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# Globalization and the Future of Industrial Clusters: an Empirical Study of the Aerospace Cluster in Montréal

by

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**Summary:** Globalization is changing the way that firms organize their activities. Whereas in the past it was better for firms to locate activities near each other to save on spatial transaction costs, improvements in transportation and communication technology are changing this logic. Nowadays it has become cheaper for firms to globally spread out their activities and integrate into global value chains. In this study, we evaluate the implications of globalization for industrial clusters. We set up a theoretical framework to examine how a reduction in spatial transaction costs affects the logic of industrial clusters, allowing us to develop a number of propositions. We next conduct semi-structured interviews with 14 informants from Montréal aerospace companies or organizations to evaluate if there is evidence in line with these propositions.

**Key words**: industrial clusters, globalization, spatial transaction costs, aerospace industry, Aéro Montréal

**Research methods:** single case study, qualitative research

*Version française*

**Résumé :** La mondialisation change la façon dont les entreprises organisent leurs activités. Dans le passé cela était meilleur que les activités soient localisées les unes à proximité des autres afin de diminuer les coûts de transaction spatiale. Cette logique est en train de changer en raison d'avances dans les technologies de transportation et de communication. Il est maintenant moins couteux pour les entreprises de séparer leurs activités globalement et de s'intégrer dans les chaînes de valeur mondiale. Dans cette étude, nous évaluons les implications de la mondialisation pour les grappes industrielles. Nous avons mis en place un cadre théorique pour examiner comment la réduction dans les coûts de transaction spatiale affecte la logique des grappes industrielles, nous permettant de développer un nombre de propositions. Ensuite nous menons des entrevues semi-structurées avec 14 répondants de compagnies ou d'organisations aérospatiales à Montréal afin d'évaluer s'il existe de la preuve en ligne avec nos propositions.

**Mots clés**: grappes industrielles, mondialisation, coûts de transaction spatiale, l'industrie aérospatiale, Aéro Montréal

**Méthodes de recherche**: étude de cas unique, recherche qualitative

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# I - Introduction

The geographic concentration of economic activity occurs because the costs that come with transporting goods, people and ideas give individuals and organizations incentives to locate near each other (Ioannides, 2007). But with continuous improvements in technology, we are seeing these spatial transaction costs rapidly decreasing. This is causing many scholars to question the importance of distance in conducting trade and business (Caircross, 2001; Friedman, 2005). As Friedman (2005) explains, "[t]he widespread availability of inexpensive computers, standardized file formats and transfer protocols, excess international fiber-optic cable capacity, outsourcing, and a handful of other trends have greatly leveled the international playing field". These changes suggest that location may no longer be important in the future; we may be moving to a world where it becomes as easy to work with a person in New Zealand than it is to work with our neighbour.

But then, what explains the prevalent role that industrial clusters continue to play in our global economy? Clusters are not only found in most developed countries, but increasingly in developing countries as well (Romero, 2011). Moreover, clusters are found in a wide range of industries, from high technology clusters in Silicon Valley, Route 128, Tokyo, Minneapolis, to fashion clusters in London, Paris and New York. Clusters are even found in industries in which location would seem not to matter, such as telemarketing in Omaha, call centers in Sydney, data entry in Manila, and software in Bangalore (Humphrey and Schmitz, 1996).

As Markusen (1996) describes it, there is a paradox of "sticky places within slippery space", and this paradox is what motivated the creation of this research paper. In a world where location seems to be becoming less important, how is globalization changing the role of industrial clusters?

This is an issue that has been understudied, and we will analyze the aerospace industry to gain more insight. The study is divided into 6 parts. In the first part, we introduce the topic. In the second part, we will present our literature review and justify the need for further research by presenting our 4 propositions that deal with the impact of the decreasing spatial transaction costs on industrial clusters. In the third part, we will present our methodology and explain why we thought it was the most appropriate to explore our research question. In the fourth part, we will provide a background on Canada's and Montréal's aerospace industry. Then we will justify using the Montréal aerospace industry for our case study. In the fifth section, we will test our propositions. Finally, in the sixth section we will provide concluding remarks on our findings. We will also acknowledge the study's limitations and the areas for future research that we see as important to further increase our understanding of industrial clusters.

# II - Literature review

Industrial clusters are a well-researched topic (e.g. Marchi and Grandinetti, 2014; Porter, 1990; Iammarino and McCann, 2013; Baptista and Swann, 1998). To narrow down my focus, I divided my literature review into three parts. I start off by defining industrial clusters. Then I explore the many reasons that firms choose to co-locate. After that, I explain what changes are provoking spatial transaction costs to decrease. Finally, I introduce my propositions that explore the impact that these decreasing transaction costs have on the logic of industrial clusters.

## A - Definition:

Clusters are not a new phenomenon. This idea can be traced back to Marshall's (1890) *Principle of Economics*. In this book, he illustrates how small firms in the industrial heartlands of the UK and Europe acquired critical external economies of scale by locating themselves in certain areas. He uses the term 'industrial districts' to explain why firms from the same industry would concentrate in specific localities. He does not provide a definition for an industrial district, but his in-text examples demonstrate that industrial districts and industrial clusters have the same meaning.

Today, there are many definitions of industrial clusters. Rosenfeld (1997) defines them as a "concentration of firms that are able to produce synergy because of their geographical

proximity and interdependence". Similarly, Porter (1990) defines clusters as "groups of interconnected firms, suppliers, related industries and specialized institutions in particular fields that are present in particular locations". Iammirano and McCann (2013), then again, emphasize that what is unique about a cluster is that the benefits are felt by a geographically clustered group of firms and people, but which do not spill over to firms or people in other locations.

Despite the mix of definitions, scholars generally agree that clusters have three defining dimensions: geographical proximity, an inter-firm network, and an institutional network (Rocha, 2004). The first dimension is the basic requirement of a cluster. The second dimension refers to the interactions between the firms in the industry, both market based transactions and informal relationships which transmit the benefits of being co-located. The third dimension refers to the relationship that firms in the cluster have with external institutions, both governmental and non-governmental. What is important to note is that a geographical agglomeration of related firms is not enough to constitute a cluster. There must be other factors at play that bind the different actors in the cluster together and make co-location advantageous.

## B – Why co-locate?

### a) Marshall's benefits of clustering

According to Marshall (1890), there are three reasons why firms benefit from co-locating with other firms. Firstly, firms benefit from knowledge spillovers and knowledge creation, and this generates 'technological spillovers'. Marshall (1890) famously explained that "the mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously"; this type of knowledge that is 'in the air' is known as tacit knowledge and will be explored more in depth in a subsequent section. Secondly, firms have access to common infrastructure, such as railway networks, universities, and think-tanks, which reduces costs for all firms within the cluster. Thirdly, firms have access to a constant pool of skilled labour. Employers are more likely to be attracted to a location where they are likely to find a pool of labour with the skills they require. Duranton and Puga (2004) summarize Marshall's benefits of clustering as a process of firms being able to *learn*, *share* and *match*. The rest of the section will deal with those three benefits in more detail. While we will treat each concept separately, it is important to note that there is significant overlap between them.

#### *i. Learn*

Co-location is important because it allows firms to *learn* from each other, by taking advantage of knowledge that they otherwise would not have access to. As Marshall (1890) explains, a

defining characteristic of a cluster is the availability of knowledge spillovers, which tend to be highly localized. For example, there is evidence that in Europe knowledge spillovers have been calculated not to exceed a radius of around 200 km from the largest and most dynamic cities (Rodriguez-Pose and Crescenzi, 2008). Knowledge has become a crucial asset in modern production systems (Lundvall, 1992) and is paramount for firms trying to increase their competitive advantage (Porter, 1990).

However, the impact of distance on the cost of exchanging knowledge depends on the nature of the knowledge in question. Knowledge that can be codified, can be easily communicated through symbols and language; it thus has the necessary features to be easily 'tradable' across large distances (Dosi, 1988). Tacit knowledge on the other hand is sensitive to distance as it can only be transmitted through face-to-face interactions. Polanyi (1966) famously stated that "we can know more than we can tell". Despite advances in technology, codification is not always possible due to some features that make codification too complicated or costly for the firm.

Co-location is important because proximity provides access to tacit knowledge from a concentration of firms and workers. Pisano and Shih (2009) explain that "an engineer in Silicon Valley, for instance, is more likely to exchange ideas with other engineers in Silicon Valley than with engineers in Boston". Face-to-face interaction is important. And studies show that the main way that knowledge spreads from company to company is when people switch jobs (Pisano and Shih, 2009). Moreover, another reason that co-location is important is because firms exchange tacit knowledge with certain local firms because they share the same values,

background, and commercial and technical problems (Maskell and Malmberg, 1999). Co-location allows firms to engage in collective learning processes through frequent opportunities for formal and informal exchanges (Maskell and Malmberg, 1999). Finally, co-location is important for firms with products in the early stages of their life cycle because access to knowledge is critical for their successful development (Basant, 2002).

Giuliani and Bell (2005) however, suggest that proximity is a necessary but not a sufficient condition for knowledge sharing. Their findings show that knowledge is not diffused evenly 'in the air' as Marshall (1890) implies when he introduced the concept of industrial clustering. Rather a cluster is a complex economic and cognitive space where firms establish knowledge linkages in ways that are shaped by their unique knowledge absorption capabilities that facilitates their acquisition and absorption of external knowledge (Giuliani and Bell, 2005). They conclude that being in a cluster does not guarantee that a firm will take advantage of local knowledge spill-overs.

Due to the difficulty in measuring knowledge sharing, there are limited empirical studies on the importance of knowledge sharing in clusters. Saxenian (1996) makes an important contribution to that body of literature. In her book titled *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, she looks at what makes clusters succeed or fail. To illustrate her point, she compares two industrial clusters: the Silicon Valley Region and the Route 128 region. She conducts a qualitative study, gathering data through exhaustive conversations with key players in both industries. Saxenian finds that Silicon Valley is made up of a regional network-

based industrial system that promotes knowledge sharing. Firms compete intensely while at the same time learning from each other through informal communication and collaborative practices. Route 128 on the other hand, is dominated by a small number of large firms that collaborate less, and internalize a large part of their activities. Saxenian (1996) explains that, "practices of secrecy and corporate loyalty govern relations between firms and their customers, suppliers, and competitors, reinforcing a regional culture that encourages stability and self-reliance". A main difference between the two clusters is the role that collaboration and information sharing plays, and this helps explain the deferring success of the two clusters. Clusters made up of firms that are more independent and engage in less knowledge sharing are more likely to fail.

In summary, a first reason why firms chose to co-locate is to *learn* from each other, and to take advantage of local knowledge spill-overs that they otherwise wouldn't have access to. Knowledge spill-overs are especially important for the transmission of tacit knowledge; this type of knowledge is sensitive to distance and can only be transmitted through face-to-face interactions within networks.

*ii. Share*

A second reason why firms co-locate is to share immobile resources. Lublinski (2003) argues that firms in clusters may have better access to workers and at lower recruiting and training costs. There are three reasons for this. First, firms can recruit graduates from local educational

institutions which provide the training that is locally requested. Second, a geographical concentration of technologically related firms creates a local pool of specialized and experienced workers. These workers help firms cope with the uncertainties that come with business. As the saying in Silicon Valley goes, people change jobs but not parking lots. Greenstone et al. (2008) explain that workers will prefer to be in areas with thick labor markets to reduce the probability of being unemployed. The concentration of firms attracts people. And similarly, firms prefer to be located in areas where the labour force is thick in order to reduce the probability of having unfilled vacancies.

Third, as we have already indicated above, labour pool sharing is also related to knowledge spillovers. Firms have access to new knowledge because studies show that the main way knowledge spreads from company to company is when people switch jobs (Pisano and Shih, 2009). This is because, as we saw in the previous sub-section, humans remain superior at transmitting complex tacit knowledge. Moreover, employees don't take a once and for all" stock of knowledge with them, but they continue to maintain their relationships with employees from their former workplace (Basant, 2002).

Fourth, Kuah (2002) argues that the concentration and accumulation of knowledge in the cluster will attract increased human capital to the cluster and, since the information exchange tends to be more informal, the spread of knowledge outside the region becomes limited.

Almeida and Kogut (1999) test the assumption that labour mobility influences the creation of localized spillovers. By tracking over 400 engineers in a study of semiconductor firms, the researchers find that the mobility of engineers between firms in a region led to the localization of knowledge within the region, while the mobility of engineers across regions led to a decrease in regional knowledge. Employees are important agents in the creation and diffusion of knowledge and are therefore an important force for co-location.

But co-location doesn't only give firms access to shared workers, but also to local inputs. These inputs specific to an industry are available in a greater variety and at a lower cost (Baptista and Swann, 1998). This also allows firms to save on transport costs and avoid costly delays, therefore reducing production costs and increasing flexibility (Ma and Van Assche, 2003). In sum, co-location is important for access to shared immobile resources.

*iii. Match*

Finally, firms co-locate because it allows them to develop a trust relationship with other firms in the cluster, thereby reducing their transaction costs. Cooke and Morgan (2000) define trust as "the confidence that parties will work for mutual gain and refrain from opportunistic behavior". Trust is an important asset if it can be secured. Cooke and Morgan (2000) summarize the main benefits of trust for a firm: "first, it saves time and effort to be able to rely on others; second, it reduces risk and uncertainty; and third, it expedites learning because the parties are privy to thicker and richer information flows on account of the fact that people divulge more to those

they trust". This information sharing may happen through daily interactions or through formal negotiations.

Firms that trust each other are less likely to behave dishonestly through lying or cheating. Sociological analyses focus on how cultural similarities, community cohesiveness, interdependence among local firms, repeated interaction, and familiarity allow firms to trust that their counterparts will not act opportunistically (0ECD, 2000). Lorenzen (2001) develops a theoretical account on why trust is important because it "lubricates" interaction between firms. Once this mutual trust is established, transaction costs between firms decrease. Moreover, it is possible for trust to develop at a distance, but firms must rely on costlier coordination mechanisms (Lorenzen, 2001).

Furthermore, when suppliers and buyers are located in close proximity, negotiations and monitoring can become less costly. And some localized industries develop standardized contracts and transaction mechanisms that lower the cost of negotiation (OECD, 2000). Enright (2003) provides an example, "the Hollywood motion picture industry, which routinized the casting of extras through Central Casting in the 1920s and eventually standardized transactions through area-specific guild and union contracts". Transaction costs, in this case in the form of search costs, are reduced by motion picture companies locating themselves near each other. In summary, another reason that firms co-locate is because it allows them to develop a trusting relationship with other firms in the cluster, thereby reducing their transaction costs.

b) Other benefits of clustering

Later studies have discussed additional co-location forces: ability to observe and access to global linkages.

*i. Observe*

Porter (1990) brought the concept of clusters back into the spotlight. He defines modern day clusters as we know them. Clusters are "groups of interconnected firms, suppliers, related industries and specialized institutions in particular fields that are present in particular locations". What is unique about Porter's approach, was that he identified other reasons for co-location: demonstration effects. Being clustered in the same location generates demonstration effects whereby firms can *observe* what their competitors are doing (Iammarino and McCann, 2013). This gives firms the drive to keep innovating and upgrading in order to stay ahead of their rivals, hence it leads to superior economic performance. Observing is related to learning but with more emphasis on competition instead of collaboration.

Porter (1998) then goes into explaining how clusters are critical to increasing the innovative ability of firms. Firstly, firms can experiment at a lower cost, compared to firms with suppliers that are faraway. This is because a firm within a cluster can delay costly commitments until it is sure that a given innovation is delivering satisfactory results. This is much more difficult for a firm with distant suppliers. Secondly, the pressure from the other firms in the cluster forces

firms to keep innovating to stay ahead of the game. In fact, the stimulation provided by local rivals is even more beneficial than the stimulation provided by foreign competitors (Porter, 1998; Iammarino and McCann's, 2013).

Similar to Porter, other authors (Baptista and Swann, 1998; Boasson et al., 2005; Klein, 1991) find that firms within clusters innovate more through competitive mechanisms. Klein (1991) finds that one of the main determinants of the success of the Sinos Valley shoe cluster in Brazil, is the presence of strong local competition and rivalry. He successfully finds a link between clustering and demonstration effects.

Baptista and Swann (1998) also test this assumption. They use regional employment as a measure of a cluster's strength. For the case of UK firms, they find that they are more likely to innovate if located in a region where the presence of local rivals is strong.

Boasson et al. (2005) explore the contribution of locational factors to firm value within clusters. They perform multiple regressions using data from publicly traded companies in the US pharmaceutical industry. The primary conclusion they draw is that companies that operate in knowledge-intensive sectors can maximize their firm value by locating their headquarters in regions that contain large numbers of competitors. This finding is supported by the fact that top pharmaceutical companies in the US tend to be located near each other (Boasson et al., 2005). Firm value positively responds to local rivalry.

In sum, being part of a cluster generates important demonstration effects that pressure firms to keep upgrading and innovating. This leads to superior economic performance.

### *ii. Local buzz and global linkages*

The literature on local linkages is well developed (e.g. Schmitz, 1995), however there is a growing realization that there are important inter-firm transactions that take place with firms outside of the cluster (e.g. Amin & Cohendet, 1999; Bathelt, 2002; Malmberg & Power, 2005; Gertler, 2003; Dicken et al., 2001). Specifically, many cluster firms build global linkages to tap into foreign knowledge pockets. This helps improve a cluster's performance.

Lorenzen and Mudambi (2012) argue that global connectivity allows firms to 'hook on to' the global production and innovation systems. This positively affects a cluster's growth by facilitating flows of knowledge, investments and other types of trade between clusters. Martin and Sunley (2006) find that global linkages can allow clusters to 'de-lock' their evolutionary path when necessary.

Owen-Smith & Powell (2004) contend that firms build global pipelines in order to benefit from knowledge hotspots around the world. They conduct a study on biotechnology firms in Boston and conclude that firms gain important, non-incremental knowledge through pipelines rather than through their local network. Their study makes it clear that firms do not solely rely on local interactions to acquire new knowledge.

Similarly, Bathelt et al. (2004) develop a cluster model that distinguishes between two kinds of learning processes: one that takes place within the cluster, and one that takes place outside the cluster. What is unique about their model is the incorporation of these external linkage that they coin "global pipelines". See the figure 1 below.

These pipelines connect the cluster to global markets. These pipelines are valuable for the cluster because firstly, firms will have access to new and valuable knowledge that is created in different parts of the world, and can gain access to this through global pipelines. Secondly, the knowledge that one firm acquires will likely spill over to other firms in the cluster through 'local buzz'. Buzz refers to the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region (Bathelt et al., 2004). Actors continuously contribute to and benefit from the diffusion of information, gossip and news by just 'being there' (Gertler, 1995).

This mix of local buzz and global pipelines creates a lively cluster. And, local knowledge exchange within the cluster takes place through informal, social networks. Entrepreneurs establish informal social ties with actors in other localities, allowing them to tap into the 'local buzz' of another cluster (Saxenian, 2006).

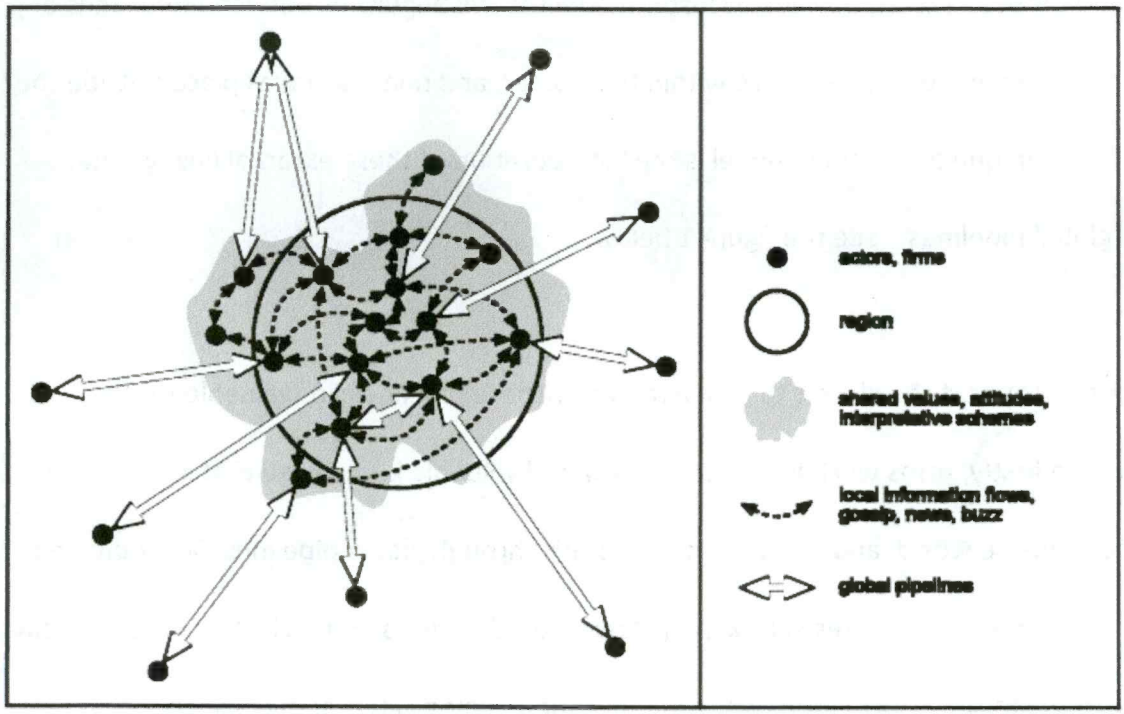


*Figure 1: Local buzz and global linkages (Source: Bathelt et al., 2014)*

Building on the work of Bathelt et al. (2004), Turkina and Van Assche (2017) find a link between a cluster's embeddedness in a global network and its local innovative performance. They develop a new typology of four cluster archetypes based on their multiplex embeddedness in the global cluster network. They find a link between a cluster's embeddedness in a global network and its local innovative performance. Its local innovative performance however, varies across the different cluster archetypes.

To conclude, this research on external linkages is important because it introduces a new perspective on the study of clusters. Clusters are no longer perceived as bounded regions but instead as specialized regions that seek to develop networks with other clusters.

### *iii. Anchor firms*

The implications of global linkages show that connectedness to foreign clusters leads to superior economic performance for cluster firms. As we saw in the previous section, it gives these firms access to a new source of knowledge, ideas and resources. Moreover, there are certain firms that play a more important role in connecting cluster firms to this global network, and one kind of firm that has gained particular attention is the anchor firm.

An anchor firm is often a strong and well-established player in the industry. It has access to external sources of information about new technologies and changes in the market. For example, in the aerospace cluster in Montréal, there are several OEMs that play the role of anchor firm, namely Bombardier Aerospace, CAE Inc, Pratt & Whitney Canada and Rolls-Royce Canada. According to Agrawal and Cockburn (2003) a classic anchor firm is:

> The large department store in a retail shopping centre that creates demand externalities for other shops. Large department stores with a recognized name generate mall traffic that indirectly increases the sales of lesser-known stores.

Lazerson and Lorenzoni (1999) define an anchor firm (that they refer to as 'focal firm') through the number and intensity of its relationship with customers and suppliers. The position of an anchor firm is often strengthened by its technological and organizational skills and its greater access to capital, which permits it to control the design, marketing, and distribution of finished products (Lazerson and Lorenzoni, 1999).

The presence of an anchor firm is an important strength for a cluster, and the viability of the cluster would be threatened with its departure. The cluster would lose an important source of local knowledge, but more importantly the cluster would lose access to the linkages that connect it to a global network of clusters. As we previously saw, these linkages are important because it gives firms access to new and valuable knowledge that is created in different parts of the world and the information that one firm acquires will likely spill over to other firms in the cluster through 'local buzz'. The success of a cluster depends on both its local and global network linkages.

## C – Declining spatial transaction costs

### *a)* Effect on *learn*

In our globalized world, firms constantly need to innovate, and introduce new and improved products or processes in order to protect or enhance their competitive advantage (Gertler, 2001). Contrary to codified knowledge, that can be easily communicated through symbols and language, tacit knowledge is sensitive to distance and it can only be transmitted through face-to-face interactions. And while all firms have access to codified knowledge, the creation of unique capabilities and products depends on the production and use of tacit knowledge (Maskell and Malmberg, 1999). Therefore, one of the main advantages of being part of a cluster is that, simply by being there, firms can have access to the sticky, tacit forms of knowledge that is being exchanged (Bathelt et al., 2004).

But Morgan (2004) argues that even this is changing as technology accelerates the codification of tacit knowledge over long distances. This is enabling firms to consciously seek new knowledge from outside the cluster to overcome the lack of knowledge in the local cluster. This is important because firms benefit from knowledge diversity (Cantwell, 1989).

One of Marshall's benefits of clustering was that firms chose to co-locate to *learn* from each other, by taking advantage of local knowledge being created that they otherwise wouldn't have access to. While access to local knowledge is still important, global linkages are allowing cluster

firms to access foreign knowledge as well. This makes it cheaper and easier for firms to integrate into global knowledge networks. This leads to my first proposition:

Proposition 1: **a reduction in spatial transaction costs is encouraging cluster firms to offshore activities for which interactions are mostly codifiable.**

However, when firms in the cluster are too focused on their linkages with global partners, these firms may become segmented. Therefore, less attention would be paid to local communication and information flows and people would be less interested in participating in local broadcasting (Bathelt et al., 2004). Too strong global linkages can threaten the long-term existence of a cluster (Bathelt et al., 2004). The success of a cluster depends on both the local and global network linkages, and the former should not be omitted.

Moreover, there is one type of firm that appears to play a more important role in knowledge creation in the cluster: the anchor firm. The anchor firm builds bridges and connects the local cluster to this global network (Schmitz and Knorringa, 2000).

The presence of an anchor firm is an important strength for a cluster, and the viability of the cluster would be threatened with its departure. By viability, I am referring to the ability of the cluster to have a reasonable chance of succeeding in the long term. This is because the loss of an anchor firm would result in the loss of an important source of local knowledge, but more importantly the cluster would lose access to the linkages that connect it to a global network. As

we saw in the previous section, clusters are rarely self-sufficient in terms of the knowledge and resource base they draw from (Wolfe and Gertler, 2004). If the connection is broken, the future of the cluster is unclear. This leads to my next proposition:

By viability, I am referring to the ability of the cluster to survive in the long term, as the success of a cluster depends on its ability to access linkages that connect it to a global network.

Proposition 2: **the departure of an anchor firm threatens the viability of the entire cluster**.

There is however a lack of research on the relationship between the anchor firm and cluster firms. The importance of the knowledge spill-overs generated by the anchor firm is hard to quantify, therefore the impact of the departure of an anchor firm is difficult to predict.

b) Effect on *share*

Firms co-locate to access new knowledge because studies show that the main way that knowledge spreads from company to company is when people switch jobs (Pisano and Shih, 2009) since, as we saw in the previous sub-section, humans remain superior at transmitting complex tacit knowledge. But there are other immobile resources that attract firms to co-locate. Lublinski (2003) argues that firms in clusters may have better access to workers and at lower recruiting and training costs. Access to shared immobile resources continues to support superior economic performance. What is changing however, is what activities are being performed in the cluster and what activities firms are offshoring.

Decreasing spatial transaction costs make is easier and cheaper for firms to offshore certain activities. This is supported by the increasing modularity of production which allows modular components to be managed and altered independently. Modular components do not need to be produced near each other. Van Assche and Gangnes (2011) describe modularity as an approach to managing complexity by breaking up complex systems into smaller subsystems, and connecting them to each other with well-defined interfaces.

Firms have therefore started to slice up their value chains and locate tasks in countries with the lowest factor costs. This is leading to the rise of "global value chains" (Gereffi, Humphrey & Sturgeon, 2005) where production is increasingly organized across international borders.

Firms are becoming like pearls on a necklace of competing and collaborating clusters, each looking to establish competitive advantages in a unique market or activity segment (Ketels, 2009). Clusters are adapting to this new reality, and are specializing in sectors where they have developed an expertise, like pharmaceuticals in the UK, machinery in Germany, fine chemicals in Switzerland, mechanical engineering in Italy, and electronics in the US for example (Morgan, 2004). A reduction in spatial transaction costs induces industrial clusters to specialize in specific value chain stages rather than entire value chains.

For example, Silicon Valley subcontracted software development activities to producers in Bangalore, while still maintaining daily contact and control of the Indian software development process in California (Iammarino and McCann, 2013). Large firms however, have been globally spreading out their supply chains for a long time. Many firms have more assets in foreign countries than they do in their home markets (Deloitte, 2013). Two-thirds of ExxonMobil's assets are not in the U.S., and only a third of BMW's assets are in Germany (Deloitte, 2013).

Decreasing transportation costs make is easier and cheaper for firms to offshore finer-sliced activities to clusters with matching comparative advantage profiles, and the future of a cluster depends on its ability to specialize in finer slices of the value chain. This leads to my next proposition:

Proposition 3: **decreasing spatial transaction costs are enabling clusters to specialize in a slice of the global value chain.**

And this trend of offshoring production will accelerate as technology enables the more rapid codification of tacit knowledge. This idea is embodied in Vernon's Product Life Theory. This theory examines the "life cycle" of a new product. New products are normally launched in developed nations, where consumers have more disposable income and are more likely to try out a new product or service. As average costs decline, products are first exported to other affluent nations, and then to industrializing countries. Then as competition intensifies, firms offshore parts of the production to developed countries where costs are lower.

The danger however, is in firms offshoring too much. Pisano and Shih (2009) explore this danger. They look at the software industry, where "(US) companies outsourced only relatively mundane code-writing projects to Indian firms to lower development costs". But over time, as these Indian firms gradually increase their own capabilities, they became direct competitors to US software firms. This erodes the competitive advantage of US firms as many of these same activities can be performed in India but at a lower cost. In order to protect the cluster, firms must be careful not to offshore too much.

*c)* Effect on *match*

Firms co-locate because it allows them to access local suppliers that make negotiation and monitoring costs decrease. Their geographic proximity allows them to develop a trust relationship which "lubricates" interactions between firms (Lorenzon, 2001).

But several authors argue that decreasing spatial transaction costs have reduced the importance of geographic proximity (Cairncross, 2001; Friedman, 2005). Friedman (2005) argues geography is no longer a barrier to connectivity and collaboration; there are no longer any 'frictions of distance' in economic relationships. He claims that advances in technology, communication and the emergence of advanced telecommunications have greatly diminished the transaction costs associated with overcoming space.

This flat world argument implies that location no longer matters, and that activities can flourish anywhere in the world. Every territory, no matter how remote has the potential to become a global player (Rodriguez-Pose and Crescenzi, 2008). In this world, location is no longer a barrier for new competitors entering the industry. Competition can come from anywhere, and technologically advanced products can be designed and manufactured in what were formerly known as developing countries and disseminated via the global distribution networks that are in place (Competition Policy Review Panel, 2008). This leads to my last proposition:

Proposition 4: **the decrease in spatial transaction costs lowers the barriers of entry for clusters, thus increasing competition within clusters.**

*d)* Effect on *observe*

Finally, being clustered in the same location generates demonstration effects whereby firms can *observe* what their competitors are doing (Iammarino and McCann, 2013). This gives firms the drive to keep innovating and upgrading in order to stay ahead of their rivals, hence it leads to superior economic performance. Despite the decrease in spatial transaction costs, this co-location benefit is relatively unaffected and remains important. To conclude, the effects of decreasing spatial transaction costs on the different co-location benefits are summarized in the table below.

| | ***Learn*** | ***Share*** | ***Match*** | ***Observe*** |
|---|---|---|---|---|
| Co-location benefit | Access to tacit knowledge | Access to shared immobile resources (other than knowledge) | Access to local suppliers that make negotiation and monitoring costs decrease | Access to demonstration effects that give firms the drive to keep innovating and upgrading |

| | | | | |
|---|---|---|---|---|
| Effect of spatial transaction cost reduction on co-location benefit | This co-location benefit is becoming less important. Some tacit knowledge has become codifiable and can now be accessed through global linkages. | Mixed effect. On the one hand, the reduction of transportation costs reduces the necessity to co-locate with suppliers. On the other hand, increased specialization attracts specialized workers and firms. | This co-location benefit is relatively unaffected. | This co-location benefit is relatively unaffected. |
| Effect on cluster | Cheaper and easier to integrate into global knowledge networks | Cheaper and easier to offshore activities and specialize in slices of global value chains. | | The fact that similar firms flock to the same location may actually strengthen the effect. |
| Propositions introduced | Proposition 1: **a reduction in spatial transaction costs is encouraging cluster firms to offshore activities for which interactions are mostly codifiable.**<br><br>Proposition 2: **the departure of an anchor firm threatens the viability of the entire cluster.** | Proposition 3: **decreasing spatial transaction costs are enabling clusters to specialize in a slice of the global value chain.** | Proposition 4: **the decrease in spatial transaction costs lowers the barriers of entry for clusters, thus increasing competition within clusters.** | |

# III - Methodology

In the next section, I will talk about the methodology that we selected and why we considered it the most appropriate method to test our propositions.

## A - Research question

Globalization is changing the way that firms organize their activities. Whereas in the past it was better for firms to locate activities near each other to save on spatial transaction costs, improvements in transportation and communication technology are changing this logic. Nowadays it has become cheaper for firms to globally spread out their activities and integrate into global value chains. I am interested in examining the effect that decreasing spatial transaction costs will have on the future of clusters. And the question I seek to answer with my research is "how is globalization affecting the role of industrial clusters?"

## B - Qualitative methodology

In depth research on a cluster is challenging because the data on cluster firms, and their local and global linkages, is very limited. Also, it is difficult to measure inter-firm trade, institutional linkages and knowledge sharing among other things. For example, in the biotechnology

industry, citations to patents and licenses are used as measurements for knowledge spill-overs (Niosi, 2005). But this same method cannot be applied to the aerospace industry as firms do not rely on the use of scientific papers to publish their results, and their processes are often protected through secrecy rather than through the use of patents (Niosi, 2005).

Therefore, we selected a case study approach. Yin (2009) defines the case study methodology as "an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Given the lack of data available, this method was the most appropriate to address our research question, as it allowed us to go more depth into the subject and to generalize our findings.

## C - Type of research

Our research was conductive. As we didn't have factual data to analyze our propositions, but relied on inferences to support or not support our propositions. This was the most appropriate method since the objective of our research was to predict the effect that globalization would have on industrial clusters. This can only be done through conductive research.

## D - Data

In our research, both primary and secondary data was used. For the primary data, we relied on interviews that we conducted with informants from Montréal's aerospace industry. For the secondary data, we relied on industry articles, journal articles, annual reports and other articles that were relevant to our research. The secondary data was used to strengthen and provide more insight to the answers of the informants.

## E - Data collection

The purpose of our interviews was to gather information on the views of the informants on specific topics and trends. This allowed us to gain a deeper analysis of the phenomenon studied. Moreover, this information is generally not available through secondary sources.

The interviews were semi-structured in order to better imitate a conversation and make the informants feel more at ease, with the hope of receiving the most accurate information. As explained by Zorn (2008):

> In semi-structured interviewing, a guide is used, with questions and topics that must be covered. The interviewer has some discretion about the order in which questions are asked, but the questions are standardized, and probes may be provided to ensure that the researcher covers the correct material (...). Semi-structured interviews are often

used when the researcher wants to delve deeply into a topic and to understand thoroughly the answers provided.

I conducted the interviews between January 31st and February 27th, 2017. There were 27 questions on our interview guide, but I was free to ask additional or alternatively worded questions depending on the responses and the level of knowledge of the informants. The interview questions were open ended in order to yield as much information as possible. The interviews lasted from 31 minute to 67 minutes depending on the lengths of the responses to the questions. The informants were generally very open to sharing their thoughts and opinions with me.

## F - Interviews

I sent out a total of 47 e-mails to employees from aerospace firms in Greater Montréal. I targeted employees that worked in the corporate strategy department. The e-mail addresses were obtained from their company's corporate website, or from the HEC Alumni directory.

I had reason to believe that employees from this department would have a better understanding of the overall operations of the company, therefore would be more suited to answer questions regarding trends going on in the aerospace industry. When possible, I also targeted employees that have worked in the aerospace industry for at least 5 years.

In order to limit the bias of my interviews, I used numerous and highly knowledgeable informants from firms of different sizes, and experts in the industry. Seventy one percent of my interviews were conducted with informants from firms that belonged to Aéro Montréal. I also interviewed a representative from the cluster organization Aéro Montréal, 2 representatives from the Aerospace Industry Association of Canada (AIAC), and a professor from HEC Montréal.

The interviews were divided into 5 sections. The purpose of the interviews was to gain an understanding of the perceptions of the informants on various trends going on in the aerospace industry. In the first section I introduced myself and my project, then I asked the informants to explain the activities in which their company specializes in. Since all the informants were from companies that belonged to the cluster organization Aéro Montréal, in the next section I asked them questions pertaining to the advantages that membership brings to their firm. I also questioned them on the global competitiveness of the Montréal aerospace cluster, the role of the Canadian government in promoting the industry as well as the threat of increasing industry competition from developing countries. The next series of questions dealt with the specialization of the cluster. Then, I asked questions pertaining to the firm's global value chain and its global linkages. Finally, the last series of questions was around the topic of anchor firms, and how important anchor firms were for the Montréal cluster. It must be noted that the three aerospace experts that I interviewed had a slightly different interview guide. Both interview guides can be found in Annex 1.

In total, I performed 14 interviews. The interviews were a mix of phone interviews (57%) and face-to-face interviews (43%). Face-to-face interviews were the preferable option, but due to the location and the schedule of the informants, in many cases a telephone interview was the requested option. The face-to-face interviews were held at the informant's office.

Below is the complete list of the individuals that I interviewed:

| **Company name** | **Interviewee** | **Specialization of company** | **Local company or foreign subsidiary** |
|---|---|---|---|
| Zenith Jet | George Tsopeis, President | Aviation services | local |
| CAE Inc. | Jean Hurtubise, Air Account Lead | Simulation/training services | local |
| Bell Helicopter Textron Canada Ltd | Gilles Isabel, Director Quality Assurance | Civil helicopters | foreign |
| CMC Electronics Inc. | Claude Chidiac, Aviation Leader | Avionics | local |
| Aerospace Industries Association of Canada (AIAC) | Iain Christie, Executive VP | National aerospace NGO | N/A |
| Aerospace Industries Association of Canada (AIAC) | Guillaume Côté, VP, Technology and Innovation | National aerospace NGO | N/A |
| Aéro Montréal | Martin Lafleur, Senior Director Innovation | Strategic think-tank | N/A |
| Thales Canada | *Confidential*, Marketing Department | Avionics | foreign |
| *Montréal aerospace company* | Pierre Pyun, VP, Government Affairs (*holds position at BBD) | | |
| Bombardier Aerospace | *Confidential*, Strategy Department | Commercial + Business Aircraft | local |
| Bombardier Aerospace | *Confidential*, Strategy Department | Commercial + Business Aircraft | local |
| HEC Montréal | Jacques Roy, Professor | Business school | local |
| Héroux-Devtek | Dominique Dallaire, VP Eastern Region | Landing gears | local |

| | | | |
|---|---|---|---|
| Pratt & Whitney Canada | Nathalie Arnoul,<br>Offset Manager | Aircraft engines | local |
| Pratt & Whitney Canada | Frédéric Brousseau,<br>Senior Director Global Operations, Strategy & Operations Programs | Aircraft engines | local |

# IV - Background: the aerospace industry

In this section, I will explain why the aerospace industry was chosen for our study. Then I will briefly talk about the organization of the aerospace industry. Then, I will explore the aerospace industry in Canada before narrowing down my focus on the aerospace industry in Montréal and justifying why we selected it as our case study.

## A - Choice of the aerospace industry

There are several reasons that made the aerospace industry attractive for our study. Firstly, the aerospace industry is very knowledge intensive, and it is characterized by high levels of R&D and innovation (Niosi and Zhegu, 2005). Second, aerospace companies are extremely reliant on inter-firm collaboration in order to create their products (Erikkson, 2006). This is because developing aerospace products comes with long lead times and heavy development costs (Erikkson, 2006); inter-firm collaboration is the logical solution to spread out risk. Third, despite the tendency of aerospace companies to cluster (e.g. Seattle, Toulouse, Montréal), their value chain is globalized. For example, the number of global suppliers that Boeing used for its 787 aircraft can be seen in figure 2.

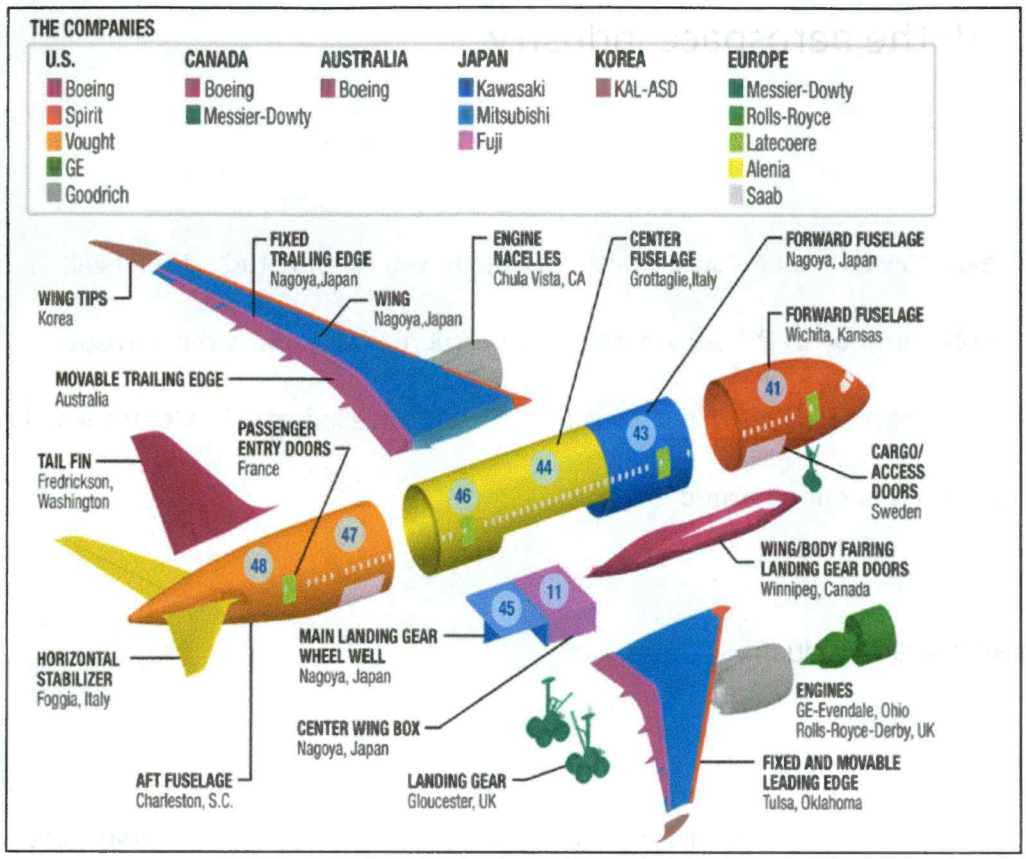


*Figure 2: Boeing's suppliers for the manufacturing of the 787 aircraft (Source: Kotha and Nolan, 2005).*

## B - Organization of the industry

The organization of the industry has drastically changed over the years. During the 1990s, the industry was dominated by large vertically integrated original equipment manufacturers (OEMs) such as Boeing that produced most production systems itself or with the assistance of select suppliers. But nowadays, OEMs are much less vertically integrated. OEMs mostly specialize in a system-integration role centered on the airframe (the fuselage, wings, tail, and control surfaces), while outsourcing the rest of production to specialized suppliers.

The industry is organized into tiers (Niosi and Zhegu, 2005). This is summarized in figure 3 on the next page. At the top of the pyramid, we find airframe assemblers (original equipment manufacturers or OEMs), such as Airbus, Boeing, Bombardier and Embraer. At the second level there are Tier 1 suppliers. Tier 1 companies possess the requisite technical skill to design, as well as the required management resources and financial strength to produce complete systems for the OEMs. Then we find manufacturers of propulsions systems such as Rolls-Royce or General Electric. This level also includes companies that produces avionics and manufacturers of airframe structures and subassemblies such as landing hear and hydraulic systems. These are Tier 2 suppliers. Finally, we find Tier 3 suppliers that are producers of electronic subassemblies, hydraulic systems and fuselage parts. At each level, there are a handful of companies that dominate.

Moreover, Niosi and Zhegu (2005) observe that aerospace OEMs have moved from arm's length American-style procurement practices to more "Japanese" inspired supply chain collaboration with both OEMs of subassemblies and suppliers exchanging knowledge on products, processes and costs.

| *Tier Position* | *Definition* | *Key Areas* | *Main Players* |
|---|---|---|---|
| OEM | Original equipment manufacturers (OEM) are companies that have complete control of design, selection of suppliers, detailed development and manufacturing of critical equipment, assembly and servicing and solutions. | Regional aircraft, helicopters and simulators. | Bombardier, Bell Helicopter, Diamond, Viking, CAE. |
| Tier 1 | These companies have full responsibility for the equipment to be provided to the OEM, with full engineering and design authority and assumption of some financial risk. | Propulsion, landing gear, environmental control systems, avionics. | Pratt & Whitney Canada, Thales, Honeywell, Goodrich, Héroux- Devtek, CMC Esterline, Messier-Dowty. |
| Tier 2 | These companies assemble aircraft structures but have no design authority. | Aero structures, landing gear components, transmissions. | |
| Tier 3 | These companies are parts suppliers to equipment manufacturer or OEM. | Specialty product, components. | |

*Figure 3: Structure of Canada's aerospace industry (Source: Arcand, 2012)*

## C - The aerospace industry in Canada

### *I. History*

The aerospace industry in Canada can be traced back to the beginning of the aviation industry, when Alexander Graham Bell was doing early experimental work in the 1890s ("Beyond the Horizon", 2012). He was performing aerodynamic experiments with kites. By 1907, he had formed the Aerial Experiment Association, a collaborative organization between Canada and the US. The team was responsible for designing and building the Silver Dart, and in February 1909, one member of the team namely J.A.D. McCurdy took to the sky with the airplane. He flew 800 meters. That event marked the beginning of Canada's aerospace industry.

World War I saw Canada's aviation industry take off. Almost overnight, Canada became a training ground for British pilots and a manufacturer of training planes. In 1935, Canada's aircraft industry totaled about 4,000 employees producing 40 aircraft annually (Brown, 2008). During the second war, this would soar to a peak of 116,000 workers with 16,500 aircraft built during the conflict years. When the war officially ended and European countries started repatriating their capabilities, Canada was left with an unprecedented wealth of highly qualified people and of transferred technology (Brown, 2008). With strong government support, Canadian companies continued building innovative aircrafts.

In this early period, many of the most important aerospace players were created, such as Pratt & Whitney Canada in 1928, Air Canada in 1937 (originally "Trans-Canada Airlines"), Héroux-Devtek in 1942 and Canadair in 1944. Today, the Canadian aerospace industry is the 5$^{th}$ largest by revenue.

### *ii. A global industry*

The aerospace industry is highly globalized. Roy and Van Assche (2012) use the 2008 Canadian input-output table, only 69% of the aerospace export value is made in Canada, while 31% is the value of imported components. Moreover, the domestic market makes up about 20.7% of industry revenue (Ibisworld, 2016). Companies are therefore heavily reliant on international customers.

### *iii. Competition*

Barriers to entry are very high due to the capital commitments required to design and produce aircraft (Niosi and Zhegu, 2005). This makes it so that there are very few competitors. Several Canadian-headquartered aerospace companies however, are global leaders in their markets. Bombardier is the third largest commercial aircraft manufacturer in the world, behind Boeing and the European Aeronautic Defence and Space Company (EADS), the parent company of Airbus. The Canadian aerospace industry is dominated by a small group of large companies, and the largest— Bombardier Inc.—is one of nine companies that control over 95 per cent of global civilian aerospace revenue (Arcand, 2012).

## D - The aerospace industry in Montréal

Before introducing the aerospace industry in Montréal, I will justify why we thought it was appropriate to select it as the case study for our project.

### *i. Case selection*

Despite the mix of definitions, scholars generally agree that clusters have three defining dimensions: geographical proximity, an inter-firm network, and an institutional network (Rocha, 2004).

The Montréal aerospace cluster meets this definition of a cluster. Firstly, 98% of Québec aerospace activities take place in Greater Montréal. In Aéro Montréal's 2015 annual report, they reported that there are 191 aerospace firms in the Montréal region. From those, there are 4 OEMs, 10 are equipment manufacturers and 177 specialized suppliers.

Secondly, there is a great amount of cooperation between aerospace firms in the cluster. Montréal is home to the Consortium for Research and Innovation in Aerospace in Québec (CRIAQ), as well as other organizations that ensure the mobilization and cooperation within the sector, including Aéro Montréal and the Comité sectoriel de main-d'oeuvre en aérospatiale du Québec (CAMAQ). In Montréal, there is a mix of OEMs, Tier 1, Tier 2, and Tier 3 suppliers that work together. For example, Pratt & Whitney Canada designs and manufactures engines in Montréal. Those engines can then be found in Bell Helicopter and Bombardier's aircraft models manufactured in Montréal.

Thirdly, aerospace firms have strong relationships with external institutions. There is an extensive network of educational institutions and organizations that are focused on providing a skilled workforce for the aerospace industry. There are several university programs in aerospace engineering in partnership with major local aerospace companies: Concordia, Laval, McGill, Sherbrooke, École Polytechnique and École de Technologie Supérieure.

There is strong public-private collaboration, and aerospace firms have a close relationship with the federal and the provincial government. CRIAQ is a non-profit aerospace research and

innovation organization founded in 2002 through government of Québec funding. Its mission is to enhance the aerospace industry's competitiveness and collective knowledge base through better training. Also, the Québec government has supported Bombardier's troubled C-series aircraft program, through the $1.3 billion "C-series investment" in October 2015 (Bombardier Press Release, 2016).

And in more recent news, the government of Canada has agreed to invest $372.5 million in Bombardier (Bombardier Press Release, 2017). The investment will fund R&D for the new Global 7000 business jet and ongoing activities related to the development of the companies C-series aircraft. The governments have long devoted attention to the aerospace sector, motivated by the industry's role in creating high-quality jobs and technological innovation.

*ii. The aerospace industry in Montréal*

The largest concentration of Canadian aerospace activities takes place in Montréal. Aéro Montréal states in their 2015 annual report that there are 191 aerospace companies in Montréal: 4 are OEMS, 10 are equipment manufacturers and 177 are specialized suppliers. The cluster started with industry. It was not the result of governmental decisions.

Montréal's aerospace sector includes large multinational firms such as the Canadian-owned companies Bombardier Aerospace, Héroux-Devtek and CAE, and the foreign-owned firms Pratt & Whitney Canada, Bell Helicopter Textron Canada, GE Canada and Rolls Royce Canada. The

following graph illustrates the distribution of the aerospace companies in the Québec region. As seen in the following graph, the greatest concentration of firms can be found in the Saint Laurent region. Two of Montreal's 4 OEMs have facilities there (CAE Inc, and Bombardier Aerospace).

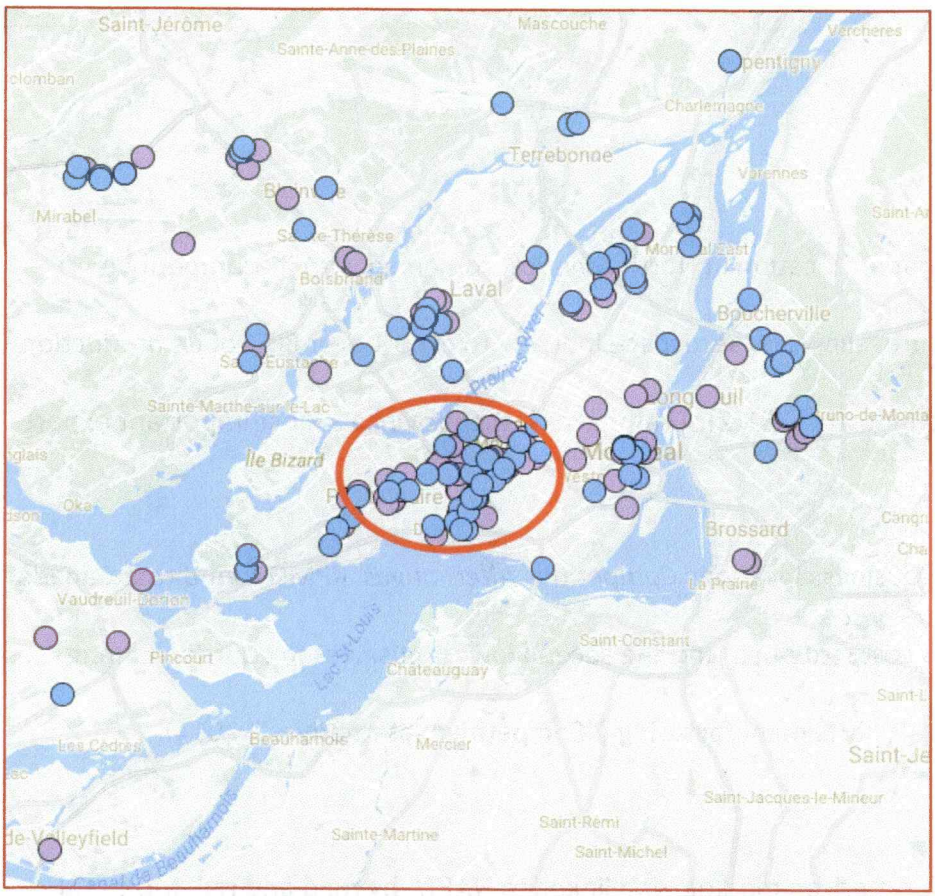


*Figure 4: Aerospace companies' geographic distribution (Source: "Companies in the Aerospace Industry of Greater Montréal", Montréal International, http://www.montrealinternational.com/en/foreign-investments/sectors/aerospace/aero-hub-map/)*

Moreover, the industry in Montréal is almost entirely oriented towards the civil sector. Civil aerospace includes the design, manufacturing and the sale of commercial and recreational

aircraft, and civil flight simulators. The activities that the cluster specializes in are aerostructures, civil helicopters, commercial and business aircraft, training and simulation, avionics, engine components, landing gear, engines, engine MRO ("Invest in Canada", 2016). And unlike many cities in the US, the aerospace cluster in Montreal doesn't benefit from important military contracts for research, development and fabrication.

*iv. Strategic location*

Montréal's strategic geographic location in North America, combined with its competitive transportation infrastructure, allows its aerospace industry to export over 80% of its production ("Profile of the Aerospace Industry", 2012). That makes it the province's most important export.

In its 2014 study of global business locations *Competitive Alternatives*, KPMG found that Canada offers the lowest business cost structure, and the second lowest business tax burden among the G-7 countries for aircraft parts manufacturing ("Competitive Alternatives", 2014).

Situated near major North American markets and linked to NAFTA by road and rail, Montréal also benefits from one of the globe's busiest interior seaports, adjacent to the downtown area, and two major international airports serving the world's largest centres ("Profile of the Aerospace Industry", 2012).

National free trade agreements make it an attractive location. NAFTA is a comprehensive trade

agreement between Canada, the United States and Mexico. It eliminates most tariff and non-tariff barriers to free trade and investments between the 3 countries. Canada also has a free trade agreement in place with South Korea. This represents Canada's first free trade agreement in Asia and provides a strategic gateway to this fast-growing region ("Invest in Canada", 2016).

These free trade agreements ensure that the Montréal cluster remains well connected to the global market, and as an industry that exports over 80% of its production, this connectedness is vital to its success. CETA could also have an impact in making Montréal a more attractive location. Canada would have preferential access to the markets of the 28 countries that make up the European Union.

v. *Revenue*

In 2010, Québec's aerospace industry's real GDP was close to $4 billion. This represents 60% of the total Canadian industry's real GDP ("Profile of the Aerospace Industry", 2012).

vi. *Trading partners*

The aerospace industry is also very globally oriented as over 80% of production is exported. In 2015, a majority of our exports (60%) went to the neighboring United States. The second most

important market is Europe with 21% of aerospace exports. The following graph depicts the distribution of our exports.

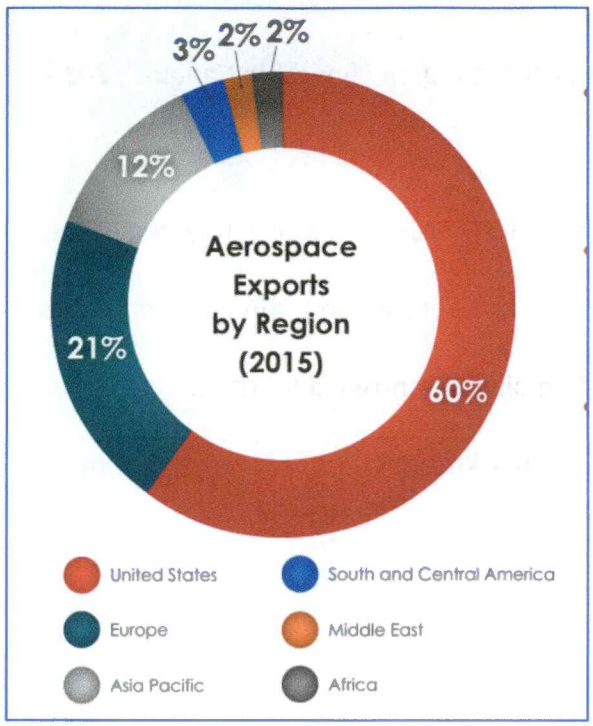


*Figure 5: Montréal aerospace export distribution (source: "State of Canada's Aerospace Industry: 2016 report", 2016).*

vii. *Employment:*

Montréal represents over 50% of Canada's employment in the aerospace industry. Approximately 212 aerospace companies employ over 42,000 individuals ("Profile of the Aerospace Industry", 2012). In 2011, prime contractors employed 62% of all aerospace workers. See the complete distribution of aerospace employment in the following graph.

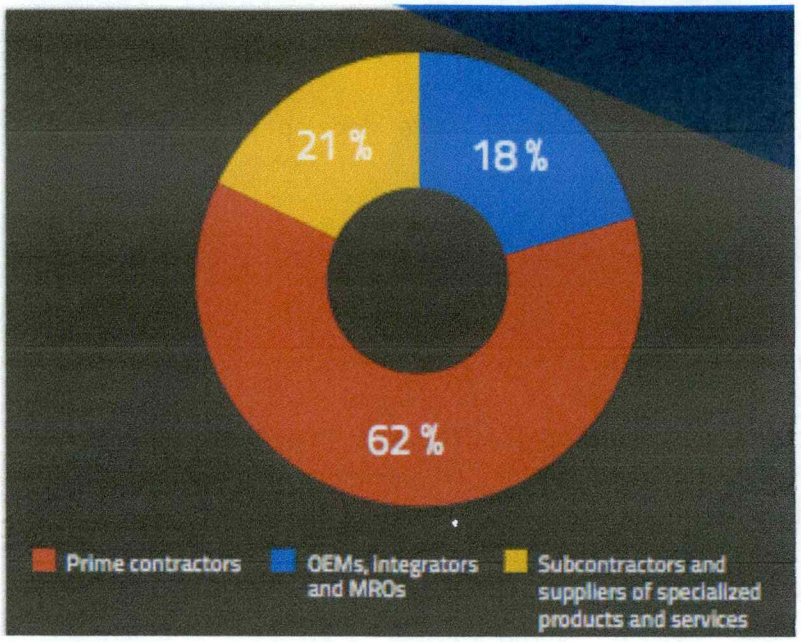


*Figure 6: Aerospace employment by subsector in Québec (Source: Aéro Montreal and Montréal International, 2012).*

### *viii. Aéro Montréal*

This organization was created as a strategic think tank in 2006. The idea behind its creation was to bring together all the major decision makers in Québec's aerospace sector, including companies, educational and research institutions, associations and unions. The organization mobilizes industry players around common goals and concerted actions to increase the cohesion and optimize the competitiveness of Quebec's aerospace cluster. Aéro Montréal aims to foster the growth and expansion of the cluster to ensure that it will continue to create wealth for Greater Montréal, Québec and Canada.

Aéro Montréal has 6 committees on issues of priority: (1) supply chain, (2) imagine, visibility, influence, (3) innovation, (4) next generation workforce, (5) market development – SME, (6) defense and national security.

For example, the Defense and Security Committee is trying to push Montréal companies to become stronger in the military sector. Guillaume Côté (AIAC) believes that Québec is under its potential. Ontario has a strong military sector, and accounts for 50% of Canada's military sector. In Québec, we only have around 15%. Aéro Montréal tries to encourage this development by participating in events such as CANSEC, Canada's Global Defence and Security Trade Show. This event, held in Ottawa, is the longest and most important defence industry event in Canada.

Another important priority of the organization is improving the supply chain of aerospace companies. Aéro Montréal has a Supply Chain Development Working group. It is composed of 13 individuals representing stakeholders in the aerospace supply chain, with the ultimate goal of increasing the competitiveness of Québec's aerospace suppliers. With that in mind, in 2011 the MACH initiative was launched. The initiative has three main priorities aimed at improving supplier competitiveness: excellence in leadership, excellence in operations and excellence in planning and human resource development. Excellence is measured on a scale of Mach 1 to Mach 5 allowing for an assessment of a supplier's mastery of 15 business processes and the awarding of a certificate of performance. Moreover, companies must have a sponsor before they can enter the program, and undergo an audit of 800 questions measuring 15 corporate process to receive an initial MACH rating of one through five (most companies begin around

MACH 1 or 2). In 2015, Alcoa Titanium and Engineered Products became the first supplier to obtain a MACH 5 performance label.

This initiative has been successful, and this is partly due to the support of the OEMs. For example, Bell Helicopter is currently working with 4 suppliers as part of the initiative. And due to the popularity of the program, the federal government recently announced funds to develop a Canadian MACH Initiative based on Aéro Montréal supplier development model, in collaboration with the Aerospace Industries Association of Canada (AIAC).

Another priority of Aéro Montréal is helping aerospace companies, particularly SMEs, embark on Industry 4.0. "Industry 4.0" is a simplified term for a "cyber-physical system of production", a concept that was introduced in Germany in 2005 to describe the fourth current revolution in the manufacturing industry (White paper "Aéro Talents", 2016). Industry 4.0 is being led by 9 foundational technology advances (see figure 7 on the next page). These changes are transforming production and leading companies to define a different vision (White paper "Aéro Talents", 2016).

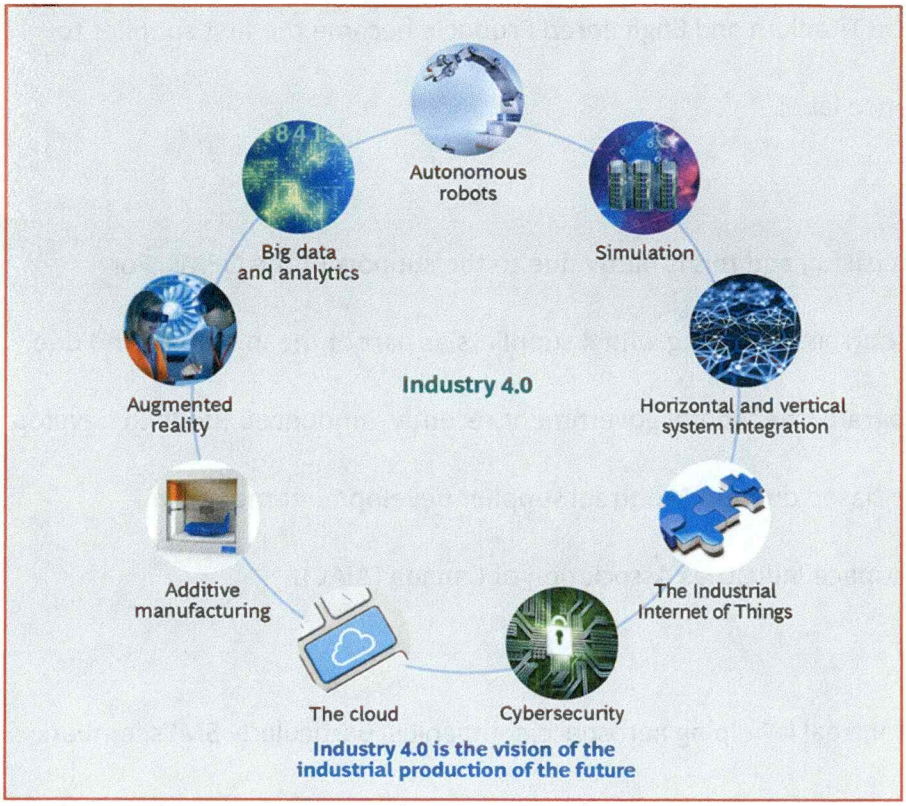


*Figure 7: Industry 4.0 (Source: Rüssman, Michael et al., 2016)*

In the fall of 2016, Aéro Montréal launched MACH FAB 4.0, a partnership program with École de Technologie Supérieure (ÉTS), the CEFRIO and STIQ. The program provides funding and support to pre-qualified firms to develop projects that would introduce greater digitalization into their manufacturing processes. The aim of this program is to support and accelerate the digital shift for aerospace companies.

*x –Aerospace companies' perception of Aéro Montréal*

As we just saw, the goal of Aéro Montréal is to increase the cohesion among aerospace companies in Montréal. The organization has many initiatives in place to help achieve this, but next we will explore how useful aerospace companies think Aéro Montréal is.

According to Jacques Chidiac (CMC Electronics), when it comes to various governmental support programs, such as the provision of R&D credits, Aéro Montréal is good at communicating and connecting to the government on behalf of companies. However, it is more useful when it comes to contacting the Québec government, compared to contacting the Canadian government.

Dominique Dallaire (Héroux-Devtek) believes that Aéro Montréal is very active from the promotion perspective. He explains, "they are very visible, and give good press to the industry in shows, contributing to the attraction of foreign firms to the cluster". For example, Stelia, a subsidiary of Airbus, had to choose between setting up activities in Toronto or Montréal, they chose Montréal because the cluster was better organized and more structured. The cluster is therefore a source of attraction for international firms, and Aéro Montréal is partly responsible for promoting that.

For Thales, it puts the company in contact with other actors in the Montréal cluster. An informant from Thales explains, "if (Thales) is building a new product, we want to find local

suppliers in order to receive government funding". Aéro Montréal then provides a forum that guides Thales in its selection of local suppliers that they can deal with. Aéro Montréal is therefore useful in cutting the cost of finding suppliers. Similarly, for Bell Helicopter, Aéro Montréal allows the company to have a competitive source of suppliers nearby. Aéro Montréal's MACH initiative, helps companies judge the quality of local suppliers.

Overall, the firms that I interviewed had a positive impression of Aéro Montréal. Aéro Montréal offers good collaborative platforms to keep and maintain relationships between firms in the cluster, both OEMs and SMEs. For example, Aéro Montréal hosts a yearly event called Aéromart when they invite the big and the small players for 2-3 days of business-to-business meetings. Aéro Montréal states on its website, "Aéromart Montréal is a platform for them to connect with companies offering the right capabilities and services through our matchmaking program". This is an example of an event that allows cluster companies to interact and better understand what's going on in the industry and what capabilities OEMs are looking for.

Aéro Montréal connects all the players in the industry. Companies don't tend to naturally network with other companies unless they are part of the same supply chain, but Aéro Montréal has these platforms that connects all the companies and opens this communication channel.

# V - Findings

In the next section, I will present the findings from my proposition testing.

## A – Location and anchor firms

Anchor firms were important for the creation of the Montréal cluster, as they attracted other firms to the same location. For example, Bombardier attracted Pratt & Whitney Canada, a subsidiary of US-based UTC. After World War II, Pratt & Whitney Canada started producing small turbines in Montréal, and incorporated local design capabilities for them (De Bresson et al., 1991). Today Pratt & Whitney Canada is a strong OEM in the Montréal cluster; the company manufactures aircraft engines that are entirely designed in Montréal. We developed a proposition to predict how the viability of the Montréal cluster would be impacted if an anchor firm were to leave.

Historical examples predict that the departure of an anchor firm would cause the cluster to disappear. Fairchild Industries produced airplane parts for commercial airliners, as well as the tail assembly for the space shuttle. It decided to close in 1988 when the Air Force cancelled its key contract with the firm to build T-46 jet trainers. As a result, Fairchild Industries decided to completely quit the aircraft sector. This put an end to the 59-year-old aircraft cluster that existed in Farmingdale, New Jersey (Niosi and Zhegu, 2010). Another example involves

Lockheed Martin. In 1986, the company decided to transfer its head office from Burbank to Calabasas (both in California). Its subsequent decision to close its installations in Burbank led to the end of the 60-year-old aerospace cluster in the area. Fairchild Industries and Lockheed Martin played the role of anchor firm in their respective clusters, and their departure led to the end of the clusters.

But despite these historical examples, respondents didn't agree that this would be the case for the Montréal cluster. Respondents agreed that there are certain firms that play the role of anchor firm in the Montréal cluster. These are the OEMs, namely Bombardier, CAE, Bell Helicopter and Pratt & Whitney Canada. These firms are the strongest and most well-established players in the industry. Two respondents named Héroux-Devtek, despite it not being an OEM, as an anchor firm for the cluster.

The impact seems to be relative to the size of the firm. Gilles Isabel (Bell Helicopter) explains that "even though Bell Helicopter has a lot of international suppliers, a lot of small companies wouldn't survive if it happened quickly. Because for some of them, these big companies are their only customers, or their main one". For example, if Bombardier were to leave, Thales Canada would consider leaving the Montréal cluster as Bombardier is their main client. Gilles Isabel (Bell Helicopter) predicts that smaller companies could consider following their biggest customer and moving. For these firms, the impact of an anchor firm leaving the cluster could be significant.

The same however, was not said for OEMs. In all cases an OEM would not consider leaving the cluster if another OEM left because they don't rely on each other for sales.

In sum, the general perception was that the departure of an OEM would weaken the cluster through the loss of know-how and the loss of certain small suppliers, but that the cluster wouldn't be threatened. Aerospace companies, with the exception of small suppliers, wouldn't consider leaving the cluster as a result. Moreover, what was mentioned as lessening the impact of the departure of an anchor firm is quite simply that the Montréal cluster has more than one.

My proposition #4 that **the departure of an anchor firm threatens the viability of the entire cluster** is not supported.

This result can be explained by a trend that has been going on. In the last 10-12 years, the OEMs have started to go more global, as a result decreasing their dependency on local suppliers. This decrease in dependency has led OEMs to feel less accountable for keeping a cluster company alive. This is an important change because in the past, all suppliers were sponsored by one of the OEMs, which would ensure that they wouldn't fail.

The industry is globalized from a supply chain base, and now increasingly from a customer base. Dominique Dallaire (Héroux-Devtek) sums it up, "the OEMs are less loyal to the cluster, but the cluster is also less loyal to the OEMs". This globalization of the customer base is a positive sign, as it could increase the overall cluster market share.

To conclude, globalization is shifting the cluster away from a cluster of full dependency. It is becoming less important for suppliers to located near an OEM. That dependency has been replaced by competition; if suppliers want to stay alive, they must keep innovating to maintain their competitive advantage. This is a positive sign for the Montréal cluster.

Key findings:

→ The Montréal aerospace cluster's OEMs play the role of anchor firms

→ The impact of the departure of an anchor firm depends on the size of the firm

→ The supply chain is becoming more globalized: OEMs are less dependent on local suppliers, and local suppliers are less dependent on local OEMs

## B - Location and specialization

Despite most respondents (64%) agreeing that there is a trend of offshoring going on in the cluster, most respondents didn't agree that the cluster is specializing in a slice of the value chain. The activities that the Montréal cluster performs are very diverse and don't appear to be changing. The cluster specializes in commercial aircraft (regional and business), helicopters, turbo-shaft and turbojet engines, avionics, landing gear, space systems, systems integration. One activity that would appear to stand out more than the others is the manufacturing of landing gears. Montréal is becoming increasingly strong at designing, developing and manufacturing landing gears, but that is not to the detriment of other aerospace activities. The leading player, also the third largest global landing gear company, is Héroux-Devtek.

Jean Hurtabise (CAE) doesn't believe that the cluster is specializing, but he notices that there are a lot new companies in the Montréal area that specialize in activities such as electro-optics, or cyber security. He describes this as the market responding to the cluster's need for more of these technologies.

The cluster doesn't seem to be becoming more specialized, but at the firm level there are companies that are specializing in certain activities. Frédéric Brousseau (Pratt & Whitney Canada) says that his company's current strategy is one of re-centralization. The company's activities are more specialized in the core activities required to make a product. This re-focus is enabled by the development of its international partnerships. Frédéric Brousseau explains, "(re-

centralization) allows us to focus on our core business, to focus on where we are the best, and we try to partner with companies where we can leverage their strength in other areas. And in the end, the product is better, and the customers are served better".

No respondent voiced support for the idea that the cluster is specializing in a certain activity, therefore my proposition that **decreasing spatial transaction costs are enabling clusters to specialize in a slice of the global value chain** is not supported.

*Is this trend a threat to the cluster?*

Despite other aerospace clusters increasingly specializing in certain activities (the UK for example, specializes in designing and manufacturing aircraft wings) the Montréal cluster doesn't seem to be going that route. This is not considered a weakness of a cluster, but a competitive advantage as Montréal is one of the few places in the world where an entire aircraft can be assembled using parts sourced from within a 30-mile radius (Conference Board of Canada, 2012).

Key findings:

→ The activities that the Montréal cluster performs are very diverse and do not appear to be changing

## C - Location and offshoring

When asked whether aerospace activities have been moving away from Montréal in recent years, a majority of respondents (64%) answered yes. Aerospace companies are moving activities to countries such as Poland, Morocco and Mexico. It's a strategy they are using to remain competitive.

Bombardier has had a strong presence in Mexico since 2005 when it established a manufacturing facility in Querétaro ("Bombardier: more than 20 years in Mexico", 2014). Querétaro is an industrial hub where there are a great number of research centers and multinational companies. Then in 2008 the company announced a $250 million investment to perform the sub-assembly systems installation, as well as the manufacture of the carbon composite structure, electrical harness and wing assembly, for the Learjet 85 aircraft at its Queretaro facilities ("Bombardier: more than 20 years in Mexico", 2014). And in 2011, Bombardier announced a $50 million investment to support the manufacturing of the aft fuselage of its new Global 700 and Global 800 business jets in Queretaro" ("Bombardier: more than 20 years in Mexico", 2014). As demonstrated with the example of Bombardier, this trend of offshoring is still strong.

This trend is seen with large aerospace firms in the cluster; for small companies, it is more difficult. Opening a foreign subsidiary is a long and risky journey, and a smaller company with limited capital cannot easily afford it. But even that is changing. Frédéric Brousseau (Pratt &

Whitney Canada), argues that Pratt & Whitney Canada is attracting smaller suppliers to China, India and Poland. He describes the company's strategy with a hypothetical example, "we approach our external paint supplier in Montréal and ask them whether they want to establish a shop near our facility in Poland. We agree to give them the contract for the paint that we will use on all of our products in Poland". That is one way that Pratt & Whitney Canada is encouraging smaller companies to join the offshoring bandwagon.

*What activities are leaving the cluster?*

The industry is still very labour intensive, and aerospace companies are therefore attracted to emerging countries where the cost of labor is on average is three to five times lower than it is in the developed world (Christophe Bédier et al., 2008).

Claude Chidiac (CMC Electronics) says that CMC Electronics is offshoring low value software type labour to India. He explains that "it's not the design, or the engineering activities but the tests and validation, which is very repetitive work and can be done anywhere". The perception is that activities, that are being done outside of Canada, are less complicated and have less added value. For lower value parts manufacturing, it is increasingly difficult for Canada to remain a competitive location.

But for the respondents that notice that aerospace activities have been moving away in recent years (64%), all of them agreed that the types of activities that are being offshored are changing.

Frédéric Brousseau (Pratt & Whitney Canada) explains that it's not only labour intensive activities that are leaving the cluster, but its evolved into "whatever we feel is not something that could be a threat to our market or to our technology" we outsource. Even activities that are complex are being outsourced.

Offshoring remains a strong trend for aerospace companies in Montréal, therefore, my proposition that **globalization is encouraging cluster firms to offshore activities for which interactions are mostly codifiable** is supported. It's a strategy aerospace companies continue to use in order to remain competitive.

*Is this trend a threat to the cluster?*

There is a general perception that offshoring is a threat to the cluster, but also an opportunity. Offshoring can allow firms to refocus their resources and capabilities on high value adding activities. Engineers might, for instance, focus on developing the next clean-propulsion technology when the labor-intensive job of drawing detailed designs is undertaken elsewhere (Christophe Bédier et al., 2012). The aerospace industry is global, and offshoring is part of firms' strategies.

There is also another reason that aerospace companies are offshoring activities that is not motivated by cost reductions: offset requirements. The client of an aerospace company is usually a country. And when a firm makes a sale to a foreign country (usually their military), there are often offset requirements that are imposed by the government to gain economic benefits from the sale. A firm's offset obligation is usually worth 50-100 per cent of the value of the contract and can be direct or indirect (Hoyos, 2013). Often firms must agree to transfer technological know-how, or to use local suppliers, to produce the product they are selling. Aerospace companies are therefore offshoring activities to other countries not necessarily because their local suppliers aren't competitive, but because they have to in order to win the contracts. And there is a feeling that this could potentially be a threat to the cluster if companies becoming increasingly obliged to comply to offshore requirements.

Key findings:

→ Offshoring is still a strategy that firms use to remain competitive

→ It's no longer primarily labour intensive manufacturing activities that are leaving the cluster, but also complex activities

→ Offset requirements are forcing firms to offshore activities in order to win contracts

## D – Location and competition

The aerospace industry is much more competitive than it was 10 years ago. Iain Christie (AIAC) explains that competitors in other jurisdictions have so much government funding and support, that "it's not only a competitive game between companies in Montréal, it's a competitive game between countries". And international market access is crucial for firms since they are so heavily dependent on exports. Bombardier Aerospace for example, only gets 5% of its revenues from the Canadian market. It therefore relies on foreign markets for the remaining 95%.

France has the strongest aerospace industry in Europe, and this is due to the continuous governmental support that it receives. One example is France's repayable launch investment for new aerospace products. The agreement stipulates that the government would advance up to 33% of the program cost, and the loan must be fully repayable if the project is successful over a 17-year period, with a 0.25% interest rate plus the cost of government borrowing (Niosi, 2012). All Airbus models received such government support. Aerospace projects are extremely capital intensive, and these programs greatly reduce the strain on firms to come up with the initial capital to launch a new project.

Moreover, the number of competitors is increasing, as it's not only the traditional aerospace jurisdictions that are competitors. There are emerging economies like China and Mexico that have made strengthening their aerospace industry a national priority due to the high value jobs that it creates.

Most respondents however, didn't seem to think that developing countries' aerospace industries may threaten the future of the cluster. Over half of the respondents (62%) answered no. A small portion answered yes (8%). And the rest either didn't know, or one respondent answered that "it's a threat depending on the size of the company, therefore it's yes and no".

My proposition #3 that **the decrease in spatial transaction costs lowers the barriers of entry for clusters, thus increasing competition within clusters** is not supported. The general perception is that the competitive threat from developing countries depends on their ability to produce aircrafts that match the quality of western OEMs products, and so far they don't seem to have reached that level. George Tsopeis (Zenith Jet) thinks that this expertise with commercial aircraft will be difficult to acquire. He argues, "in aerospace, you need a pedigree of at least 20 years when you forge this knowledge though mistakes and lessons learned and you develop expertise". The one exception is Brazil's Embraer.

*Is this trend a threat to the cluster?*

The perception is that this increased competition won't make the Montréal cluster weaker, and it can potentially make it stronger. The following example of the Chinese aerospace industry will demonstrate why.

Despite Chinese aircrafts typically being used internally, the state-owned COMAC is looking to export their aircrafts to the Western world. This however requires a certain level of safety and

certification that the company is not used to. For example, the ARJ21 lacks both U.S. Federal Aviation Administration (FAA) and European Aviation Safety Agency (EASA) certification, although approved by Chinese authorities in 2014 (Ohlandt, 2016). According to an informant at Thales Canada, to reach the required safety standards, COMAC will need to work with Western suppliers. For that reason, the rise of China's aerospace industry is an opportunity for suppliers. If COMAC produces all the C919s on its books, Honeywell, an American engineering group, would make $15bn from supplying it with parts. CFM International, a joint venture between General Electric and Safran of France, stands to earn $16 billion from the list price of its engine sales ("China's big aerospace ambitions are delayed", 2016).

Rather than being a competitive threat, the development of the Chinese aerospace industry is an important opportunity for suppliers in the Montréal cluster. Montréal aerospace companies can therefore see these new aerospace companies in developing countries as potential customers, rather than competitive threats.

Key findings:

→ Many developing countries are seeking to develop their own aerospace industries

→ These developing countries lack the experience and expertise in commercial aircraft manufacturing, and will need to work with Western suppliers to make up for this

# VI - Conclusion

As we saw in the beginning of my paper, there are many reasons why co-location can lead to superior economic performance for firms. Firstly, cluster firms have access to demonstration effects whereby firms can clearly see what their competitors are doing. This mutual transparency pressures firms to keep upgrading and innovating in order not to be left behind. Secondly, cluster firms have access to valuable local knowledge spill-overs, and can gain access to tacit knowledge through global linkages. This makes it cheaper and easier for firms to integrate into global knowledge networks. Thirdly, firms have access to local suppliers that make negotiation and monitoring costs decrease. Fourthly, cluster firms have access to shared immobile resources, such as workers and industry specific inputs. This makes it cheaper and easier to offshore activities and specialize in slices of the global value chain.

My research examined how a reduction in spatial transaction costs affects the logic of industrial clusters. Due to the limited data on cluster firms, and their global linkages, I decided to use a qualitative approach to explore this question. I chose the Montréal aerospace cluster as my case study, and by conducting interviews with informants from 14 aerospace companies and organizations in Montréal, I was able to test my propositions. I will end this section with some concluding remarks.

The offshoring of production remains strong. Decreases in transportation costs are reducing the necessity to co-locate with suppliers and is enabling firms to globally spread out their activities.

But this doesn't mean that this is the end for industrial clusters. As we saw with my case study on the aerospace cluster in Montréal, clusters are leveraging the advantages of other clusters in order to remain relevant and successful. Industrial clusters are changing in that, one of the most important advantages that they provide firms is this ability to hook onto global production through the establishment of global partnerships. Successful clusters can no longer operate in isolation. Clusters need to adapt to this new reality, and make sure that cluster firms are not excluded from the global supply chain of production. Global value chains are the way of the future, and firms need to take part of it.

Suppliers and OEMs are increasingly selecting global suppliers/clients. Proximity to each other is less important; firms can partner with firms from all over the world due to the decrease in spatial transaction costs. And as spatial transaction costs continue to decrease, this "stickiness" will become less and less important. Firms therefore need to make themselves attractive global partners and gain a competitive advantage in the activities that they specialize in.

The danger is that small players, that don't have the ability to establish international partnerships, risk not being able to compete in the future. For the case of the aerospace industry in Montréal, Aéro Montréal has the responsibility to protect these SMEs and ensure that their interests are promoted internationally. This will help ensure the future strength of the aerospace cluster in Montréal.

Also, this can perhaps help guide government policy in protecting and promoting the cluster.

Policies should be put in place that encourage co-operation between clusters, thereby supporting smaller firms' ability to compete on an international scale. Clusters are a driving force in increasing exports and are magnets for attracting foreign investment (Porter, 2000). Governments need to understand the changing role of clusters in order to enact proper policy, therefore more studies on the effects that decreasing transaction costs have on clusters is needed.

## Limitations:

With my research, I tried to be as objective as possible, but a complete lack of bias is not possible in qualitative research. And due to my case study approach, my ability to generalize my results was limited.

The Montréal aerospace cluster is unique due to the dominant role that Bombardier plays, and this may have impacted the responses to certain interview questions. Specifically, when asking informants questions relating to the departure of an anchor firm from the cluster, this question was often answered the same as "what would happen if Bombardier were to leave the cluster". The uniqueness of the Montréal cluster therefore may have biased certain informants' answers.

There were also other limitations relative to the collection of data. It was difficult to get in touch with the right individuals in the organizations that I wanted to get an interview with. Also, my questions dealt with several different topics, and the informants were not always able to answer all my questions due to a lack of knowledge. This was more the case in bigger

organizations, where an informant's position was more specific relative to an informant in a smaller organization.

Another limitation was that for over half my interviews, I was not able to conduct face-to-face interviews. This weakened the quality of the interviews. I couldn't read the informant's body language therefore it was difficult is to see how the informants were reacting to my questions.

## Further research:

For further research, I would broaden the scope of my interviews and gather data from a greater number of firms. Also, it would be interesting to compare the changing roles of clusters in different industries; is globalization impacting clusters of different industries similarly? This would increase our understanding of industrial clusters, and help guide governments in enacting appropriate policy.

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# Annex I

## Interview Guide: Aerospace Companies

Interview #:
Company:
Interviewee:
Date:

**Introduction:**

1. What activities does your company specialize in?

**Aero Montréal (the organization):**

2. Is _____ part of Aéro Montréal?
3. How do you perceive Aéro Montréal?
4. What opportunities does Aéro Montréal provide for your company?
5. How did Aéro Montréal influence your decision to locate in Montreal?
6. In your opinion, what do you think the current opportunities and challenges for Aéro Montréal are?
7. How do you think the Montreal cluster has changed in the past years? What were the driving factors?
8. How competitive do you think the Montreal cluster is, relative to other aerospace clusters?
9. How do you think the aerospace cluster can get stronger?
10. What is your projection for the future of the aerospace cluster in the next 10 years?
11. Do you think the provincial and federal government are active enough in protecting and promoting the Montréal aerospace cluster?
12. Do you see the fact that developing countries (Mexico, China) are increasingly developing their aerospace industry, as a threat to the future of the Montreal cluster?

**Specialization:**

13. Are there aerospace activities that have been moving away from the Montréal cluster in recent years?
14. Is it because of offshoring? Or firm closure?
15. Has this trend intensified over the years?
16. Do you see a danger in too many activities leaving the cluster?

17. Are there aerospace activities that have coming back to the Montreal cluster in recent years?
18. Has this trend affected the type of activities that the aerospace cluster specializes in?
19. Do you see a danger of the aerospace cluster becoming too specialized in certain activities?

**Global value chains:**

20. Who are the major partners in your supply chain?
21. Do you think that aerospace companies in Montréal are increasingly choosing global partners? Why?
22. In your opinion, have the global linkages of aerospace firms intensified over the years?
23. Do you see a danger in the aerospace supply chain being increasingly globally spread out?

**Anchor firms:**

24. Are there anchor firms that are particularly important for the survival of the cluster?
25. Why, and which ones?
26. How do you think the cluster would be impacted were that anchor firm to leave, with no immediate replacement?
27. Would your firm consider moving to another aerospace cluster with the departure of an 'anchor firm'?

# Interview Guide: Aerospace experts

Interview #:
Company:
Interviewee:
Date:

**Introduction**:

1. What is your current position?
2. Where does your knowledge of the aerospace industry come from?

**Aero Montréal (the organization):**

3. How do you perceive Aéro Montréal?
4. What opportunities do you think that Aéro Montréal provides for aerospace companies?
5. In your opinion, what do you think the current opportunities and challenges for Aéro Montréal are?
6. How do you think the Montreal cluster has changed in the past years? What were the driving factors?
7. How competitive do you think the Montreal cluster is, relative to other aerospace clusters?
8. How do you think the aerospace cluster can get stronger?
9. What is your projection for the future of the aerospace cluster in the next 10 years?
10. Do you think the provincial and federal government are active enough in protecting and promoting the Montréal aerospace industry?
11. Do you see the fact that developing countries (Mexico, China) are increasingly developing their aerospace industry, as a threat to the future of the Montreal cluster?
12. Do you see the fact that developing countries (Mexico, China) are increasingly developing their aerospace industry, as a threat to the future of the aerospace industry in Montreal?

**Specialization:**

13. Are there aerospace activities that have been moving away from Montreal in recent years? If yes, which type?
14. Is it because of offshoring? Or firm closure?
15. Has this trend intensified over the years?
16. Do you see a danger for the aerospace cluster in too many activities leaving the cluster?

17. Has this trend affected the type of activities that the aerospace cluster specializes in?
18. Do you see a danger of the aerospace cluster becoming too specialized in certain activities?

**Global value chains:**

19. Do you think that aerospace companies in Montréal are increasingly choosing global partners? Why?
20. Do you see a danger in the aerospace supply chain being increasingly globally spread out?
21. In your opinion, has the global linkages of aerospace firms intensified over the years?

**Anchor firms:**

22. Are there anchor firms that are particularly important for the survival of the cluster?
23. Why, and which ones?
24. How do you think the cluster would be impacted were that anchor firm to leave, with no immediate replacement?

# CERTIFICATION

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En foi de quoi, j'ai signé à Montréal

France Morin
Date : 8 janvier 2018

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