

**Interorganizational Relations, Proximity, and Innovation:  
The Case of the Aeronautics Sector in Montreal**

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*Abstract*

Local interorganizational relations are crucial in aeronautics. On the basis of an empirical research carried out in Montreal, this paper addresses the role of proximity within the construction of these interorganizational relations and analyses how these relations are structured, which actors are crucial for their construction, and to what extent they foster innovation. The paper shows that aeronautics in Montreal is characterized by a dense network structured by prime contractors and intermediate organizations and a strong sense of belonging. Diverse forms of proximity shape the aeronautics sector in Montreal, with the specific characteristics of the sector (strong vertical integration and major spatial concentration of the productive chains) and of the place, in this case Montreal (priority to partnership, presence of intermediate organizations), are converging and contributing to the building of an innovative system at the metropolitan scale.

*Keywords:* aeronautics, Montreal, network, proximity, innovation system, governance

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*Résumé*

Les relations locales entre les organisations sont cruciales dans l'aéronautique. Sur la base d'une recherche empirique menée à Montréal, cet article aborde le rôle de la proximité dans la construction de ces relations et analyse la manière dont ces relations sont structurées, quels sont les acteurs clés pour leur construction, et dans quelle mesure ils favorisent l'innovation. L'article montre que l'aéronautique à Montréal se caractérise par un réseau dense structuré par les donneurs d'ordre et les organismes intermédiaires et d'un fort sentiment d'appartenance. Diverses formes de proximité structurent le secteur de l'aéronautique à Montréal, combinées aux caractéristiques spécifiques du secteur (intégration verticale forte et la concentration spatiale importante des chaînes productives) et à celles du territoire de Montréal (importance du partenariat, la présence d'organismes intermédiaires), contribuant à la construction d'un système d'innovation à l'échelle métropolitaine.

*Mots clés:* Aéronautique, Montréal, Réseau, proximité, système d'innovation, gouvernance

**Introduction**

The aeronautics industry requires a very high level of technological competence, in turn requiring ongoing innovation. This challenge calls for the continuous mobilization of resources and major R&D investments (Ravix 2000). Strong international competition moreover requires businesses in the sector to stay at the cutting edge of technology and to achieve productivity increases by creating new products and by developing new production techniques. The innovation process, being long and costly, relies heavily on interorganizational relations and the cohabitation of actors (e.g., intermediate organizations, universities, R&D centres) that can advance knowledge production, knowledge transfer, and innovation.

Aeronautics is thus an industry where proximity and local interorganizational relations are crucial. Diverse authors point to the fact that this sector is concentrated in urban centres, such as Toulouse, Seattle, and Montreal where entrepreneurs find advantages of scale and of proximity (Scott and Mattingly 1989; Jalabert and Zuliani 2009; Benzler and Wink 2010). In Montreal, for example, the aeronautics sector can find the conditions for establishing interrelations between many types of actors: public actors, private businesses, and intermediate actors (e.g., research centres, industrial associations, schools, universities, unions, local governance bodies). These interrelations are facilitated by proximity. The object of this paper is to analyze, for one, the role of proximity within the construction of these interorganizational relations, and secondly,

how these relations are structured, which actors are crucial for their construction, and to what extent they foster innovation.

### **Social innovation networks and social capital**

The link between interorganizational relations and innovation must be examined within the broader context of the relation between "the social" and innovation. Here, the works of Schumpeter and Veblen have laid the groundwork. According to these works, innovation occurs in places where local culture promotes the social acceptance of risk and novelties (Fontan, Klein and Tremblay 2008). The works of the evolutionist school and of studies on innovation systems complement the research of Schumpeter and Veblen by proposing a comprehensive vision of innovation. These works place great emphasis on the fact that innovation involves many socioeconomic actors. Moreover, they perceive innovation as a cognitive process in which actors of multiple origins coexist and collaborate in contexts of collective learning (Asheim and Isaksen 2002). The interaction of different actors is at the origin of a systemic effect that interconnects different knowledge bases according to the actors and that consequently influences the possibilities of innovation. According to this perspective, innovation is promoted by tangible and codifiable information in combination with knowledge tacitly inserted in networks comprised of diverse types of actors (Granovetter 2000).

These studies highlight the importance of social innovation networks. The works on social innovation networks highlight knowledge sharing and contend that innovation requires diverse forms of intangible capital, i.e., represented by ideas and by information, coming from business networks between entrepreneurs, clients, and suppliers. From this angle, a social network could be seen to comprise a capital good in terms of social capital (Coleman 1988; Nahapiet and Ghoshal 1998; Amara, Landry and Lamari 2003), or even as a competitive advantage that contributes to the competitiveness of the territories. Moreover, access to new sources of knowledge could then also be seen as a condition for innovation (McFadyen and Cannella 2004).

Social capital is defined as being all relations woven within a community that influence personal interactions and, consequently, allow entrepreneurs to launch new projects and to innovate. It is based on the type of social organization that facilitates collaboration among the economic actors (Coleman 1988). Bourdieu (1986) considers social capital as the sum of resources, for an individual or a group, emanating from a more or less institutionalized sustainable network of relations, from mutual contacts, and from recognition. Access to information constitutes the main advantage of social capital. For Coleman (1988), access to information influences the costs of production. This point has been well studied in network theory, which analyzes how social connections

increase the chances of an actor finding good information (Granovetter 1973; Burt 1992).

Social capital takes on three generic and overlapping forms (Amara, Landry and Lamari 2003): networks of actors, rules of conduct, and relations of trust:

- Networks emerge when actors develop reliable and efficient means of communication and interactivity;
- rules of conduct develop over the course of time through exchanges and interactions repeated within the created networks; and
- trust is built socially through personal interrelations, including face-to-face encounters.

For the purposes of our research, social capital is thereby measured on the basis of the nature of the relations between the actors (collaboration, cooperation, etc.) and the rules of conduct instituted tacitly and informally through recurrence. The main significance and contribution of these works is their hypothesis that the relation between innovation and social capital arises from a two-fold process: one, a social process, in that the composition of the social network influences the capacity to innovate; and secondly, a territorial process, because social relations take place in spaces that are configured as a result of an identity and a sense of belonging that is shared by the actors (Bresnahan, Gambardella and Saxenian 2002; Grossetti and Bes 2003; Klein 2008).

### **Proximity, space, and innovation: a short survey of the literature**

Interrelations between social actors are important for a community's social capital, development, and contribution to innovation. Since the 1980s, there has been a growing interest in proximity and its potential effects on innovation as well as on the development and structuring of economic space. Various authors, including Piore and Sabel (1984) or Benko and Lipietz (1992) have emphasized the importance of physical proximity for the development and success of spaces.

However, the effect of physical proximity on development has been called into question in recent years, along with a questioning of cluster theories. Several authors have identified the importance of unformalized compromises between actors (Salais and Storper 1993), institutional density (Amin and Thrift 1993), and the university-firms link (Grossetti and Bès 2001; Doloreux, Filion and Klein 2005) in the differentiated trajectories of local milieus within

a largely globalized economy. Storper (1997) even advanced the hypothesis of a new winning configuration for the third millennium, namely, a configuration based on innovation, organizations, and territory. This begs the question of whether the mere concentration of actors coupled with physical proximity suffices for constructing locally-based social capital and social networks.

Markusen (1996) suggests that relations are certainly not determined merely on the basis of physical proximity, even if the network of relations between actors (firms, decision-makers, technology producers) is extensive. In other words, the mere fact of cohabiting in the same territory is not a sufficient condition for actors to have relations with each other, as has also been observed in recent research on Montreal clusters (Tremblay, Chevrier, and Rousseau 2004). Conversely, some actors develop relations without cohabiting in the same territory. This finding raises the question of scale for the local level. What is the scale of "the local" as defined by actors when they characterize the network of their relations? And is relational proximity more important than physical proximity, as other authors have suggested (Tremblay *et al.* 2002; Britton, Tremblay and Smith 2009)?

The concept of proximity is a key indicator for determining what socio-economic actors mean by "local space." In this paper, we shall present an examination of the precise meaning of this notion, namely on the basis of a brief overview of the literature on this topic.

Space has long been perceived as a neutral geographical forum for economic relationships. However, space is now increasingly perceived as a determining geographical environment when it is invested with intangible resources that can have a positive impact on the development of new projects and new initiatives. Distance in quantitative terms is supplanted by the "proximal" quality of resources that social actors and entrepreneurs can mobilize.

The increasing importance of the notion of proximity in the recent literature on the interaction between firms and on innovations has led some authors to speak of a "proximity economy" (Bellet 1992). This notion, based on a Marshallian perspective (Marshall 1889) and again taken up in the 1980s by various authors (Brusco 1982; Piore and Sabel 1989; Becattini 1992; Benko and Lipietz 1992; Courlet 1994), initially referred to the concentration of firms in a limited space. At present, the notion has become polysemic (Kirat and Lung 1995; Vant 1998) and analyses of the links between proximity and innovation have given rise to several approaches. We thus need to determine which approach is best suited for examining the attitude of firms toward cooperation and innovation. What type of proximity are we referring to in relation to innovation and inter-organizational relations? Are all forms of proximity determining factors in the localization of firms and their decision to cooperate and to innovate?

### *From physical proximity to relational proximity*

*Physical proximity* is the simplest form of proximity. It refers to the location of firms and institutions of higher learning (e.g., research centres and universities) in a given space. The main parameter of this kind of proximity is the distance that separates actors from each other. Physical proximity is based on the premise that the greater the number of local firms, the more opportunities for cooperation in problem solving; and the denser the local exchange of relations, the more these speed up the research process of individual firms and the accumulation of technological and other knowledge (Haas 1995). Proximity among actors thus serves to ensure accessibility to scarce information (Planque and Py 1986), also referred to as a “spatial insurance” (Veltz 1996). While physical proximity alone is clearly not a sufficient condition for establishing a collective dynamic, it lays the ground for a potentiality that makes social contact possible (Colletis and Winterhalter 1991; Kirat 1993).

A second type of proximity is *technological proximity*, which can act in a somewhat similar way as organizational proximity. It is based on a specific notion of technology that evolved from an evolutionist standpoint and that examines the micro-economic bases of innovation (Nelson and Winter 1982; Dosi 1988). According to evolutionary theory, innovation is endogenous, taking the form of continuous and gradual changes in an incremental process, such as a set of routines<sup>1</sup> and selections built up through trial and error processes (Tremblay 1989; 2007). Based on this approach, production organizations have specific knowledge and know-how that comprises collective knowledge that, although shared within the organization, cannot be immediately appropriated by the environment. Technological proximity constitutes one of the bases of inter-firm cooperation, and it is on this basis that collective learning takes place between firms participating in a production system or cluster (Kirat 1993; Dupuy and Gilly 1996). Just like organizational proximity, technological proximity can be favoured over physical proximity since, aside from reducing transaction costs (Scott 1999), it can facilitate cooperative relations.

The third form of proximity is *relational or organizational proximity*. It implies that firms and organizations, in their collective dimension, either share or do not share the same patterns of thought, production, communication, and innovation. Organizational proximity exists when groups of agents that were initially independent set up coordination procedures for achieving agreed upon goals. Organizational proximity exists within organizations (firms, establishments, etc.) and sometimes between organizations that have common economic or financial dependencies or interdependencies (e.g., companies that are members of an industrial or financial group, within a network).

Organizational or relational proximity is characterized by a dual dimension.

The first dimension refers to a proximity of similarity or of common references (Pecqueur 1989), while the second dimension refers to the frequency and the quality of interactions among separate organizations (external coordination between organizations). These dimensions are reflected in the building of common knowledge that facilitates the collective learning process, in turn leading to, for example, the construction of new resources or the development of opportunities (Amendola and Gaffard 1988). This is how a process of learning by doing can evolve, which then provides the basis for building a collective memory. The concept of organizational or relational proximity has also been shaped by the writings of evolutionary theorists, such as Lundvall (1988), who highlight the interactions between users and producers.

Organizational or relational proximity is thus immaterial and non-marketable; it is supported by multiple relations outside the market. In addition, it can be independent of all spatial dimensions. The conditions for the appearance of organizational proximity can be favoured by physical proximity, but can also be impeded by the latter. This is the case with multimedia firms, for example, who anxiously protect their technologies and do not necessarily exchange a great deal of information, even when they are geographically concentrated (Tremblay *et al.* 2002).

Finally, there is a fourth type of proximity, which could be considered an extension of relational proximity, namely *cultural or institutional proximity*. It implies that entrepreneurs share the same representations, rules of conduct, and values. This type of proximity is determined by the interactions between firms and agents that are engaged in a collective learning process. This collective learning process may involve physical proximity between agents, insofar as this proximity is a condition for forming long-lasting relationships and a vehicle for exchanging non-codifiable knowledge (habits, routines, conventions), i.e., knowledge that cannot be moved in space with technical means. (Tremblay, Fontan and Klein 2009)

There is now more and more agreement on the fact that physical proximity can have an influence on a sector or a firm's capacity to innovate if it also translates into relational or organizational proximity. Entrepreneurs consider the social, cognitive, and communicational aspects of proximity to be vital in explaining the innovation that takes place within the firms of their sector (Cooke 2001; Doloreux 2003; Doloreux and Parto 2004; Julien 2005).

### ***The effect of proximity on the capacity to innovate***

The different forms of proximity described above define the many levels of action of firms, thus determining their capacity to innovate. A firm's capacity to innovate results from and is defined by the superimposing of the different

forms of proximity, together forming a territorial innovation system. In this way, the territorial mechanisms for the coordination and interrelation between firms are established through processes that include partnership, participation in social networks, collective sanctions, information sharing, informal codes that favour trust, frequency of contacts, and relationship building.

This is what Marshall referred to when he suggested that the relationship between the firm and its immediate environment structures the processes of learning and industrial cooperation, leading to the creation of new resources. In this day and age, this immediate environment is somewhat different from the one observed by Marshall. It has become more complex and, especially, is organized into a spatial hierarchy (from the local to the global). While being geographical, its scale is associated with social capital, which is territorially structured and cannot be replicated (Storper and Venables 2004).

This is where the link between proximity and innovation comes into play as the process of knowledge acquisition is facilitated by social networks. Innovating thus becomes a process that arbitrarily combines existing experiences leading to the creation of new concepts that are more effective in terms of solving a particular problem (Dupuy and Gilly 1996).

### **The aeronautics sector as an innovating place-based system in Montreal**

Montreal is considered one of the world's main aeronautics hubs, along to Seattle, Wichita, and Toulouse. The sector brings together many types of actors: public actors, private businesses, and intermediate actors, and receives generous support from the three levels of government. At the business level, it is characterized by a pyramid structure divided into three groups of businesses: prime contractors, equipment manufacturers, and subcontractors. There are four main prime contractors: Bombardier, Bell Helicopters, CAE, and Pratt & Whitney. These are specialized in the construction of complete aircrafts, helicopters, simulators and aircraft engines. The equipment manufacturers produce larger components and assemblies such as engine, engine accessories, and communications equipment. At the bottom of the pyramid, there are the subcontractors, in all some 220 SMEs, offering products and services such as machined parts, casting and smelting works, surface treatment, machinery, and other products (CMM 2004).

As the Montreal aeronautics industry has matured, a network of intermediate organizations have emerged offering diverse services such as training, organization, financing, and R&D. The main intermediate organizations are Aéro Montréal, an organization that coordinates the entire sector; the Association québécoise de l'aérospatiale (AQA, the Quebec aerospace association); the Comité sectoriel de la main d'œuvre en aérospatiale (CAMAQ, the Aero-



space Industry Labour Board of Quebec) and the Consortium de recherche et d'innovation en aérospatiale au Québec (CRIAQ, consortium for research and innovation in aerospace in Quebec). The innovation process in aeronautics is long and costly, explaining the importance of external support from various actors such as universities, organizations, and R&D centres. For example, for airplanes, the R&D process takes, on average, 10 years before putting the first airplane into production. The innovation projects of the prime contractors constitute the driving motor for the innovation of the rest of the sector. In other words, the equipment manufacturers and subcontractors innovate according to the needs of the prime contractors.

### ***Objective and methodology of the research***

The research highlights the relations between actors and the social capital generated by these relations in the case of the aeronautics sector in Montreal. Our hypothesis is that these relations and social capital constitute the pillar of an innovation system that is made possible by the physical and relational proximity between the various actors.

The research is based on semi-directed interviews held with the intermediate organizations and the representatives of businesses in the aeronautics sector. The interviews took place between June 2007 and October 2009. The first series of interviews was conducted with ten organizations that have mandates concerning the aeronautics industry, such as Aéro Montréal, the AQA, the CAMAQ and the CRIAQ. The second series was with representatives of 18 firms of the sector. These were chosen to represent the range of firms active in the aeronautics industry (e.g., prime contractors, equipment manufacturers and subcontractors) and geographic locations spanning the Montreal metropolitan region (e.g., North Shore, South Shore, and Island of Montreal). The interviews lasted on average of 1 hour and 30 minutes and were transcribed and processed using the software Nvivo<sup>2</sup>.

### ***The social dimensions of the innovation system and proximity issues***

Montreal's aeronautics sector is characterized by a strong social network that has evolved through relations of proximity between actors (frequent meetings, physical proximity, etc.) over the years. Contrary to other economic sectors in Montreal (e.g., garment, see Klein, Tremblay and Bussi res 2009), relations in the aeronautics actors are characterized by fairly solid cooperation. Competition and conflict do exist, particularly at the level of small businesses that compete for contracts. However, in general, interviewees emphasized a climate of cooperation. Some even went so far as to speak of a "big aeronautics family"...but, as we know, even families are not exempt of conflicts.

*[Translation]*

Rather amicable. [...] It's a small network. They're people who come from the same sector. One could say that it's like a big family. People are always happy to see each other. In aeronautics, there is even a certain passion for aviation. If there's one common denominator, it's a passion for aviation. So, people always have something in common. (Director of a professional training school. Interview, 2007)

This cooperation becomes even more pronounced during common projects that concern the future of the sector, such as the Bombardier's C-Series project (Table 1). Often, these projects entail the mobilization of a good majority of the actors, especially as, financial stakes being high, a concerted effort is required to lobby for public financial support. When such important issues are at stake, relational proximity contributes to getting the actors together behind the large firms.

**Table 1**  
**The actors and their contribution to Bombardier's C Series project**

<b>Actor</b>	<b>Contributions</b>
Governments	Financial contributions
Workers and unions	Concessions with regard to social benefits and working conditions
Suppliers	Financial contributions
Comité sectoriel de la main d'œuvre en aérospatiale (CAMAQ)	Training

Interorganizational relations have become deeper with time and repeated interaction. Trust was also built over time and frequent relations and productive exchanges with various projects. This, in turn, transforms relational proximity into a form of stable cooperation.

*[Translation]*

I think that it's going relatively well. There's a good synergy between the players, despite certain diverging interests. The entire industry is advancing quite well; we have a tradition of working together. That's a big plus. (Project manager at an industrial association. Interview, 2007)

As regards the intermediate organizations, these are viewed, for the most part, as quite specialized and as operating with a certain division of labour, as explained as follows:

*[Translation]*

Each organization has its niche. The AQA, for example, is the developmental force behind the SMEs at various levels. CRIAQ drives research and development. I, for one, believe that the sector is well organized. CAMAQ assumes the responsibility for manpower, and it is the mission of Aéro Montréal to make all these people work well together. (Director of an R&D centre, Interview, 2007,)

However, some interviewees pointed to a small degree of overlapping and competition in the handling of certain issues. This indicates not only that relations between intermediate organizations are not always amicable, but also that relational proximity does not ensure the absence of conflict.

*[Translation]*

I think that the relations are generally good, but there are clashes. There's a kind of battle or struggle among the organizations with regard to establishing themselves as spokesman. In other words, the AQA, Aéro Montréal, and the Ministère are somewhat vying with each other as to who could be the umbrella spokesperson for the aeronautics industry as a whole. So, presently the atmosphere is somewhat tense between these three organizations. I know that at least with regard to missions abroad, this surfaces as a difficult issue. [...] However, the businesses that are members of the AQA and of Aéro Montréal don't have the time to get involved in these squabbles. (Representative of a provincial funding organization. Interview, 2007)

Concerning the prime contractors and businesses, their relations change depending on the size of the company and its place in the hierarchy. After all, the needs of the industry are not uniform and monolithic (CMM, 2004). In other words, the needs of Bombardier or of Pratt & Whitney Canada do

not always correspond to those of an equipment manufacturers or a small subcontractor (Table 2).

**Table 2**  
**Types of relations according to the type of business**  
**in the aeronautics sector**

	<b>Prime contractors</b>	<b>Equipment manufacturers</b>	<b>Subcontractors</b>
<b>Prime contractors</b>	Collaboration	Dominance	Dominance
<b>Equipment manufacturers</b>	Dependence	Collaboration, Competition	Dominance
<b>Subcontractors</b>	Dependence	Dependence	Competition

Among the prime contractors, relations are generally good and are characterized by collaboration. This is due mainly to the absence of competition between these corporations, each having its own niche. Bombardier is specialized in regional and business aircraft, Bell Helicopters in helicopters, CAE in simulators, and Pratt & Whitney in engines for aircraft and helicopters.

*[Translation]*

It's all very friendly. One of the characteristics of Montreal's aeronautics industry is the absence of competition. In Montreal, there are four lead firms—Bombardier, Pratt, Bell, and CAE. These four firms work in different domains and don't have to compete against each other. So, competition and all the rest is not an issue here and no problems arise. (Representative of a training institution. Interview, 2007)

However, the relations between the prime contractors, the equipment manufacturers and the subcontractors are characterized by domination and this can give to conflicts. Moreover, since some years, the relations between prime contractors and their suppliers (equipment manufacturers and subcontractors) have been undergoing a major transition, namely, from traditional client-supplier relationship to partnership. Similar to the automobile industry, the prime contractors of the aeronautics sector tend to limit their activities to the design, final assembly, and marketing of the aircrafts. They try to considerably minimize the number of suppliers by requesting increasingly larger and more

complex sub-assemblies. The realization of other aspects of the projects is also increasingly entrusted to a more restricted number of large-scale suppliers. This has led to the appearance of integrators who, instead of the prime contractors, take full charge of the assembly and delivery of complete sub-assemblies, such as the assembly as well as the fitting and furnishing of the cabin, cockpit, and cabin control systems (CMM 2004).

To maintain control of their production process without having to exercise complete control, the prime contractors have recourse to two methods. The first method consists of implementing certifications and quality assurance systems. The second method consists of establishing more stable and sustainable relations. Prime contractors generally wish to establish very strong relations with subcontractors and suppliers, requiring a major investment by both parties involved. Being able to rely on stable relations with subcontractors and suppliers represents major savings for the prime contractors, in particular with regard to risk management and also inventory management (use of just-in-time method).

*[Translation]*

When we've been working with a supplier for a long time and had a good relationship, in other words, when they're satisfied and we're satisfied, this benefits our future collaboration. It's just like any relationship in life. But, if you've had difficulties with a supplier, of course you're not going to work with that client again on a following project. (Director of R&D of a prime producer. Interview, 2008)

This stability allows prime contractors to save on expenditures for certifying suppliers.

*[Translation]*

There's no use putting your head in the sand. It costs money to approve and to certify a supplier. So, when we decide to do that, we have to make major investments. We try to minimize those costs as much as possible, of course. For example, we try to make sure to select the right supplier from the start, and that these have a quality system in place that meets the standards in aeronautics. Once all that is confirmed, we work on establishing a relationship that we can maintain over many years. In this way, we would be obliged to find someone else only under very special circumstances, such as, for example, if a supplier decides that he no longer wants to do that kind of work. We don't have,

for each repair, a double or triple backup. We try to avoid that because it's costly to maintain double and triple sources. (Project manager for an equipment manufacturer. Interview, 2008)

The relations between the SMEs of subcontracting are often marked by competition, as these are rather hesitant to cooperate and to exchange information with other businesses, and even with research centres and universities. Moreover, the prime contractors put them in competition with each other in order to obtain the best price.

*[Translation]*

The SMEs are still reluctant to join forces and work together. It's not in the nature of entrepreneurs to collaborate in this way. Instead, it's "every man for himself" (Representative of a union organization. Interview, 2007)

*[Translation]*

That's the method imposed by Bombardier. It consists of using competition to lower the prices. (Director of R&D for an equipment manufacturer. Interview, 2008)

However, in general, the relations between, excluding the prime contractors, are relations based on a mix between cooperation and competition, and often firms are clients, competitors, and partners at once.

*[Translation]*

Aviation is a strange environment where one and the same business can be a supplier, competitor, and partner at the same time. So, Rokwell, Thales, and co. are suppliers, clients, as well as partners on certain projects, and sometimes even our competitors. The nature of the relation changes on the basis of the project and the client. (Director of R&D for an equipment manufacturer. Interview, 2008)

However, with regard to human resources, the relations between firms are characterized by competition. We remind that following the events of 9/11, the aeronautics industry experienced a period of crisis with a drop of sales. As a result, young people, afraid of not being able to find jobs in the sector, became less interested in working in aeronautics, in turn explaining the drop in registrations for aeronautics-related training programs and institutions. As

a consequence, for some years now, and especially with the return to a growth course, the sector is experiencing a labour shortage in certain aeronautics professions such as the technicians. Presently, this constitutes one of the biggest challenges of the industry. The majority of firms encountered confirmed the existence of competition among each other for the recruitment of labour. However, the economic crisis of 2009 and its accompanying layoffs decreased the intensity of this competition.

*[Translation]*

The SMEs are in confrontation with the businesses from here, above all with the prime contractors who are capable of offering better salaries. (Director of an SME in subcontracting. Interview, 2008)

This competition also concerns affiliated sectors, among them metalworking, where aeronautics businesses tend to look for qualified labour.

*[Translation]*

In this sector of activities salaries are generally higher. So, in our smaller businesses, there are a lot of comments going around concerning good workers being quote on quote *stolen* [...]. Finally, in the aeronautics sector, the emphasis is on quality. So, those folks have the capacity to pay and to offer more and better social benefits. So yes, for sure, effectively it's a "labour drain." (Director of an economic development organization. Interview, 2007)

The relations between firms thus oscillate between competition and cooperation. But, in general, relations are good because firms are aware of the importance of cooperation for advancing their projects and for ensuring the overall development of the sector.

*[Translation]*

Relations are pretty smooth between the businesses. OK, at times there are certain issues, so to speak, where interests just don't overlap; but that's entirely normal. But on the whole I think we all benefit and, as mentioned, we're in the right industry. (Project director at an industrial association. Interview, 2007)

### ***Governance of the aeronautics innovation system in Montreal: Formal and information rules***

As in many other sectors, relations between actors in the aeronautics sector are defined by a series of expected behaviours based on common rules and norms. Some rules and norms are formal, others informal. Concerning innovation and R&D, the rules are well established by contracts that carefully define and establish the role of each party in the research project. This is explained by the nature of the aeronautics industry: a strategic industry where questions of safety hold a prominent place. Also, R&D demands a lot of time and money, explaining the importance of intellectual property and of protecting innovations.

#### *[Translation]*

In fact, it is very open, because it has already been established at the contractual level when drafting the intellectual property agreements. So, what belongs to us and what doesn't belong to us was discussed right at the start. (Director of an SME in subcontracting. Interview, 2008)

Certifications also hold a prominent place in the structure of the relations between firms, in particular the client-supplier relations. To maintain control over their production process, the prime contractors make use of certifications and quality assurance systems allowing them to ensure the reliability of firms with which they do business. Traditionally, the choice of the suppliers and subcontractors was considered essentially as a short-term decision (Lefèvre *et al.* 1993). The choice was made largely on the basis of price. Today, however, in addition to price, quality and prompt and timely delivery have also become major criteria in performance evaluations. Most of the prime contractors have set up a rigorous certification procedure allowing equipment manufacturers and subcontractors, to do without the inspection of goods receiving and shipping. The firms interviewed in the categories of equipment manufacturers and subcontractor declared investing a lot of energy to produce quality products that respond to the needs of the prime contractors as well as their own demands in terms of quality. The quality of the products supplied by the subcontractors and equipment manufacturers is a necessary condition for the reliability of the final product. The majority of businesses of this category have been put under pressure to become certified.

#### *[Translation]*

If we don't comply with them and tend to every detail, we could lose our accreditation. And if we lose our NADCAP



accreditation, we're out of business. Because that's the bottom line. I cannot deliver parts [...] Bombardier or Bell or any other prime producer will not accept to receive parts processed by us knowing that we do not have the required accreditation, that we are not certified by the required quality system to produce those parts. So, no one is going to take that chance. (Director of an SME in subcontracting. Interview, 2009)

This stability, and we could add relational proximity, also favours the establishment of standards of conduct that develop over time and that facilitate communication:

*[Translation]*

We always try to retain the same subcontractors because there's a whole history that takes shape, a relationship that develops, and an expertise that facilitates the communication. We therefore avoid changing frequently. (R&D project manager for an equipment supplier. Interview, 2008)

However, informal rules nevertheless occupy a major place, in particular in the relations between the prime contractors and the rest of the actors. The four prime contractors realize 70% of sales (\$7.8 billion) and account for 58% of jobs (22,700) of the sector. Therefore, all the actors acknowledge that the prime contractors constitute the most important actors in the sector, as underlined by the representative of a sectoral association of aeronautics:

*[Translation]*

The prime contractors are fairly independent. They have their own agenda, [...] the "big boys agenda." Thus, in terms of leadership, it's always important that prime contractors are present. (Interview, 2007)

Prime contractors thus hold a key place in the governance and decision-making of the sector. They are also consulted by all levels of government in matters concerning the sector. Also, the organizations, aware of the importance of having prime contractors at the table, often try to gain the active support of the latter before launching their projects (e.g., the creation of Aéro Montréal). Often, it is the businesses that initiate projects, which are then followed up by the organizations (e.g., the Special Committee on Defence<sup>3</sup>). The same applies to firms. The innovation projects of the prime contractors constitute the driving motor for innovation in the rest of the sector. Often, the equipment

manufacturers and the subcontractors innovate according to the needs of the prime contractors, and try to anticipate their problems and needs:

*[Translation]*

We try to identify with the problems that the prime contractors have; not with regard to marketing, but with regard to engineering. That's our strength. (Director of an SME. Interview, 2008)

The same phenomenon applies to the rest of the sector. The prime contractors are the drivers of innovation for the entire sector. As a result, university research in the aeronautics field often focuses on the needs of the prime contractors. Thus, on the whole, the relations of the prime contractors with the rest of the actors, in particular with the equipment suppliers and the subcontractors, are characterized by dominance. This leads to the prevalence of informal rules of conduct.

*[Translation]*

Ultimately they're the ones that keep the wheel turning. I'm not saying that they determine every detail of our daily life, but everything comes from them, everything. [...] At the end of the day, it's them that manufacture the aircrafts. So, of course, everything that's made to go on the aircraft is done according to their demands. This is something that occurs across all levels. (Director of an SME in subcontracting. Interview, 2009)

*[Translation]*

I even asked my clients whether they have agreements that protect them against these kinds of decisions. Oh, they all say, it is written black on white in the contract that if there's a delivery delay, there'll be a penalty. But we can't use it. The penalties are in the agreement, but they're useless because it's still the prime contractor who carries the big stick, and who'll simply say: So, do you want the contract? So, your clause in the contract, look, you may as well forget it. (Director of an SME of subcontracting. Interview, 2009)

***Intermediate organizations, proximity, and social capital***

Intermediate organizations play an important role in developing relational proximity and social capital between the actors within the sector. Since its founding and until the 1970s, the Montreal aeronautics sector consisted of an

accumulation of businesses that coexisted alongside each other yet that did not interact. The relations between these firms were restricted to their productive relations and involved little cooperation in other fields such as R&D and innovation. Montreal was thus no more than a number of loosely associated firms that hardly interacted with their environment (Zhegu 2007). This period also lacked organizations dedicated to aeronautics, apart from the AIAC (Aerospace Industries Association of Canada), with headquarters in Ottawa. The activities of the different organizations (Aéro Montréal, AQA, CAMAQ, CRIAQ) fostered the development of a relationship of trust and a relational proximity between the actors, as well as a sense of belonging to the same territory and sector, an aspect that was mentioned in many of the interviews. The great majority of these interviewees liked to point out, with pride, that Montreal is the only place in the world where it is possible to manufacture an aircraft "from A to Z" within a radius of thirty kilometres. This territorial pride was then complemented with a certain sectoral pride. The majority of stakeholders expressed their pride of working in aeronautics and their passion for the sector.

The intermediate organizations help the firms and different actors to network and collaborate through activities and networking events. They facilitate relations between the different actors, in particular the firms. For example, the activities organized by the AQA are important for the businesses, allowing them to network and develop their markets.

*[Translation]*

Thanks to the dinners organized by the AQA, networking is quite easy. There is at least one networking activity every three months, not counting the networking sub-activities. There are also quite a few events in the innovation sector. CRIAQ holds an annual forum, and makes a point of inviting the universities to attend, so that these can better understand the needs of industry. (Representative of a government organization. Interview, 2007)

Also, a brief look at the composition of the board of directors of aeronautics associations (Table 3) reveals the high participation of firms in these bodies. Usually, the associations try to have all the actors around the table to ensure their involvement and the success of their projects.

**Table 3**  
**Composition of the boards of directors of the**  
**four principal aeronautics associations**

<b>Association</b>	<b>Businesses</b>	<b>Organizations</b>	<b>Public agencies</b>
Aéro Montréal	15	8	3
Association québécoise de l'aérospatiale (AQA)	12		2
Consortium de recherche et d'innovation en Aérospatiale au Québec (CRIAQ)	32	19	1
Comité sectoriel de la main d'œuvre en aérospatiale (CAMAQ)	4	8	2

*[Translation]*

We wanted our council to be as big as possible; we tried to get representatives from all the categories: the big and the small, from training and R&D. (Project manager at a sectorial association. Interview, 2008)

According to certain respondents, the participation on boards of directors constitutes an important means of establishing relations and creating a network of contacts with other organizations and businesses whose representatives are sitting on the same board or committee.

*[Translation]*

Presently, we have more affinities with the people from ÉTS, due to contacts. When I founded the Research Chair, the ÉTS put me in contact with people, and these relations have lasted. I have been sitting on ÉTS's board of administration since 2002. So, I'm very attached to the ÉTS. (Head of engineering for an equipment supplier. Interview, 2008)

Some respondents confided that their main objective of sitting on these boards or committees was to establish business relations with other businesses. In response to the question concerning the objective of their participation in a committee organized by Aéro Montréal, of which Bombardier is also a mem-

ber, the head of engineering of an equipment manufacturer responded:

*[Translation]*

We hope that in the long term Bombardier will have an interest in working with people like us. This is something that evolves over the long term and that is very much based on human relations. So, the trust, I've known him for about 5 years. I see him regularly. If I get a new project, I'll go talk to him to see if there's an interest. (Interview, 2008)

### ***Relational proximity as a determining factor?***

Physical and mostly relational proximity are extremely important in order to develop interorganizational relations that can lead to innovation. Relations can often be superficial in business networks; however, the work of intermediate organizations as well as the common interests of the sector have clearly led to a strong relational proximity—one that is conducive to good productive relations and to cooperation in innovation. Therefore, physical proximity facilitates face-to-face interaction, the development of trust between actors, and subsequently relational proximity:

*[Translation]*

There's no doubt that this proximity helps a great deal when developing this relationship of trust, which grows from one year to the next. So, we're very satisfied. (Director of an SME of the supplier category. Interview, 2008)

*[Translation]*

It's very practical to have visual, face-to-face contact when you need to sit down and they're only 10 minutes away. For example, I live downtown. So, every morning on my way to work I stop there, and it makes things so much easier. (Project manager for a supplier. Interview, 2008)

Over the years, this physical proximity helped the businesses and other actors to establish relations, harmonize their standards, and develop a sense of belonging with regard to the territory and the sector. In this way, physical proximity stimulated the development of an organizational and relational proximity that is anchored more in the territory.

*[Translation]*

That is exactly our professional trademark, if you like: personalized contact. I can't say that it's a magic wand; but here, at least, it works. We developed a level of trust, a credibility that took shape [...] This evolved over the course of the years. (Head engineer with a supplier. Interview, 2009)

While strong relational proximity serves to establish a solid cooperation, it is also accompanied by a negative dominance of the large firms over the smaller ones, who are not always invited to participate in innovation activities or to benefit otherwise from these activities. Thus, the smaller firms would do well to decrease their dependence on the larger firms, for example, by doing more business with other sectors.

## Conclusion

We found that the aeronautics sector in Montreal is characterized by a strong relational proximity, one which fostered cooperation without stifling healthy competition. This tradition of cooperation has its roots in the difficult crisis and reconversion period of the 1980s. Back then, in order to face the economic crisis of the 1980s, the stakeholders in development, political institutions of all levels of government, and the community of business people, created many new platforms of dialog and strategic plans. Eventually, through the agency of intermediate and governmental organizations, the firms were then brought to work together.

The origins of the culture of cooperation and partnership in the aeronautics sector can be traced back to this decade of concerted action on the part of all stakeholders. As mentioned, this close cooperation and proximity does have some drawbacks for the smaller firms, who, prone to rely excessively on the larger firms, forego other business opportunities and fail to diversify their activities. In so doing, they suffer the full force of the upswings and downswings of the aeronautics industry. We observed, on the one hand, an alignment of all the relations and interactions in the aeronautics industry around certain well identified prime contractors, who dominate the sector and who impose their rules on the rest of the actors. On the other hand, we saw that all these relations and intermediaries are facilitated by the proximity of the actors within the metropolis. It is not physical proximity per se that is important, although this does play a role in the case of the productive collaborations between prime contractors and subcontractors. What matters, rather, in addition to being located in Montreal, is to have access to the social capital developed by the prime con-

tractors and to receive support from the intermediate organizations. It is this social network that, as a whole, has given rise to the strong territorial identity, and in particular a strong sense of belonging to the metropolis, in the aeronautics sector. The diverse forms of proximity thus shape the aeronautics sector in Montreal, with the specific characteristics of the sector (strong vertical integration and major spatial concentration of the productive chains) and of the place, in this case Montreal (priority to partnership, presence of intermediate organizations), converging and contributing to the building of an innovative system at the metropolitan scale.

## Notes

<sup>1</sup> Routines are interaction models that constitute effective solutions to specific problems. These interaction models are specific to group behaviour, although some inferior routines may be specific to individual behaviour (Dosi, Teece, and Winter, 1990).

<sup>2</sup> <http://www.qsrinternational.com>

<sup>3</sup> The *Comité spécial sur la défense* is responsible for promoting the unique capabilities of the Greater Montreal aerospace cluster to the federal government and its suppliers with regard to Canadian Armed Forces military equipment purchases and related Canadian industrial offsets.

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