional services	7	26.9	4.50	1.069
Software, IT, etc.	6	23.1	4.00	1.512
General business consulting, marketing research	6	23.1	3.75	1.581
Engineering, laboratories	7	26.9	3.75	1.389

*Note: Score bases on range 1 = Not intense to 5 =Very intense

Source: Maritime Survey, 2005.

Concluding Remarks

The paper investigates innovation activities and collaboration in the Quebec's coastal maritime industry. The paper builds on an original survey of 46 maritime firms. The results presented in this article are, however, of a descriptive nature, and have some limitations. First, the empirical study provides a detailed analysis of the internal dynamics of clustering activities of one selected industry within one selected region and suffers the limitations of not having a control group of maritime firms outside the Quebec's coastal maritime cluster, who would represented a somewhat different views of the issues addressed here. Second, the study is cross-sectional on the nature of clustering dynamics and provides insights into the nature and dynamics at one specific point in time, neglecting to capture the constant on-going changes in the nature of innovation and collaborations activities. Third, the number of surveyed firm is small, while we were unsuccessful in obtaining interviews from the region's entire population of firms. These limitations prevents from generalizing results.

At the empirical level, we have showed that maritime industry in Quebec's coastal region does not complies with the basic characteristics and dynamics of regional clusters. In terms of cluster dynamics and activities in the Quebec's coastal maritime industry, the results provide evidence of the weakness of the industry. It represents a relatively vulnerable sector which mainly comprising small firms sparsely distributed over three regions, with a low export base and operating on thin markets, mainly domestic. Maritime firms are highly dependent on a small set of local customers and the home market remains particularly important for them. Innovation activities are poorly developed and innovations found were small-scale and incremental in nature. The obstacles hampering innovation to explain the low intensity of innovativeness are related to the high cost of products or equipment and the industry regulations which are perceived as highly restrictive with respect to innovation activities. In addition, the research also illustrated the weakness of the industry in terms of scarce local connectedness and limited ties to external partners to facilitate longer term and more sustainable growth.

Some factors contribute to the weakness of the maritime industry to sustain their competitive advantage trough innovation and clustering activities, namely the lack of complementarities among maritime firms, innovation pressure and market potential as the outcome of the cluster process. These elements are important mainly because of their effect on innovation, collaboration and international competitiveness. In the case of the maritime industry, the lack of these elements hamper the increase of scale of production and the critical mass of demand and of potential collaborators which in turn prevent the maritime firms to be competitive and sustainable as well as for the growth potential of these firms and of the cluster in Quebec's coastal region.

In terms of cluster per se, our conclusions are twofold. On the one hand, it is clear that cluster embody a specific vision of economic development, vision which is mainly based on well-known examples of affluent sectors and regions, i.e. companies and areas experiencing rapid economic growth. In particular, a local industrial structure with many firms competing in the same industry or collaborating across related industries tends to trigger processes that not only generate dynamism and flexibility but also learning and innovation. Therefore, regions which exhibit clustering tendencies and have concentrated clusters within their territory, are likely to be more economically and technologically competitive, regardless of the types of sectors and regions. In the case of Quebec's maritime cluster, this utopian vision has not been realized, which is not to say that other peripheral regions have not been successful. The question which remains open is the extent to which any planned intervention based on the cluster model can create the dynamics necessary for these economies to appear.

On the other hand, it is apparent that clusters is not a panacea in terms of promoting and stimulating industrial development, especially in peripheral regions where many of the basic preconditions for a cluster to function and growth are absent or weakly developed. Moreover, the specific circumstances and the processes generating clusters and foster their development are distinctive and context-specifics which may not be amenable to generalization or disseminated throughout other cluster experiences. One must recognize that the literature on cluster has emanated principally from cities or from densely populated areas. Even in these areas it is sometimes problematic to bridge the gap between underlying concepts such as cluster and the reality of economic development. This raises the question of whether the ideas concerning innovative clusters coming from studies of clusters in urbanized regions also relevant for analyses of peripherally located clusters?

To conclude, the thrust of our research is empirical and policy oriented. From this perspective, the results call into question the policy agenda to develop – and sometime expand- clusters strategy for industrial development and the claims made for these clusters by the policy-makers. In peripheral regions, the preconditions of cluster development - many of which are to do with geographic and demographic factors that are not amenable to policy intervention – cannot always be generated endogenously: sometimes it may be useful to recognize that a region is in decline or did not encompass all the elements to develop into a dynamic cluster, and that an appropriate strategy is to manage the decline in such a way that local communities and populations can adjust. This does not exclude the possibility that new niches may be emerging within an overall context of decline: but it does suggest a more nuanced policy approach than the application of off-the-shelf ideas about innovation and clusters to regions where the concepts are of rather remote relevance to the fundamental development challenges that are being faced.

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