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Cluster Innovation in Satellite Cities: The Case of the Laval Manufacturing Cluster

par
Samantha Khoury

Sciences de la gestion
(International Business)

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Résumé

Cet article explore les influences qui conduisent à l'innovation des grappes industrielles dans les villes satellites. Nous étudions la théorie qui explique les effets de cette localisation géographique sur l'innovation des grappes industrielles ainsi que les éléments qui influencent l'innovation de ces grappes. Afin de mieux comprendre les répercussions de la localisation périphérique d'une grappe, nous avons collaboré avec Laval économique, l'agence de développement économique de la ville de Laval, et utilisé une méthode mixte de collecte de données. Notre volet quantitatif a été réalisé à partir d'une liste de 608 entreprises compilée par Laval économique à laquelle nous avons envoyé un sondage auquel 84 entreprises ont répondu (taux de réponse de 14%). Pour la partie qualitative, nous avons utilisé une seconde liste de 31 entreprises (toujours fournie par le Laval économique) que nous avons contactées où 10 entreprises ont répondu positivement pour des entrevues plus approfondies. Les résultats et les conclusions de cette étude permettent de mieux comprendre l'impact de l'éloignement du noyau urbain dense sur l'innovation des clusters et ajoutent à la littérature sur les villes satellites, un sujet qui n'a pas encore fait l'objet d'études approfondies. Elle met également de l'avant des implications pour le sujet de l'innovation et réfute certaines hypothèses négatives sur l'innovation dans les villes satellites. Enfin, les décideurs politiques intéressés par le développement ou le soutien des grappes industrielles dans les régions périphériques seront aussi intéressés par les résultats de cette étude puisqu'ils mettent de l'avant les éléments qui influencent le succès des grappes dans les villes satellites.

Mots clés : Villes satellites, grappes d'entreprises, innovation, liens, politique, soutien des pouvoirs publics

Abstract

This paper explores the influences that lead to cluster innovation in satellite cities. We study the theory that explains the effects of this geographical location on the innovation of clusters as well as the elements that influence cluster innovation. To better understand the repercussions of a cluster's peripheral location, we studied the Laval manufacturing cluster, worked with Laval économique, the city of Laval's economic development agency, and used a mixed method data collection approach. Our quantitative section was conducted using a list of 608 companies compiled by Laval économique to which we sent out a survey where 84 firms responded (14% response rate). For our qualitative section, we used a second list of 31 firms (again provided by Laval économique) that we contacted to which 10 companies responded positively for more extensive interviews. The findings and conclusions of this study enable a better understanding of the impact of remoteness from the dense urban core on the innovation of clusters and adds to the literature on satellite cities, a subject that has not been studied extensively as of yet. It also brings forward implications for innovation study and repudiates some negative assumptions on innovation in satellite cities. Finally, there is also relevance for policymakers interested in developing or supporting clusters in peripheral regions.

Keywords: Satellite cities, Clusters, Innovation, Linkages, Policy, Government support

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List of Abbreviations and Acronyms

FDI: Foreign Direct Investment

ISED: Innovation, Science and Economic Development Canada

IP: Intellectual property

ITF: International Transportation Forum

MEIE: Ministère de l'Économie, de l'Innovation et de l'Énergie du Québec

OECD: Organisation for Economic Co-operation and Development

R&D: Research and development

SME: Small and Medium Enterprise

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Chapter 1

Introduction

Over time, urban density and the spread of cities has been well documented around the world. While cities grow and spread out farther and farther, cities on the outskirts of metropolises, also known as ‘satellite cities’ or ‘peripheral regions’, have also been developing in parallel and creating their own unique ecosystems by taking advantage of the opportunities their locations, both through proximity to their bigger, denser neighbours, and through remoteness to urban cores, allow.

Advantages include the lower cost of living, improved secrecy, and more, and the additional benefit of being compelled to innovate because of the distance to the urban core (Delventhal et al., 2021; Eder, 2019; Kang et al., 2020; Shearmur & Doloreux, 2016). However, the challenges they face such as lack of human capital, a smaller amount of R&D spending, less connectivity and support, create significant impacts on these peripheral regions (Caragliu et al., 2016; Eder, 2019; Xu et al. 2022).

Nevertheless, regions with the presence of factors such as a university, a diversity of firms, government support, and linkages to other regions greatly impact the outcomes of satellite cities (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019). While these elements do not guarantee the success of the region, they do benefit it and give it a step up towards development and growth.

Interestingly, these aspects are likewise linked to the notion of business clusters and pertain to their growth and development. In fact, since the early 1990s and following Michael Porter’s

research on the subject, more specifically in “The Competitive Advantage of Nations” (1990), the subject of clusters and the area of innovation have taken prominence in business language and research. This paper is possibly one of the most cited and influential pieces written on the subject and has led to massive interest and a shift in perspective in the way clusters can drive innovation and competitiveness for a regional ecosystem.

This shift has enabled the rise of interest and research on the subject and even the development of cluster mapping tools to observe and study clusters such as the European Cluster Collaboration Platform and the U.S. Cluster Mapping (European Cluster Collaboration Platform, 2023; U.S. Cluster Mapping, 2023).

In effect, the popularity of clusters has been on the rise ever since, and their success has encouraged countries to try and replicate this model of development through different initiatives and policy (Boschma & Gianelle, 2014; Kukalis, 2010). Research has shown that there are many positive direct and indirect impacts on the economy and social structure from clusters on the geographical region that they are located in and that they affect the way knowledge is processed (knowledge creation, sharing, spillovers) in the business community (Boschma, 2014; Brenner & Schlump, 2011; Nooteboom, 2000).

However, cluster innovation and performance are highly dependent on a number of factors, such as their geographical situation or their propensity for collaboration, and their performance are very much affected by internal and external considerations that, in turn, impact their dynamics (Boschma & Gianelle, 2014; Ketels & Protsiv, 2013; Kukalis, 2010; Porter, 1990, 1998).

Yet, it is important to note that while geographical considerations affect a cluster greatly, international linkages and global networks can also transform and foster innovation in a cluster,

especially when knowledge creation and knowledge sharing is involved (Liao & Yu, 2013; Turkina & Van Assche, 2018). And this access to new knowledge can impact and transform the region as a whole and promote, inspire, and foster new innovation within the ecosystem (Al-Laham & Souitaris, 2008; Coombs et al., 2006).

This is before mentioning the impact of crises such as the COVID-19 pandemic, during which the data collection for this thesis was conducted, though the full extent of the repercussions on firms and regions will be felt for years to come. This global health emergency greatly impacted companies and their ability to create new partnerships and collaborations, and its future impact on clusters remains to be determined. To survive such trying times, businesses had no choice but to evolve and innovate through the challenges that were thrown at them whether it be a global pandemic, technological disruptions, economic shifts, or simply other factors out of their control (Brenner & Schlump, 2011; Pinkse et al., 2018; Porter, 2003).

As clusters are made up of not only a diverse number of private companies, but also of public institutions such as government entities and universities that collaborate, the challenges they face could very much affect their need to innovate (Boschma & Gianelle, 2014). Not only do they rely on government incentives and policies, but also on the investment of private foreign companies and the knowledge creation of universities which often includes a diverse student body (Boschma & Gianelle, 2014). A cluster's reputation, innovation, growth, and dynamism could greatly be disturbed by issues such as companies moving elsewhere, or a brain drain impacting their access to knowledge, expertise, and skilled labour (Brenner & Schlump, 2011).

It is highly probable that the impact of the current global events might be affecting the desire of companies to expand their activities abroad or, in some cases, even innovate through collaboration, international or otherwise.

The fear of the impact of recent years on border restrictions and changes in political stability are potentially changing the way firms, clusters, and policymakers approach innovation, collaboration, and clustering, and the encouragement of knowledge creation, but even more so knowledge sharing to account for potential sudden disruptions and unforeseen events.

Nevertheless, access to external sources of financing, knowledge, partnerships, and networks support companies in their growth and are all vital to regions for innovation and for their competitiveness (Boschma & Gianelle, 2014; Brenner & Schlump, 2011).

Simply because of the density and population of cities, clusters tend to develop in or around these main urban agglomerations (Boschma et al., 2014; Eder, 2019; Shearmur & Doloreux, 2009, 2016; Xu et al., 2022). However, with the spread of urban agglomerations, ease of transportation, and increase in prices linked to cost of living, there comes a growing number of people and firms that decide to settle on the outskirts of a major metropolis. The location of so-called “satellite cities” can be both a boon and a challenge as the region can benefit from the juxtaposition of a large city, but it can also suffer greatly from the competition that comes with this geographical proximity (Boschma et al., 2014; Eder, 2019; Shearmur & Doloreux, 2009, 2016).

While the research on cluster innovation has surged significantly since Porter’s research in the 1990s, the research on clusters in satellite cities has not followed suit. Researchers have focused and highlighted everything from the development, the needs, the life cycle, and beyond of

clusters, but very few have lingered on studying clusters in satellite cities and the impact of their geographical location on innovation in the ecosystem.

This brings us to our question: *How can clusters in satellite cities remain innovative?*

The goal of the study is to determine how satellite cities can continue to be competitive compared to their bigger, more populous counterparts and how this shapes cluster dynamics and innovation. It is important to understand how being outside of a metropolis can impact clusters and how clusters are adapting to these challenges and opportunities.

The need to answer this question is so great for satellite regions to drive innovation and economic growth that we collaborated with the City of Laval (through their economic development promotion agency, Laval économique) to study and gather data on the Laval manufacturing cluster in the region. In fact, we received a stipend to contribute to the better understanding of factors at play in the region and to gather data determining the needs of firms in the region to appreciate and comprehend what can foster greater innovation for this satellite city.

The need to better understand the drivers behind firm innovation in the region are essential for Laval économique to help support the cluster in its development and growth and to understand the regional relationship between Laval and Montreal, as well as the opportunities and challenges brought on by this geographic position next to a metropolis.

Moreover, this collaboration with Laval led to the publication of the article titled *Causal Configurations of SME Strategic Renewal in Crisis: Qualitative Comparative Analysis (QCA) of Quebec Entrepreneurs amid COVID-19* (Wang et al., 2023) which correlates empirical results to pragmatic ramifications for SMEs and policymakers on firm-level cluster resilience from crisis.

This investigation is an accompanying support and continuation to the corresponding journal article that may bring insight into new trends and patterns for clusters situated in regions adjacent to much larger ecosystems, help forecast the potential future of cluster dynamics between regions, and help us understand the needs as well as the challenges and opportunities faced by the firms in satellite cities. In turn, the elements observed, and conclusions drawn from the statistical relationships and correlations in this study will enable us to comprehend the potential effects of various variables affecting clusters in satellite cities, determine the drivers driving innovation in satellite cities, and the need for firms to stay innovative.

This paper consists of seven sections that describe the theories and steps behind the research that also led us to our conclusions on the subject. The following section (chapter two) discusses the literature and theories that define satellite cities, clusters, linkages, and innovation. In Chapter three, we then develop propositions on the functioning of clusters in satellite cities that try to answer our main question. In chapter four, we delve into the methodological aspect of the study to explain the steps we took to gather and analyze the data we collected. This chapter explains the rationale behind the steps and methods used and we evaluate them to better understand the controls of this study. Then, chapter five discusses results and analysis and sorts and analyzes the data we collected to better understand and illustrate the patterns in the information gathered. Chapter six, the Discussion, considers the findings from the study, and explores the implications on the topic. Finally, the last section, chapter seven, is the conclusion of the study which includes limitations and potential for future research.

Chapter 2

Literature Review

2.1 Satellite Cities

While most of the research on innovation has focused on large cities because of the obvious advantages of populous centres (access to infrastructure, talent, and capital, proximity to industry stakeholders, etc.), satellite cities, also referred to as peripheral regions, are not to be disregarded when it comes to the development of innovation (Boschma et al., 2014; Eder, 2019; Shearmur & Doloreux, 2009, 2016).

2.1.1 Challenges Faced by Satellite Cities

According to researchers, satellite cities face certain challenges compared to dense metropolitan areas for instance "lower accessibility, the lack of research and development (R&D), or a critical mass of actors"; other challenges observed include "lack of support infrastructure, human capital, R&D expenditure, and the dominance of traditional industries as decisive factors." (Caragliu et al., 2016 as cited by Eder, 2019) These challenges are so hard to overcome that, when studying innovation in neighbouring regions in China, Xu et al. (2022) conclude: "A region's technology accumulation has significant effects on economic scale, constantly attracting technology and talent from the surrounding underdeveloped areas and producing an inhibitory effect on the optimization and upgrade of the industrial structure in the less-developed surrounding regions, leading to the emergence of negative spillover effects."

Conversely and in spite of these challenges, different research highlights, theorizes, and discusses the potential effects of a peripheral geographic location on firms. In fact, Shearmur and Doloreux (2016) argue that there is a bias towards cities as the innovation metrics used often focus on patents which are habitually tabled by large companies located in larges metropolitan areas while other types of innovation that are more common outside of large cities such as process and organizational innovation, innovations protected by secrecy, and innovations in smaller establishments are disregarded or passed over for more quantifiable alternatives.

This is made clear in the following statement "since innovators in remote regions do not follow urban-specific strategies, there is a tendency to assume that firms in remote areas are less able to innovate." (Shearmur & Doloreux, 2016) This sentiment is echoed by other researchers such as Eder (2019), Lee and Rodriguez-Pose (2013), and Alderman (1998) who argue that the type of innovation studied influences the amount of innovation found in a region and that innovation also happens in more traditional sectors that might not be as studied. Eder (2019) also quotes Caragliu et al. (2016) and describes the possibility that there are simply different R&D outcomes in different regions, or that there might be a need for specialization in remote locations to achieve regional growth and success.

Shearmur and Doloreux (2016) discuss a phenomenon where innovative firms grow in smaller regions to then migrate to larger urban centres later on: "Shearmur (2012, 2015) suggests that some isolated innovative firms subsequently move towards larger cities (purchased by larger firms, opening marketing and production facilities in cities or simply moving there) because cities provide the resources to grow the firm and market the innovation."

They continue: “[o]f course, innovation does seem to occur in cities for a straightforward reason: that is where the majority of economic activity takes place (Iammarino & McCann 2006).” (Shearmur & Doloreux, 2016) There is no denying that large urban areas have several advantages such as infrastructure and connectivity, access to a qualified labour force, a higher number of networks and linkages, a potentially more attractive recognition for foreign actors, and physical/geographical proximity to other firms and ecosystem actors.

2.1.2 Innovation in Satellite Cities

Still, overlooking satellite cities also overlooks the tremendous amount of innovation that is being generated outside “typical” large cities and what can be seen as the advantages related to being a smaller city in the periphery of a larger metropolitan area.

Such advantages can push a firm towards the peripheral region of a large city. For example, a more affordable cost of living including lower wages, taxes, and utilities, more available space for activities, more ease for isolation in the case of a desire for secrecy to limit the diffusion of innovation, and more (Delventhal et al., 2021; Eder, 2019; Kang et al., 2020; Porter, 1998; Shearmur & Doloreux, 2016). Additionally, the distance from what is traditionally considered crucial input for the innovation process such as “a vibrant environment and fewer possibilities to discover new ideas, scientific research, and possibilities for cooperation by chance” can force firms into creative enterprise that culminates in innovation (Eder, 2019).

Even with this in mind, Shearmur & Doloreux (2016) stress that the way innovation is developed and treated in satellite cities and metropolitan areas will vary greatly and, hence, have come up with the terms “slow innovation” (in-house development, secrecy) and “fast innovation” (latest

knowledge, frequent interactions necessary), to describe the innovation strategy in each respective location.

While it is true that the geographical proximity of firms in the city can be alluring, “there is little recent evidence that the variety of interlocutors decreases with distance from major cities”, especially since the advent of high-speed internet networks (Shearmur & Doloreux, 2016) and with the use of trade shows and events that enable “temporary spatial proximity” (Eder, 2019). In effect, with the right network infrastructure, linkages and networks in place, and the right strategic foresight, “firms in a peripheral region lacking the option of local buzz can be innovative if they are well integrated in global pipelines.” (Eder, 2019) According to Eder (2019), the literature seems to agree on the fact that innovation networks, especially with actors outside the region, are the most crucial element to firms located in peripheral regions. In those cases, public institutions and government are typically a facilitator in introducing an exchange (Boschma & Frenken, 2009; Eder, 2019; Roelandt & Hertog, 1998; Xu et al., 2022).

The reality is that satellite cities are not all created equal and that certain factors can also positively affect their economic outcome and the regional innovation found in these locations. While Eder (2019) argues that the location is less important than the firm’s desire to innovate, we also know that the proximity to a university, a diversity of actors, intervention by public institutions, and tailored innovation policy increases the region’s chances of successful growth and innovation (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019).

While none of these are a guarantee of success, interestingly, these positive factors are likewise related to the concept of business clusters and the factors that support their growth and innovation.

2.2 Business Clusters

2.2.1 Research on Business Clusters

Described by Marshall (1920), but popularized by Michael E. Porter in the 1990s, the concept of business clusters, states that “clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate.” Since then, this notion has taken hold and the study, identification, and classification of these business agglomerations has grown significantly over time even culminating into prominent databases such as those of the European Cluster Observatory and the U.S. Cluster Mapping (European Cluster Observatory, 2023; U.S. Cluster Mapping, 2023).

Moreover, while Porter remains the most influential author on the subject, the subject matter has been explored in different lights and viewed from many different angles to better understand the notion as well as to gain a greater understanding of the diverse elements that make up business clusters, influences and affects them and the businesses within it.

The theories on business clusters indicate an effect on the development and growth of innovation as well as on firm performance, often stating the best example of the successful emergence of the Silicon Valley Cluster in California. This specific example has had countries, regions, and cities try to replicate its success by implementing policies and incentives to recreate their own successful iteration.

Clusters are groups of businesses concentrated in the same geographical location. In turn, these firms become linked through networks and shared knowledge, creating innovation, development, and potentially success for the entire region (Marshall, 1920; Porter, 1990).

Again, according to Porter (1990), different characteristics linked to location influence clusters such as its geographical location itself, natural and environmental resources, business environment, and existing economic conditions. Porter's diamond conditions (Porter, 1990) can provide us with a clear framework to determine the competitive advantage of a nation over another and, hence, the advantages its clusters can benefit from, simply because of location.

The presence of a company in a cluster also seems to contribute, not only to the economic health of the region, but also to the success of the company itself (Porter, 1990, 1998). Being surrounded by other firms in the same or complementary industries enables an access to collaboration and knowledge that would otherwise be much more difficult to obtain (Porter, 1990, 1998).

In fact, nowadays, it is almost essential to a company's success and innovation practices to be connected to other firms (Turkina et al., 2019). The way that companies confront challenges they are faced with and develop new innovations has changed greatly and their survival can often depend on external factors such as access to external knowledge sources, through collaborations with other firms (Turkina et al., 2019).

2.2.2 Knowledge Design in Clusters

Knowledge spillovers, transfers of knowledge, creation of knowledge through collaboration and more are all part of the fundamentals of new knowledge and innovation in these ecosystems. On the one hand, according to Audretsch and Feldman (1996), these effects of geographical concentration are stronger the closer to the knowledge source and weaker the farther the distance from the knowledge source, meaning that geographical proximity is a necessity in this case.

However, Boschma and Gianelle (2014) believe that this proximity is not necessary for knowledge creation or transfer:

> The same applies to the process by which knowledge is transferred between organizations, incorporated, and transformed into something new. Other barriers of effective knowledge transfer need to be overcome, such as social or cognitive distance (see e.g. Torre and Rallet, 2005; Balland, 2012). Some, if not all, of these forms of proximity between actors need to be secured to make them connected, and to facilitate knowledge transfers (Lagendijk & Oinas, 2005). (p.4)

Nooteboom (2000) explains that there is a need for cognitive proximity for knowledge transfer and knowledge sharing, but that too much proximity may even impair new collaborations as there is a necessity for some divergence to grow, acquire new knowledge, and create new knowledge. This also applies to a cluster: for conducive growth, innovation, and success in a region, it is essential for there to be variety. A combination of related industries, companies of different sizes, and more will contribute the most to the region (Frenken et al., 2007) as a lack of diversity could lead to what Boschma (2005) describes as a "lock-in effect". The lock-in effect in clustering activities happens when a region becomes overspecialized and thus leads to the decline of the cluster.

2.2.3 The Life Cycle of a Cluster

As we've just stated, elements such as diversification and adaptability highly influence the fate of a cluster and its region. It is necessary for these ecosystems and the firms in the region to

create new progression through the development of new and innovative products, services, or processes, and through their own structures to stay relevant, inventive, and competitive.

These elements actively impact the life cycle of clusters and influence their path, growth, and innovation at every point in their process. While cluster emergence and success are not fully understood as of yet, a business cluster will usually naturally follow the life cycle of its industry (Ketels & Protsiv, 2013).

> However, even for a given set of starting conditions across all these factors there is huge variety in terms of whether a cluster actually emerges, how quickly that process takes root, and what economic benefits it delivers to companies and the region. The understanding of what turns a promising environment into the successful launching pad of cluster evolution is still weak. One candidate is 'social capital', a factor that the regional science literature has increasingly highlighted as a major driver of performance differences across locations (Rodríguez-Pose & Crescenzi, 2008). (Ketels & Protsiv, 2013, p.7)

Additionally, this 'social capital' is deemed a characteristic of clusters by researchers, "setting them apart from other agglomerations" (Kukalis, 2010), through their embeddedness that simplifies interactions and networking between its members. This active facilitation of networking and information sharing is what sets clusters apart and enables them to thrive compared to other groups (Ketels & Protsiv, 2013; Kukalis, 2010).

Elements such as the "level of trust between and within the private and public sector", active collaboration/joint action, beneficial local environment, cluster initiatives, and other conditions are highly influential to the development and conduciveness of cluster creation (Kukalis, 2010).

Researchers posit that there are four distinct stages of development that a cluster will go through: emergence, growth or expansion, sustainment or maturity, and, finally, decline.

During the early emergence stage, the cluster is at its initial stage; firms are putting down foundations of the cluster and the industry is also often in its infancy (Brenner, 2001; Brenner & Schlump, 2011; Menzel & Fornahl, 2007). This is where, according to Brenner and Schlump (2011), local conditions have a great influence on the development of the cluster. Elements such as the presence of related industries (Boschma & Wenting, 2007) as well as "universities and public research, seem to contribute to the development of clusters. This implies that all variables and parameters related to firm foundation, the presence of industries, universities and public research should be high in this early phase of the cluster life cycle."

Following the initial emergence stage, the growth or expansion stage takes place and enables the further development of the cluster. In this stage, the industry or technology grows as does the need to sustain the market through firms, employment, and more (Brenner & Schlump, 2011). As the cluster gains momentum, it becomes more self-sustaining as the number of businesses and suppliers in the area increases. It's at this moment that the cluster starts attracting investment, develops a substantial, specialized expertise, and begins achieving economies of scale. During this stage, "the local firm population benefits from a common labour market, synergies, and interaction between firms and the development of service and supplier firms in the region." (Brenner & Schlump, 2011) This is when knowledge spillovers, between firms from the same industry or different industries, are beneficial and enable the growth of the cluster. Hence, networking and the creation of partnerships or cooperation between firms are very important to the development of innovation and continued growth of the cluster during this phase (Brenner &

Schlump, 2011; Glaeser et al., 1992; Henderson et al., 1995; Klepper, 1997; Menzel & Fornahl, 2007).

The next stage, sustainment or maturity, is when stabilization and equilibrium occur in the life cycle. At this stage, the cluster becomes a well-established part of the local economy, and gains recognition, for example, by becoming a hub of innovation, or by its members collaborating on research and development projects. At this point, the cluster is well established, and the networking and partnerships are already in place and the cluster can benefit from economies of scale (Menzel & Fornahl, 2007). Additionally, Porter (2003), as cited in Brenner & Schlump (2011), mentions that "[s]ome regional self-reinforcing forces are still found, and firms might still benefit from being located in a cluster".

Finally, the fourth and final stage is the declining phase of the cluster's life cycle. The main feature of this phase is mostly focused on the obvious decrease of demand for the industry's product or service, forcing the firms, cluster, and industry to evolve or change in order to survive (Brenner & Schlump, 2011). Several reasons can explain the decline of a cluster: changing trends, shifting competitive landscape, rise of a new innovation/technological disruption, fluctuating consumer preferences, and more. In this stage, the cluster has two avenues: it needs to transform itself by adapting to new markets or developing new products or services, or it will deteriorate and eventually disperse as its members vanish or relocate (Brenner & Schlump, 2011; Glaeser et al., 1992; Henderson et al., 1995; Klepper, 1997; Menzel & Fornahl, 2007).

In order to escape this inevitable decline, it is essential for an industry or cluster to adapt to conditions, renew itself, or transform completely in order to escape its demise. Following this cycle, an industry is usually disrupted or completely replaced by an entirely new industry

(Brenner & Schlump, 2011; Menzel & Fornahl, 2007). However, this process of decline can be abated, and the cycle can regenerate which will in turn restart and enable the cluster to "always enter into loops of self-sustainment, successive cycles of growth and decline, or even re-orient themselves" completely (Viederyté, 2018).

Pinkse et al. (2018) discuss how the emergence, survival, and evolution of a cluster depends on a number of factors and how clusters are often faced with "a 'cluster paradox', that is, a situation in which a collective identity and homogeneity breed cohesion between members and efficiency in inter-organisational collaboration, yet hinder the variety needed to adapt to disruptive change and prevent lock-in situations (Menzel & Fornahl, 2009; Tichy, 2001)."

Hence, clusters are faced with the almost impossible task to be both homogeneous enough that firms can work and understand each other while also being heterogeneous enough that firms can learn from each other, innovate, and build resilience (Pinkse et al., 2018). Heterogeneity is a complex situation as it's bound to create more conflict within a cluster, however, it also empowers creativity and disruption and, in turn, causes the renewal and essential keeping abreast of changes in the industry and their environment (Baglieri et al., 2012; Pinkse et al., 2018; Suire & Vicente, 2014). This conflicting predicament is a characteristic enabling clusters to not only grow and evolve, but also to maintain their relevance and survival over time. The impacts of a cluster's life cycle can be hard to determine, but "the tendency of each industrial cluster to close in on itself in the medium term" can be mitigated through the support of innovation-focused firms which in turn increases industry competition in the region (Koshcheev et al., 2021).

Furthermore, as per Boschma and Gianelle, 2014:

> Studies have learned that the ability to develop new growth paths is not equally divided across all regions. Perhaps one of the most daring example is the American motor city of Detroit that has completely failed to do so, and which has lost more than one million inhabitants as a result (Hill et al., 2012) […] In Europe, there are regions that have succeeded in stepping out of stagnation, economic downturn or decline of traditional manufacturing and found their way to new economic development and urban regeneration. Well-known examples are Bilbao (Etxebarria and Franco, 2003), Turin (Vanolo, 2008) and Manchester (Quilley, 2000), based on differentiation of the existing skill and knowledge base into new activities, supported by increased accessibility through infrastructure building, creation of attractive events, and urban and regional branding. (p.2)

Therefore, diversification is high on the political agenda of several regions. Most notably, the European Commission has spent a vast amount of time and money to study and implement the right types of processes and policies to ensure a continuous growth and evolution of its regional innovation ecosystems through policy, economic or otherwise (Boschma & Gianelle, 2014; Eder, 2019; European Cluster Collaboration Platform, 2023). Eder (2019) even points out that most empirical research has been of European origin.

2.2.4 Networking and Clustering

As networking and clustering has gained importance, these relationships and interdependency have also grown with the ease of global communications enabling a sort of internationalization

of clusters through knowledge-sharing and knowledge creation (Boschma & Gianelle, 2014; Liao & Yu, 2013; Turkina & Van Assche, 2018).

This, in turn, has opened doors to possibilities of intercluster or interfirm collaboration that would have been far more difficult years ago. According to Turkina and Van Assche (2018), "[e]stablished knowledge hotspots like Silicon Valley (ICT), Montréal (aerospace), and San Diego (biotech) rely on the global connectedness of their firms to foreign locations to constantly reinforce their local innovation capabilities. Emergent clusters such as Queretaro (aerospace) and Tallinn (ICT) increasingly integrate into global knowledge networks by becoming suppliers for global value chains." This means that international linkages might actually reinforce innovation locally and these international interactions might enable greater dynamism within the cluster. However, the distinction between developed and developing economies seems to also affect the linkages and, in turn, affect innovation (Liao & Yu, 2013; Turkina & Van Assche, 2018).

We have already discussed the need and the impacts of heterogeneous linkages within clusters, so one would envisage that international linkages would be the most heterogenous collaboration possible, yet, the diversity of knowledge, technology gaps, and cultural disparities found from cluster to cluster, from country to country, might challenge the practicality of international linkages in certain cases (Liao & Yu, 2013; Turkina & Van Assche, 2018).

Nevertheless, these challenges can sometimes be mitigated by elements such as: clusters and firms' international experience, foreign firms' motivations, needs. Or proclivity to ally with partners, domestic firms' position "within the national network structure (network size and firm's centrality within the network)", and more (Al-Laham & Souitaris, 2008; Coombs et al., 2006). In fact, Al-Laham and Souitaris (2008) also confirm that "local clusters foster the

internationalization of new ventures by increasing their awareness of international opportunities, and by offering an arena to learn from the experience of internationally connected firms."

In turn, this means that local clusters not only share and create knowledge to foster technological or product/service innovation, but also work as sounding boards enabling the evolution of other firms, and the cluster itself, through their experience. Consequently, the lessons learned by experience seem to have the potential of becoming part of knowledge sharing within a cluster. However, we can posit that some variables, such as the embeddedness of the cluster, the national and international experience of firms in the cluster, the institutional context, etc. could affect this "shared experience" of knowledge sharing (Al-Laham & Souitaris, 2008; Coombs et al., 2006; Liao & Yu, 2013).

Additionally, Liao and Yu (2013) describe the effects of local and international linkages on innovation depending on the economy the clusters find themselves in:

> Local linkages in emerging economies typically lead to the transference of supply-side knowledge, or exploitative knowledge used for production purposes. International linkages that span several developed countries may lead to the transfer of deeper sorts of knowledge (e.g., knowledge acquired via close interactions with international customers) and greater breadth of knowledge (e.g., knowledge ascertained through trade fairs) (Chen 2009). In such cases, the influence of international linkages on innovation is likely to be greater than that of local linkages, although both types of external linkages are crucial to innovation. (p.823)

Hence, the impact of networks and linkages for firms, clusters, and regions cannot be understated and are essential for growth and the development of new innovation.

2.3 Impact of Government Policies on Clusters and Regional Development

Following the success (and sometimes failure) of clusters, government policies, and the role of innovation policy has become prevalent in the development, process, and even structure of regional innovation. Hence, policy makers are more and more interested in the phenomenon, giving way to observation and collaboration platforms to study, learn, and develop the best policy.

Through platforms such as the European Cluster Collaboration Platform and the U.S. Cluster Mapping, interested parties have been able to navigate, map, and even create collaborations with and within clusters (European Cluster Collaboration Platform, 2023; U.S. Cluster Mapping, 2023). These platforms also inform policy makers and researchers alike about the clusters themselves and the policies surrounding them, helping them better understand their development and how they to create efficient policy. The European Union is an especially active and interested party to cluster observation and collaboration to guide policy-making decisions (Boschma & Gianelle, 2014; Eder, 2019; European Cluster Collaboration Platform, 2023).

However, there is still no clear consensus from researchers on the exact impact of government policies on the subject.

On the one hand, some advise against government intervention, some studies prescribe the "redefin[ition] of the role of government as a facilitator of networking, as a catalyst of dynamic comparative advantage and as an institution builder, creating an efficient incentive structure to remove systemic and market inefficiencies in (national) systems of innovation." (Roelandt & Hertog, 1998)

2.3.1 Developmental Phase and Policy

While, on the other hand, others believe that government innovation policy may be useful as long as it is tailored to the respective cluster or that it may help at some stages of the cluster life cycle (Eder, 2019; Seyfang & Smith, 2007). It's important to understand the different types of cluster emergence to better determine the impact of government policies on these different agglomerations. The grassroots innovation model predates government intervention where clustering and collaboration between firms occurs in an often natural and symbiotic way. Grassroots innovations are usually bottom-up and fill a void or develop innovations that are tailored to the natural needs of the region or local industry (Seyfang & Smith, 2007). Government-backing then simply enhances this through financial assistance, for example, which helps the cluster enhance their research and development and, hopefully, their innovation.

Recognizing the interesting economic development effects of industrial clusters for regions, some governments have, in turn, tried to emulate their success by trying to set up and create clusters from scratch through cluster plans (Babkin et al., 2013). A more top-down approach, these clusters are often created to enhance and serve national purpose and have little to do with the natural collaboration that might develop between firms. In fact, some of these cluster policies are developed and engineered solely for the national strategy and do not rely on firms' potentially mutually beneficial cooperation or knowledge exchange, "regardless of whether it is an advantage to participants or not" (Babkin et al., 2013).

Forcing associations between firms without common goals and lacking "established mechanisms and modes of interaction, cooperation and coordination of resources" can severely obstruct the firms' development as well as the cluster's innovation (Babkin et al., 2013).

This creates a difficulty for policymakers, forcing them to determine which clusters and strategies benefit both government objectives and businesses' development and innovation as well as when cluster or innovation policy would be the most beneficial to the cluster and to the region in and of itself (Babkin et al., 2013; Eder, 2019; Seyfang & Smith, 2007).

Nevertheless, if a government plays its cards right, the successful implementation and advancement of a cluster can have great economic impact on regional economic development and innovation and entice policymakers to keep trying to determine the winning combination of policies to produce an effective cluster that positively impacts regional economies (Babkin et al., 2013; Boschma & Gianelle, 2014; Eder, 2019; Seyfang & Smith, 2007).

In fact, it is hypothesized that the success of clusters impacts the region in more ways than one and explains why policymakers are interested in the matter and try to find the winning combination. Sternberg and Litzenberger (2004) have studied the impact of clusters on the economics of German regions and have concluded that there is a positive relationship "between the number of clusters and the number of employees in clusters" and "and entrepreneurial activities and—even stronger—entrepreneurial attitudes like the assessment of good start-up opportunities and fear of failure of a start-up on the other."

On the other hand, while Resbeut & Gugler (2016) have come to a similar conclusion when studying Swiss regions and their clusters, they determined that:

> [E]mpirical analysis shows strong support for the presence of convergence forces at the region-industry level. In contrast, regions with a strong cluster environment experience greater agglomeration forces, resulting in higher employment growth rates. In addition, a region that is surrounded by neighbors with a strong cluster environment also experiences

> higher agglomeration forces. However, this feature appears solely at the cluster level and not at the region-industry level. (p.205)

Alternatively, they also concluded that regions with a strong cluster presence also have higher growth rates and that complementarities across related industries play a vital role in the growth rates of regions. So much so that they suggest a focus on policies and grants focused on the synergies of related industries (Resbeut & Gugler, 2016).

2.3.2 Government Policies Needed for Cluster Development

Considering the amount of evidence that has accumulated in recent years related to diversification and its link to cluster and regional growth, policymakers would be remiss if they did not focus on this aspect. However, as Boschma and Gianelle (2014) state:

> The objective is not to aim for diversification per se either, as this runs the risk of developing new economic activities that are not embedded in the region, or, even worse, of building 'cathedrals in the desert'. Instead, the objective is to aim for specialised diversification into related technologies which generates new economic activities that are rooted in the region and that can draw on local related resources (Boschma, 2009; Neffke et al., 2011; McCann and Ortega-Argilés, 2013). (p.7)

Hence, regions must be made part of a "smart specialization policy", making connections between related activities and creating collaborations between complementary regions (Boschma & Gianelle, 2014).

It is important for the government to retain a certain role in a cluster that aligns with the cluster's needs to encourage its growth and evolution and, even more importantly, this role cannot be solely financial. While always helpful, the financial aspects of government support in regional or cluster development are only a fraction of the needs for smooth development and can, in fact, sometimes hinder or reduce the innovation produced by the cluster as theorized by Porter (1998) and later observed by researchers.

As mentioned previously and as stated by Eder (2019), when it comes to innovation policy, it seems that, when looking at a longer-term perspective, regions that have an innovation policy in place fare better than those that do not: "Most scholars acknowledge that a well-targeted innovation policy is crucial to triggering innovation in peripheral regions if it is based on a thorough analysis."

However, there does not seem to be a one-size-fits-all policy that encompasses the specific needs and challenges faced by regional ecosystems at all stages of their development. This is why, it is important for policymakers to ensure that their policies are adapted to the ecosystem it targets with the intention of ensuring its continued growth and success (Boschma & Gianelle, 2014; Eder, 2019; Seyfang & Smith, 2007).

2.3.3 Government Roles

The government can take on different roles to encourage regional and cluster development: this includes, but is not limited to, roles such as an advisory role to help the cluster plan out its growth or evolution, or to align with government strategy and priorities; the role of a facilitator to inspire linkages and networking; the contribution of data and analysis that may help a cluster

in their organization; the coordination or communication of helpful strategy, policy, or programs that can be helpful to firms in the cluster or to the cluster itself; and the promotion of the cluster's vision within levels of government and outside government (for example, to encourage FDI) (Boschma & Frenken, 2009; Boschma & Gianelle, 2014; Eder, 2019; European Cluster Collaboration Platform, 2023; Roelandt & Hertog, 1998; Xu et al., 2022).

Moreover, the government's main role lies in its clear mandate to ensure the preservation of competition and the facilitation of the development of innovation in its clusters to make them thrive (Babkin et al., 2013; Boschma & Gianelle, 2014; Porter, 1998; Seyfang & Smith, 2007).

Non-financial public incentives that enable innovation in regional clusters can take the form of investments in infrastructure, network connectivity, and training, competitions, networking and facilitating the creation of partnerships, establishment of an industry-specific task force or round table, matchmaking between SMEs and bigger companies, policy, and more (Eder, 2019; ISED, 2023; ITF, 2018; Roelandt & Hertog, 1998; Xu et al., 2022).

Three excellent examples of government policy to encourage clustering, partnerships, and innovation can be found in Canada in the form of the *Innovation Superclusters Initiative* (now rebranded as the *Global Innovation Clusters*) and, in Québec more specifically, there are two policies of the sort: the *Fonds d'accélération des collaborations en santé* and the new *Zones d'innovation*. While all three programs have a financial component to them, their main goal is to encourage innovation and dynamism industries through collaboration and, in turn, create internationally recognized clusters (ISED, 2023; MEIE, 2023).

In fact, according to the Brookfield Institute's 2021 report "Building Superclusters for Canada", one of the objectives for the program is to strengthen weak networks within different ecosystems to encourage innovation:

> The Superclusters serve to promote strong ecosystems and networks, including those in new digital and intellectual property (IP) strategies. Canada has not promoted cluster development in the way other countries have in their innovation policies, and, as mentioned above, the data shows a low density of networks and collaboration. […] All of the Supercluster objectives reach beyond the impact of their individual projects to promote benefits from new technologies and networks that partner and learn innovative, new practices over time—so-called "network effects." In Canada, the benefits of these effects have been often overlooked. (p.5)

Since their inception, building these Global Innovation Clusters has created positive interest in Canada from other countries as well as acting as a promotional tool for businesses worldwide (Invest in Canada, 2023). In the future, these effects, both tangible and intangible, might be felt in the networks, collaborations, and global partnerships created, but also in the FDI attraction, technological developments, innovation and R&D, business investments, and the highly skilled talent attracted.

We can learn from this 'experiment' in Global Innovation Clusters that regional innovation ecosystems impact a lot more than simply the industry and their firms. The effects can be felt on several levels including at a macroeconomic level, hence why the policies needed for such programs must be well thought out and, most of all, need to encourage the continued renewal of innovation within these ecosystems (Brookfield Institute, 2021).

As discussed previously, some authors decry government intervention in the development of regional innovation ecosystems (Babkin et al., 2013; Roelandt, & Hertog, 1998) while others see government policies aimed at supporting clusters as potentially beneficial (Eder, 2019; Porter, 1998; Seyfang & Smith, 2007). As these policies have only come into play in recent years, long-term effect and success is still to be determined and highly dependent on a multitude of factors such as the life cycle stage of the cluster, success and competitiveness of the industry and/or ecosystem, etc. (Enright, 2003; Hospers & Beugelsdijk, 2002 as cited by Brenner & Schlump, 2011)

However, the literature does not agree on the impact of government policies put in place and creates confusion and a chasm between the theory and the application of cluster policy. Brenner and Schlump (2011) summarize this issue:

> To sum up, on the one hand the literature provides arguments that suggest (cluster) policies are of little importance or take a marginal, indirect and long-term role. For example, it is said that policy measures seem to be superfluous because cluster dynamics should make intervention redundant (Maskell & Kebir, 2006). On the other hand, the literature provides arguments stressing the impact of cluster policy. In case studies, policy is often said to play an important role (Brenner & Mühlig, 2007). (p.1367)

While it can be argued that creating clear policies and guidelines for government engagement can erase doubts and promote an organized support for clustering, it can be hard to prove the tangible value of the state's engagement in regional ecosystems.

Nonetheless, the exponential interest and policy implementation to promote cluster development in recent years still prompts the need for research to determine the best discourse when it comes to policy to then guide policymakers in their decisions.

However, detractors to the idea of government interactions often fail to remember the local conditions that the cluster evolves in. The OECD (2006) mentions the justification of government intervention in two cases of what they define as a "market failure or system failure", defining "market failure" as "situations in which price mechanisms do not take externalities into account" (underinvestment in knowledge creation or to create public goods that the market cannot offer), and "system failure" as four major kinds: infrastructure failure, institutional failure, network failure, and capability failure (Woolthuis et al., 2005). The definition of system failure is particularly noteworthy as the development of infrastructure benefitting the cluster would be practically impossible without government intervention.

The best made policies take into account the distinct characteristics of the cluster, for example, as discussed previously, the stage of the life cycle the cluster is currently in. A mature cluster will not require the same attention that a cluster in its infancy will necessitate (Brenner & Schlump, 2011; Eder, 2019; Seyfang & Smith, 2007). Furthermore, a cluster needs policy adapted specifically to its circumstances, not a simple copy/paste of what worked for a successful cluster (Babkin et al., 2013; Brenner & Schlump 2011; Eder, 2019; Seyfang & Smith, 2007), Brenner and Schlump (2011) explain: "When ignoring the local cultural, historical and industrial differences, policies run the risk of simply copying other successful clusters." Policymakers need to have a real focus and understanding not only of the cluster, but also of the surrounding market conditions as well as cultural and political conditions to ensure the right elements are present and enable the cluster and its firms to flourish.

Therefore, while direct or indirect financial incentives are often the focus for governments, other, non-financial incentives can be of great help to regional innovation, elements such as (but not limited to): support for startups and SMEs (incubators/accelerators, business development), networking and collaboration, investments in education and public research, ease of market entry, R&D support, investments in infrastructure, focus on local conditions, and access to assistance (Brenner & Schlump 2011; Eder, 2019; ISED, 2023; ITF, 2018; Roelandt & Hertog, 1998; Uyarra & Ramlogan, 2012; Xu et al., 2022).

We understand through these elements that not only is financial capital necessary for the successful development of regional innovation, but other components are essential to the facilitation and evolution of regional innovation.

2.3.4 Foundational Elements for Regional Success

When looking at these elements separately, we can quickly understand why they are critical to the success of a regional innovation ecosystem and why policymakers need to consider an overall view of the regional environment.

From the discussed elements in chapter 2, we found five major foundational elements that public institutions can focus on and that can increase a region's potential success:

Support for Entrepreneurship, R&D, and Innovation

Entrepreneurship is a crucial factor contributing to the emergence of clusters and the development of innovation. While we know that the presence of bigger players is also essential to the health of a region and cluster, it is the startups and SMEs that often play a significant role

in the development of R&D as well as innovation (Baglieri et al., 2012; Koshcheev et al., 2021; Pinkse et al., 2018; Suire & Vicente, 2014). Hence, supporting and encouraging the development of entrepreneurship and the establishment of essential linkages between bigger and smaller players improves the vitality and dynamism of the region and its innovation. Supporting these smaller players means enhancing the heterogeneity and innovation within a cluster and creating a pathway to enhancing knowledge creation and spillovers within the region (Baglieri et al., 2012; Koshcheev et al., 2021; Pinkse et al., 2018; Suire & Vicente, 2014).

Policies with a positive impact include financial aid for entrepreneurs and small businesses such as seed funding and venture capital or R&D and innovation funding, but also loans, tax credits, leases, bank guarantees; startup competitions and grants to increase the number of companies in the region; building incubators, science parks, research facilities to enable growth and commercialization; encouraging entrepreneurship; and facilitating the creation of SMEs (Baglieri et al., 2012; Koshcheev et al., 2021; Pinkse et al., 2018; Suire & Vicente, 2014; Uyarra & Ramlogan, 2012).

In addition, supporting R&D is especially necessary to promote and encourage a culture of innovation. Initiating support for these activities in the early stages of a cluster can be through financial means, but also through science parks, incubators, or simply via innovation policy (Uyarra & Ramlogan, 2012). While R&D support is especially crucial in the first stages of a cluster when innovation activity is most significant, it can be interesting in later stages when innovation is not necessarily at the heart of the ecosystem anymore to rejuvenate and develop new technologies or to grow the cluster size (Uyarra & Ramlogan, 2012).

Networking and Collaboration

Networking and collaboration are critical for actors within a cluster and can lead to knowledge sharing and innovation through interactions and ties between cluster members. During the emergence and expansion stages of the cluster, networking and collaboration are important in order to grow the cluster and establish a positive regional environment, while in the later stages, they may hold off the dreaded stagnation and over interlocking of a mature cluster (Brenner & Schlump, 2011; Glaeser et al., 1992; Henderson et al., 1995; Klepper, 1997; Menzel & Fornahl, 2007).

In fact, networking and collaboration need not be limited to the confines of the region or cluster and can be of an international nature (Liao & Yu, 2013; Turkina & Van Assche, 2018). These international partnerships represent an interesting opportunity for knowledge creation and spillovers for firms, but even more so for the cluster itself. As global collaborations are created, so is the exchange of knowledge, technology, and other potential interactions that could be beneficial to the collaborators. This knowledge can then potentially be transferred within the cluster, impacting local firms and the region itself (Al-Laham & Souitaris, 2008; Coombs et al., 2006; Liao & Yu, 2013; Turkina & Van Assche, 2018).

It's also important to remember the social networks that come with the employees working at these firms. Social networks can impact the essential fabric of a cluster through the linkages between individuals exchanging information and hence influencing firm dynamics and create opportunities that would be nonexistent if not for these human relationships (Boschma, 2014; Brenner & Schlump, 2011; Nooteboom, 2000).

Whether it's inter-firm partnerships or between private firms and public institutions, the stimulation of cooperation activities through policies and support can help strengthen the cluster and encourage innovation. Government support can be simply facilitating contacts between cluster members, or more specifically between large players and SMEs, encouraging cooperation between research and industry through industry associations and incubators or through the creation of a coordinating entity, enabling international recognition and linkages, as well as conferences, meetings, and other regional events to encourage the promotion of the cluster (Boschma & Frenken, 2009; Eder, 2019; Roelandt & Hertog, 1998; Xu et al., 2022).

Interactions are needed to grow the cluster through an organized and cohesive manner, but outside ideas are also necessary for the ecosystem to continue its positive trajectory and innovation.

Education

As stated previously, access to a university can be very beneficial to a region and increases the chances of innovation and success (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019).

Human capital through education and retention of talent is an essential driving force of innovation at any stage for a cluster. For a region to thrive, having access to the right qualified workforce and ongoing training (through universities, research institutes, training, seminars, conferences, etc.) is vital. Without access to the right knowledge and skills, a cluster cannot keep renewing itself and will inevitably decline (Pinkse et al., 2018; Viederyté, 2018).

Universities and training centres are also more than simply training for the future talent pool, they are hotbeds of innovation and research, and the investments made by governments and

public institutions have positive externalities on firms such as increases in productivity, lower costs of internal training, and more (Porter, 1998).

Connected to education and the constant evolution of skills, public research is an indispensable component to the evolution of a cluster. In fact, entrepreneurs might use ideas from public research to start businesses (Porter, 1998) and the research can inform not only firms, but also policymakers in the best ways to promote regional innovation and economic development. Public research is also "relevant for the provision and training of a qualified workforce" (Brenner & Schlump, 2011) and even for collaborations.

Public research promotion or support can look like the establishment of a new research institute or of a joint industry-research centre, the support of research collaborations, financial incentives for projects, and focus on new areas of public research (Uyarra & Ramlogan, 2012).

Ease of Market Entry

The ease of market entry is an element that needs to be on an equilibrium in an industry and can be an important advantage for a country or region. Too much ease can often mean too many competitions, while not enough could lead to too much homogeneity. It is important to mention this element as regions where there are too many barriers to market entry can dissuade local or international firms from establishing themselves in a region (Brenner & Schlump, 2011; Porter, 1990; Roelandt & Hertog, 1998). Ease of market entry also allows for a diversity of firm sizes in the ecosystem, from startups to big corporation, in turn increasing variety within the region (Baglieri et al., 2012; Pinkse et al., 2018; Suire & Vicente, 2014).

Moreover, encouraging foreign direct investment from global players can support the evolution of a cluster into a competitive, world-renowned ecosystem, increase the innovation and

potentially bring new technology to the cluster, the region, and even the country (Boschma & Gianelle, 2014; ISED, 2023; Liao & Yu, 2013). Of course, we know as per Porter (1990), that the least number of barriers also increases competition which can be positive and encourage innovation within the region.

Infrastructure and Local Conditions

Another good example of nonfinancial incentives is infrastructure and local conditions which are an essential component to regional success. Regional access via airports, roads, rail, highways, public transport, etc. is critical to cluster emergence and expansion. The lack of easy access to a region can isolate its firms and cluster and might lack attractiveness for the skilled workforce it needs and for international firms that might consider investment in the region (ITF, 2018; Porter, 1998). Interestingly however, while these elements are important in the early phases of a cluster, governments usually only make large investments once a cluster is mature and successful, potentially at the expense of the successful development of newer, smaller clusters (Menzel & Fornahl, 2007).

The local conditions found in a region are critical for its own economic development and for clusters to emerge and flourish. Infrastructure and local conditions also need a certain amount of upkeep as the region changes and evolves and as technology and infrastructure needs shift globally (ITF, 2018; Menzel & Fornahl, 2007; Porter, 1998).

According to the International Transport Forum (ITF) report on Connectivity and City Clusters (2018) states that “certain transport investments – especially in gateways such as ports and airports can influence urban specialisation and thus help leverage economic growth indirectly.”

Which, as has been stated previously could impact more peripheral regions and influence their economic activity into a more specialized area (Caragliu et al., 2016; Eder, 2019).

Additionally, the same report also discusses the influence of connectivity on the economic development of cities. While it is true that being close to firms is important to the labour force, it is even more important for firms to have access to a large and diverse talent pool.

With this in mind, the report (ITF, 2018) clearly states and discusses the following:

> [T]hese externalities result from greater proximate accessibility, contiguity in urban networks and communities, permeable urban zones that improve interaction effects, a focus on zones of impact. Investment in inter-city transport, a reduction in within-city transport times and improved access within an urban area all deliver agglomeration externalities. Productivity effects and other benefits analogous to agglomeration externalities can emerge when agglomeration are connected – when a "network of agglomerations" emerge. These externalities arise from connecting regional nodes, investments in higher speed travel and inter-city transport infrastructure. (p.28)

This means that access to connectivity via transportation networks creates positive externalities not only in terms of the literal creation of connections between different urban and more remote areas, but also gives firms located within these areas greater access to more foundational elements (talent, universities, research centres, other actors, complementary clusters, etc.) improving their potential innovation and success as well as making benefiting from other corresponding positive externalities such as productivity effects, and networking and linkages.

Nonetheless, these elements are focused on transportation infrastructure, but other types of infrastructure are also essential to innovation. For example, as stated previously, it is essential for

the region to have other types of infrastructure such as network connectivity in the form of telecommunication networks and, especially, high-speed internet (Shearmur & Doloreux, 2016). This connectivity facilitates linkages on a global scale while allowing for the cluster and its firms to be in what is considered a more remote location.

2.4 Defining and Measuring Innovation

Measuring innovation is by no means a one-size-fits-all method. Innovation can be measured in in a variety of ways, at different levels (firm-level, industry-level, country-level) and depending on the definition of innovation being used. While this gives researchers flexibility and adaptability to the specific context they are studying, it also makes defining and measuring innovation a more complex and diverse issue.

So much so that in 2006, the OECD cites Geisler (2005) to describe the challenge of establishing indicators to measure innovation: “a disparate array of indicator and measures”. They then go on to explain the flawed belief of the 1960s conviction that investment in R&D equates to commercial benefits, reflecting the evolution of what is considered innovation over the years. In fact, the OECD argues that “conventional variables” such as investment in R&D, innovation, human resources, patents, and technology balance of payments do not reflect some rudimentary and fundamental elements necessary to understanding cluster performance such as supply chain and forward market linkages, partnerships, knowledge sharing, social capital, and local sources of tacit knowledge.

The European Cluster Observatory’s 2020 report demonstrates the evolving nature of innovation and innovation metrics. The European Commission’s European Observation for Clusters and

Industrial Change published a *Methodology report for the European Panorama of Clusters and Industrial Change and European Cluster Database* that outlines a methodology for measuring cluster performance. This methodology built further upon the previous "cluster star methodology" that measured cluster strength through three variables: cluster size, specialisation, and employee productivity. This new, revised methodology adds two categories onto the previous three factors: SME performance, and innovation leaders. These two criteria have the goal of trying to capture the dynamism of cluster performance.

Moreover, with these new variables, the European Cluster Observatory also looks at the so-called "industrial modernization" of clusters that "involves the transition towards a more innovative, modern and sustainable economy. It is related to innovation, new technologies, production inputs and skills, in addition to the economic evolution as the base of competitiveness, wealth and income". From this definition, we can infer that measuring "industrial modernization" equates to measuring innovation of the cluster. According to the European Cluster Observatory, there are seven dimensions that can be used in innovation metrics: evolution towards a more innovative regional economy, new and emerging technologies, digitalisation, firm investments, entrepreneurship, internationalisation, and creativity. Then, each dimension has specific indicators that are used to calculate its performance. The composite indicator then captures the overall average performance across all selected indicators.

Hao et al. (2017) summarize several different models that innovation measurements that have been developed over the years and that researchers, firms, and industries can use to measure their levels of innovation. A good example of a model developed to try and encompass the many layers of innovation measurement at firm-level is the Diamond Model by Tidd et al. (2005) that

looks at five different dimensions of innovation: strategy, process, organization, linkage, and learning.

This multi-dimensional measurement framework incorporates internal and external factors (such as the prioritization of innovation strategy; the process of new product development; the communication of new ideas within the organization; the relationships with external stakeholders such as suppliers, customers, universities, etc.; the constant education/training of employees to name a few) to measure the innovation of companies (Hao et al., 2017).

Other examples of firm-level measurements include the Idea Management Model by Hansen and Birkinshaw (2007) that measures innovation through three phases: idea generation (creation of new ideas), idea conversion (selection and development of ideas), and idea diffusion (dissemination of ideas).

The Innovation Funnel developed by Morris (2008) that lists nine stages of innovation (strategic thinking, portfolio management and metrics, research, ideation, insight, targeting, innovation development, market development, and sales) helps companies cull and select new ideas by creating a list of metrics to measure each innovation stage.

Dulkeith & Schepurek (2012) combine different frameworks to suggest key performance indicators (KPIs) for various innovation dimensions (innovation strategy, inputs and throughputs: project and portfolio management, idea and knowledge management, culture, and organization) that are then evaluated for effectiveness of each KPI. Because their model is very layered and focused on firm-level innovation, they have also combined it with a macro-level Oslo framework (Oslo Manual, OECD 2005) to take into consideration the external influences that might come into play in a business environment (Dulkeith & Schepurek, 2012).

At industry-level, Hao et al. (2017) stress the importance of comparing innovation activities across industries using industry metrics derived from company-level metrics to emphasize industry heterogeneity and for the metrics to be pragmatic enough for the implementation of realistic operational business strategies.

Hao et al. (2017) list examples of innovation indexes such as the Service Sector Innovation Index, the National Endowment for Science Technology and the Arts (NESTA) Innovation Index, the Productive Innovation Index of the Pharmaceutical Industry, and the Elastic Innovation Index of the Financial Services and propose a new framework "The Conference Board Framework for measuring innovation activities" inspired by and summarizing the existing innovation metrics in their paper. It is important to remember that while more traditional innovation categories such as product innovation, process innovation, marketing innovation, and organizational innovation, often omit forms of innovations such as open innovation that does not necessarily fit neatly into any of these categories (Hao et al., 2017).

The two following tables are a brief summary of the signposts of innovation at firm- and industry-level developed by Hao et al. (2017) that include examples of innovation metrics at different stages:

Signpost	Input	Throughput	Output
Technology	R&D	Patents	Receipts of license fees
Digitization	ICT spending	ICT access index	ICT and business model creation
Environmental & Social Sustainability	Investment in operational sustainability	Number of ISO 14001 environmental certificates	Environmental Performance Index
Customer Experience & Branding	Spending on advertising	Relationship duration	Customer satisfaction
Internal Innovation Networks (leadership & organization, processes & tools, people & skills, and culture & values)	Spending on innovation projects	Number of new ideas created internally	Number of new products developed from new ideas
External Innovation Ecosystems	Venture capital access (links with government, research & education and access to finance)	University/industry collaboration	innovators (% of SMEs)
Profit and Revenues	Innovation budget	potential of entire new product/service portfolio to meet growth targets	% of sales revenues from new products/services

Table 1. Signposts vs. Input-Throughput-Output (examples) from Hao et al. (2017)

	Input	Throughput	Output
Macro	R&D; ICT spending; Venture capital access;	Patents; University/industry collaboration	High-technology exports
Company	Investment in operational sustainability; Spending on innovation projects	Relationship duration; Number of innovation projects	Revenues from new products; Customer satisfaction

Table 2. Input-Output-Throughput vs. Macro/Company (examples) from Hao et al. (2017)

While these tables are a great synopsis of examples of innovation and innovation metrics, they do not include all potential forms of innovations and there is a need for flexibility in the structure when selecting variables. There might be unknowns and ever-evolving types of innovations that are unaccounted for that require adjustments and modifications to the evolving nature of innovation (Hao et al., 2017).

Overall, these overarching elements show the complex and varied ways that clusters and regions can grow and innovate. While there has been a tremendous amount of research on clusters, especially in more recent years, the research has not been as focused on smaller regional ecosystems and satellite regions as much. The push and pull of having a larger metropolis close by can both help and hinder a satellite region and creates a unique environment for the cluster.

In addition, the start of the COVID-19 global pandemic in 2020 has brought on new challenges for regions and clusters and, in turn, created an unprecedented situation for firms in regional ecosystems all the while enabling us to observe the repercussions on their networks, knowledge, and innovation. The pandemic has also created an interesting pragmatic situation that helps us better understand how clusters manage crisis situations and how resilient they are when faced with less-than-ideal conditions that threaten their growth and evolution.

This study will attempt to add to the literature focusing on clusters in satellite cities while also observing clusters during a global event that impacted almost every aspect of business.

Chapter 3

Conceptual Model and Propositions

Following the review of the literature in the previous chapter (Chapter 2) and when gaining a greater understanding of the literature surrounding satellite cities, clusters, and innovation, we can come up with a conceptual model and propositions to try and answer our main question: *How can clusters in satellite cities remain innovative?*

3.1 Conceptual Model

A conceptual model (Figure 1) was developed with the help of the literature review to visualize the many factors at play when discussing innovation and, in our case, more specifically cluster innovation in satellite cities. This conceptual model provided guidance for the analysis and discussion of this investigation.

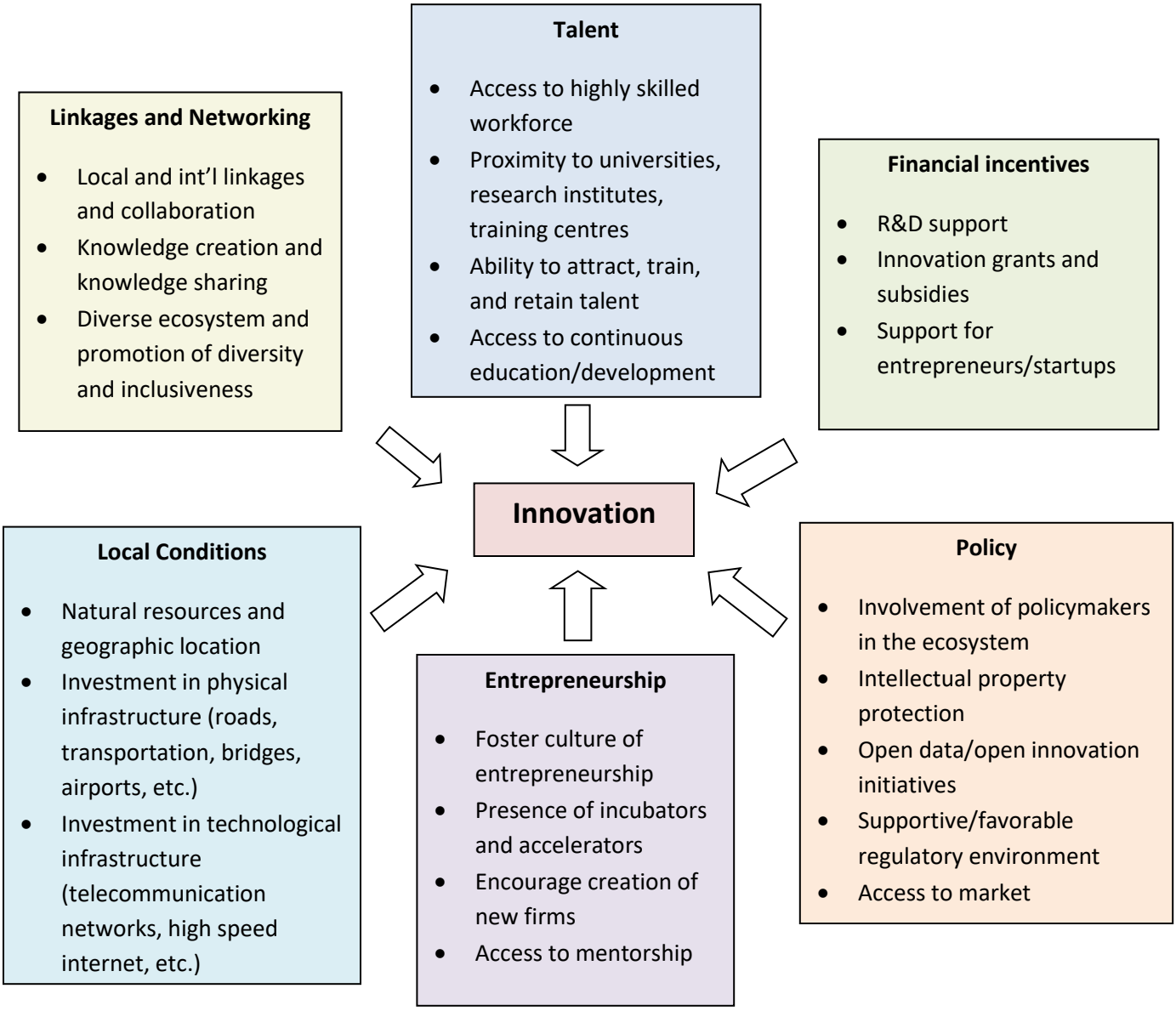

Figure 1. Conceptual Model

3.2 Propositions

Based on the literature review in Chapter 2 and taking into consideration the fact that we are trying to answer a layered research question that involves a cluster in a specific circumstance, in this case, in a satellite city, and the literature has not determined the exact formula for the successful emergence and development of regional ecosystems, we can only try to grasp the needs of clusters for them to not only be innovative, but also successful in a peripheral region. Since the first theories published by Marshall (1920) and Porter (1990), the interest and research geared towards the influences of outside forces on clusters have been varied and plentiful if not unanimous.

This brings us to our first proposition based on the literature review which encompasses the main element that researchers do agree on for clusters to thrive: an ecosystem. Important elements such as homogeneous and heterogenous private firms, local and international linkages (Al-Laham & Souitaris, 2008; Boschma, 2014; Brenner & Schlump, 2011; Coombs et al., 2006; Liao & Yu, 2013; Nooteboom, 2000; Turkina & Van Assche, 2018), universities for research and talent (Brenner & Schlump, 2011; Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019; Pinkse et al., 2018; Porter, 1998; Viederyté, 2018), natural resources, regional development and accessibility (ITF, 2018; Menzel & Fornahl, 2007; Porter, 1998; Shearmur & Doloreux, 2016), a public sector and more are not guarantees of success but are essential for healthy cluster dynamics to evolve, whether in a dense urban area or a satellite city (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019).

Proposition 1: Based on the literature review, we can assume that access to a rich ecosystem is necessary for cluster growth in a satellite city.

When presented with these elements we can also speculate not only on the need for linkages, but also on their role within a cluster in the periphery of a metropolis. The linkages that clusters form are often first and foremost because of the geographical proximity of the firms (Audretsch and Feldman, 1996), then have the potential of growing into networks that are local and potentially international, knowledge sharing or knowledge creation, innovation, and more.

These linkages become part of the cluster's identity and the experience of one firm could technically inform that of another and create a sort of barrier to outside forces that might impact the cluster and firms within it (Al-Laham & Souitaris, 2008; Coombs et al., 2006; Liao & Yu, 2013; Turkina et al., 2019; Turkina & Van Assche, 2018).

We know that knowledge sharing, and knowledge creation often lead to innovation within a cluster (Noteboom, 2000), but we also know that outside forces might impact the resources that clusters have access to. This can benefit firms in a cluster to counteract the potential negative impacts of outside forces and enrich the cluster's ecosystem (Turkina et al., 2019), especially if it lacks the natural connectivity locally (Boschma and Gianelle, 2014; Eder, 2019).

At firm level, a startup and a multinational might benefit from an R&D relationship and counteract increasing aggressive international competition through renewed innovation. In the same way, a cluster can leverage its internal networks in order to maintain stability and growth (Al-Laham & Souitaris, 2008; Coombs et al., 2006; Liao & Yu, 2013). Hence, because linkages are such a vital element of clusters, we can suggest that they might have a positive impact on the resilience of clusters in satellite cities.

Proposition 2: Based on the literature review, we can assume that linkages are an essential part of clusters in satellite cities and make them more resilient to outside forces.

In fact, the critical influence of linkages is demonstrated in the global interconnectedness of clusters. Many clusters rely on international linkages for renewal and depend on those global connections to reinforce their knowledge creation and innovation (Liao & Yu, 2013; Turkina et al., 2019; Turkina & Van Assche, 2018).

Moreover, global connections can positively impact firms in more remote clusters that do not have ease of access to more local linkages because of physical proximity (Eder, 2019; Shearmur & Doloreux, 2016). However, the economy a cluster finds itself in can likewise lend a more strategic nature to the interconnections created internationally and different types of knowledge transfer between firms.

Proposition 3: Based on the literature review, we can assume that international linkages enable more strategic alliances and innovation for clusters in satellite cities.

Individual experiences can be shared by firms in a cluster and can be a positive expansion of cluster knowledge. The influences of international linkages can be felt through the cluster and can invite the crucial complementary strengths needed for innovation (Liao & Yu, 2013; Turkina et al., 2019; Turkina & Van Assche, 2018). These linkages can support the dynamism of a cluster, and this can especially be true in the case of a peripheral region where linkages and lived

experiences can be even more impactful to the shared learning experience of the cluster (Eder, 2019; Shearmur & Doloreux, 2016).

Proposition 4: Based on the literature review, we can assume that international linkages benefit the entire cluster in a satellite city.

The need for local and/or international linkages demonstrates the need for nonfinancial factors to be present for clusters to be successful, and this is especially true for clusters in a satellite city. However, a variety of elements are needed for a cluster to thrive and be successful.

Of course, a cluster having financial incentives enables it to grow without the burden or constant need to generate funding, but a cluster cannot thrive on financial capital alone (Brenner and Schlump, 2011). Components such as networks and collaboration, trust between the private and public sectors (Ketels & Protsiv, 2013; Kukalis, 2010), the presence of related industries (Boschma & Wenting, 2007), a diverse ecosystem (Menzel & Fornahl, 2009; Pinkse et al., 2018; Tichy, 2001), universities and public research (Boschma & Wenting, 2007; Uyarra & Ramlogan, 2012), a qualified workforce with an inflow of talent and ongoing training (Brenner & Schlump, 2011; Pinkse et al., 2018; Porter, 1998; Viederyté, 2018), government policies enabling growth and support for entrepreneurship, R&D and innovation (Baglieri et al., 2012; Koshcheev et al., 2021; Pinkse et al., 2018; Suire & Vicente, 2014), infrastructure and local conditions (Brenner and Schlump, 2011; Porter, 1990), and more are essential for a dynamic cluster to emerge and evolve.

Proposition 5: Based on the literature review, we can assume that both financial and nonfinancial supports need to be present to encourage successful regional innovation and cluster growth in a satellite city.

The situation each cluster finds itself and the conditions and challenges that it may face are distinctive and complex and need to be assessed on a case-by-case basis (Boschma & Gianelle, 2014; Eder, 2019; Seyfang & Smith, 2007). It is not enough to simply try to recreate the success of another cluster as policies made for a newer thriving ecosystem would not be appropriate for a mature cluster in decline. This is very true for clusters in satellite cities as their situation is impacted, either positively or negatively, by their location.

In fact, policy that works for one cluster could have completely different results in another because of clusters' unique situations. Understanding the inside and outside forces impacting the region, the ecosystems within the region and their linkages all amount to a specific set of circumstances that needs to be addressed individually (Eder, 2019).

Proposition 6: Based on the literature review, we can assume that policymakers need to adapt cluster policy to the individual cluster, especially in the case of satellite cities.

Chapter 4

Methodology

4.1 Research Design

This chapter outlines the type of research methodology that was used to gather and analyze the data to answer our research question and to help us better understand the situation with innovation in the Laval manufacturing cluster. As a means to clearly measure the impact of different factors, such as financial and non-financial incentives, networks, and innovation on the dynamism of the ecosystem and the innovation of the firms within the region of Laval, we used a mixed method of qualitative and quantitative approaches.

4.1.1 Mixed Methods Research

A mixed methods research integrates both qualitative and quantitative data collection and analysis and uses these methods in an "integrated or synergistic" way with each method often influencing the other (Hesse-Biber, 2010; Hesse-Biber & Leavy, 2011; Leavy, 2017).

With the quantitative research method, we were able to measure variables, test relationships, uncover patterns, correlations, or causal relationships (Leavy, 2017) through a large amount of data collected. With the qualitative research method, we are then able to dig deeper into the experiences of local firms in the cluster to gain a "depth of understanding" and "explore, describe, or explain" the needs of firms in the region for the cluster to innovate and grow (Leavy, 2014 as cited by Leavy, 2017).

According to Leavy (2017), using both methods within this research design results in a more "comprehensive understanding of the phenomenon under investigation because of the integration of quantitative and qualitative data".

Utilizing these two systems enabled us to get a clearer picture of occurrences in the region while also going into more depth to better understand the factors, actors, and primary elements at play directly from the companies' perspective.

By examining the samples acquired through both methods, we were able to appreciate the dynamic at several different levels: the political sphere, the regional sphere, and at the firm level.

4.1.1.1 Laval économique

This investigation started in collaboration with the City of Laval (through their economic development agency: Laval économique): they were able to provide us with two lists of companies located in Laval tand part of the city's manufacturing cluster for each method. It is to be noted that the manufacturing sector, by essence, is a diverse sector made up of other major industries (for example, aerospace, life sciences, etc.) The first list provided included a compilation of 608 firms in the manufacturing sector in the region for the quantitative section of the research mandate, while the second was a more focused list of 31 companies in the region deemed innovative by our contact in Laval either through signals (internet research, newspaper articles, etc.) or through contact from city employees with the companies over time, for the qualitative section of the research mandate.

This collaboration with Laval économique was a wonderful situation to better understand satellite cities and Laval was a great testing ground to answer our main question. As Laval is a satellite city located just outside a major centre, Montreal, it is in the interesting geographical

location of being close enough to a metropolis to be both positively and negatively impacted by these circumstances. Laval has to compete with Montreal when it comes to attracting firms and talent but boasts lower urban density which is especially important for firms in the manufacturing sector, the cluster we studied.

Additionally, Laval is especially proactive when it comes to both economic development and their desire to become a business hub, facilitating our approach. According to their website (Laval économique, 2023), Laval économique's role is:

> Our commitment is to spur Laval's economic growth and thereby heighten its influence as a major player in Quebec's economy.
>
> Our involvement in Laval's wealth of value chains culminates in the creation of quality jobs. In addition, it is important that we encourage the productivity of our businesses and stimulate local entrepreneurship.
>
> Laval has a clear ambition for its economic development: To become a hub for business opportunities and a place of experimentation.
>
> In order to build tomorrow's Laval, we're putting forward a new economic development approach based on solutions. It is paramount that we work in collaboration with our networks and partners so that we can act as experts in the field.

Additionally, they have 3 main divisions to achieve these goals: business services, international affairs and investment, and business planning and intelligence (Laval économique, 2023).

Hence, Laval offers strategic advisory services to firms located in the region such as (Laval économique, 2023):

- Financing and tax credit programs
- Startups and entrepreneurship
- Innovation
- Growth and exporting
- Human capital: International talent attraction and training
- Sector portraits

These services are aligned with Laval économique's desire to "[t]o become a hub for business opportunities and a place of experimentation" and to "encourage the productivity of our businesses and stimulate local entrepreneurship" (Laval économique, 2023) and explains their need to comprehend the drives to innovation for firms in the region.

4.1.1.2 Quantitative Research

Given the nature of the research and the subjects discussed (such as innovation, intellectual property, etc.), a quantitative section was an appropriate method to use to measure the extent of innovation happening in the region as relying solely on a qualitative research method would not have enabled us to measure and test variables in the same way (Leavy, 2017).

In collaboration with Laval économique, we created a survey questionnaire that encompassed a variety of questions on R&D and innovation, on local and international partnerships, on investments, on financial aid, and more (Interview guide, Appendix I). These questions were partially inspired by the 2018 EU Survey on Industrial R&D Investment Trends (Potters & Grassano, 2018) as well as the 2017 Canadian Survey on Financing and Growth of Small and Medium Enterprises (ISED, 2017).

We came up with a series of 27 questions, most of them multiple choice, to give us a better understanding of the demographics of the region, the innovation happening in said region, and the needs of the companies for future innovation.

Using a survey enabled us to gather a large enough amount of data from a wide-ranging number of companies to infer statistical correlations and relationships to determine the key drivers of innovation in the region (Leavy, 2017).

The questions were sent via email (through SurveyMonkey) to a list of 608 Laval companies that was provided to us by Laval économique. The survey was first sent to all companies in the list via email, then, in hopes to increase the response rate, we called the firms on the list to inform them of the survey. Of the 608 firms that the survey was sent to, 84 companies participated, giving us a response rate of approximately 14%, and hence a good, representative sample of the population. Companies were also contacted directly via telephone in hopes of increasing the number of participants to the study. However, partially because factors out of our control such as the COVID-19 pandemic, it was hard to reach companies directly as many administrative employees were working from home at the time.

In addition, to ensure the highest level of response and to keep the data unbiased, all responses to the survey were anonymous and complied with HEC Montreal's Research Ethics Board.

While innovation is a highly studied subject, the definition of innovation itself and the propensity of firms to be able to quantify this innovation is very ambiguous. Hence, using a quantitative method of measurement enabled us to better understand the context as well as the "amount" of innovation generated by companies in the region by creating a barometer of innovation.

Additionally, the survey intended to determine both internal and external factors at play in the region leading to the innovation of firms.

As detailed in Chapter 2, measuring innovation can be challenging as there is a variety of ways innovation can be observed (Hao et al., 2017) and innovation in satellite cities can vary greatly to the more common forms of innovation in metropolises (Eder, 2019; Shearmur & Doloreux, 2016). Taking this into consideration, in terms of internal factors, we looked at the R&D of the firms by verifying the types of intellectual property the company might have engaged in (as of October 2020), making sure to include a wide range of choices knowing that innovation in satellite cities can be different to the more common commonly studied intellectual property (patents):

- Trade secrets
- Non-disclosure agreements
- Registered trademarks
- Patents
- Registered industrial designs

In terms of external factors, we looked at the following:

- Buyers of products and services
- Suppliers of equipment, materials, components, or software
- Strategic alliances (joint venture partners, consulting firms, market competitors, etc.)
- Universities and R&D centers
- Government

Companies that participated also provided us with the geographical location of their partners whether they were local partners, Canadian partners, or from other international regions such as USA and Mexico, Europe, Asia, or other regions.

In Chapter 5, we put forward Figures 2 to 5, using descriptive statistics to showcase innovation and collaboration in the region:

- Figure 2 clearly shows innovation through the R&D activities of the surveyed firms in the Laval agglomeration.
- Figure 3 visually demonstrates the number of innovations per company surveyed in the Laval region.
- Figure 4 displays the internal factors that are linked to innovation of the firms surveyed.
- Figure 5 demonstrates the collaborations and linkages formed by the firms in Laval cluster.

From this information, we were then able to conduct a regression to understand the factors that influence different types of innovation of the firms surveyed depending on the type of collaboration in place, with Table 3 presenting the results of the analysis.

4.1.1.3 Qualitative Research

To dive deeper into the subject and to get a firsthand account directly from the firms in the cluster, within a region, we conducted one-on-one interviews with companies willing to discuss with us and willing to share their thoughts and opinions on the influence and the direct impact of the political context in the region on their business.

We chose to conduct one-on-one interviews with select firms for them to get the chance to detail and contextualize their experience in Laval's regional ecosystem (Leavy, 2017). As per Yin (2016), qualitative research is "to understand how people cope in their real-world settings" and the use of both quantitative and qualitative data collection methods to "provide a more complete picture" gives us a better grasp of the situation.

Taking the time to perform an in-depth interview, lasting approximately 30 minutes, helped us scrutinize in more complexity the needs of firms when it comes to innovation, growth, and development and expanded the information collected during the survey. Once again, participants are kept completely anonymous and we followed HEC Montreal's Research Ethics Board's parameters to ensure the best, most unbiased data collection.

However, given the COVID-19 pandemic restrictions at the time of data collection, all interviews were conducted safely via videoconferencing through Microsoft Teams or by telephone. This interestingly added another layer to the qualitative research process as the pandemic influenced greatly all aspect of the interviewee's lives and work and, hence, the contextual conditions of the interview (Yin, 2016). According to Yin (2016), "qualitative research explicitly embraces the contextual conditions – that is, the social, institutional, cultural, and environmental conditions – within which people's lives take place" and this data collection through interviews, at the time that they occurred (Autumn 2020) gave us a glimpse of a very specific moment in time, but also a fascinating time for innovation.

Conducting interviews directly with firms not only allowed us to gain direct feedback from them, but also helped us gauge their reactions to the current access to incentives in their region, their

perceptions on what would support growth and innovation for their own business and the region, as well as hear their thoughts on their region's positioning and their cluster's quality.

Taking into consideration the fact that this data gathering was done in conjunction with the City of Laval's economic development department, the method used to approach companies was fairly simple. As the region knows its cluster the best, we were able to gain access to a list of 31 companies deemed innovative by its employees through signals or interactions.

Once this list was given to us, an email was sent to each potential participant detailing the goal of the study, the framework of the interview, and the potential impact of their participation for the study and their region.

Of the 31 companies approached, 10 responded positively to the request for participation while another 5 firms responded negatively due to lack of time or unwillingness to discuss what they deemed to be a "sensitive subject" with an outsider. Other firms did not respond to the request for an interview.

Interview questions were selected, and the interview was structured in order to gain the most knowledge from a variety of angles to assess firms' innovation and operations in the political context of their region as well as the efficacity of current and potential policy or other support, incentives, or aids to the business ecosystem and the region as a whole (Interview guide, Appendix II).

4.2 Triangulation

In order to decrease biases and assumptions and to increase the reliability of results for the study, we used a mixed methods research method that includes both a quantitative and a qualitative component (Leavy 2017; Yin, 2016). As this study uses a mixed methods research methodology, the triangulation is a methodological triangulation of the data (Yin, 2016). Since two sets of data were acquired through data collection, quantitative data, through a survey questionnaire, and qualitative data, through interviews, we are able to get a more complete and realistic sense of the situation and more reliable analysis and conclusions (Leavy 2017; Yin, 2016). Furthermore, gathering data from several sources "helps build confidence in the findings" (Leavy, 2017). Hence, using several data collection methods as a tool for methodological triangulation supports the development of more credible and rigorous results and a reduction of biases in the research (Leavy, 2017; Yin, 2016).

Chapter 5

Results and Analysis

This chapter is devoted to better understanding the results from the data we gathered during both the survey and the interviews with the Laval manufacturing cluster. Observing both quantitative and qualitative results together will enable a more comprehensive overview of the situation at firm- and cluster-level.

When looking at the results of the study, we can first visualize the extent of innovation happening in the region and surmise how innovative the firms, the cluster and, subsequently, the region are at the moment. The results of the survey clearly indicate the types of innovation happening within the organizations and speak of the processes at firm-level that push innovation forward.

Firstly, it is interesting to note the openness and availability of Laval companies to participate in our study. They were not only very responsive, but also very open and willing to answer our questions whether via our survey or through interviews.

This openness allowed us to have fruitful discussions with them, which demonstrated a clear desire on the part of these businesses to be an integral part of improvements and change in their region. Businesses seemed to want to see more promotional activities to showcase Laval and put the region “on the map”, so to speak. This desire and openness for growth and innovation for the region was mentioned over and over by the firms interviewed and showcased a clear desire from these individuals to be part of the solution for the growth of the manufacturing cluster in the region.

One company said:

> "There is everything we need in Laval! We have a good positioning, a good location, but people need to know the region better. We need to provide the right infrastructure and the right projects to attract more businesses and young families to continue to grow and evolve."

Businesses are therefore proud of their region and want to see it innovate and evolve, but more importantly, they want to be part of that evolution and provide concrete solutions that can make it shine.

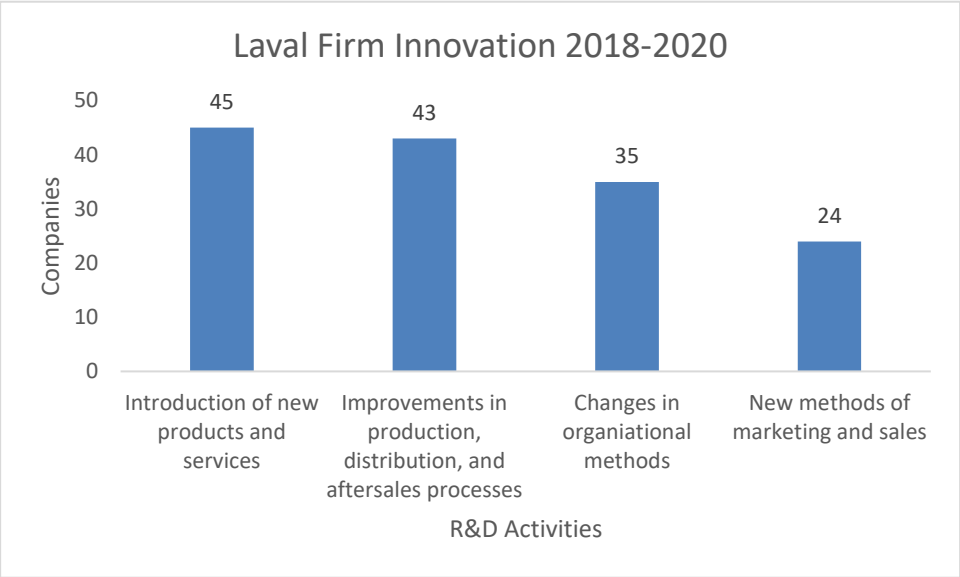

Figure 2. Laval Firm Innovation through R&D Activities

From Figure 2, we can see that the firms surveyed can be characterised as significantly innovative. Figure 2 indicates the number of companies dabbling in the different sections of what can be considered as types of innovation. When looking at the results, we noticed that almost

half of the companies surveyed (49%) were involved in at least two different types of innovation and that 80% of the companies had noted at least one innovation type between 2018 and 2020.

More specifically, for 45 firms, innovations were in the introduction of new products or services (the most popular type of innovation here), 43 firms saw innovations in the improvement of production process, distribution method and service support, 35 firms focused on innovation in organizational methods (IT system upgrade, HR management restructure, business model change, forming a new partnership), 24 firms looked at innovating in marketing and sales, and 16 companies surveyed did not mark any innovations (this amounts to 19% of the population).

As well, 12 of the firms surveyed engaged in all the 4 types of innovation (this amounts to 14% of the population), while 41 firms engaged in at least two types of innovation (this amounts to 49% of the population). Therefore, the companies surveyed in the cluster demonstrated a diverse number of innovations in the region.

When looking at these results, we can also see that firms are very much engaged on product and service innovations and improvements in production, distribution, and aftersales processes. These are very tangible and often technological improvements that companies in the area are focusing on. Organizational methods and marketing and sales methods rely on less tangible activities, more abstract processes, as well as less outside recognition which could explain that firms tend to focus slightly less on these elements of innovation in a manufacturing cluster such as Laval's.

Interestingly, when discussing innovation during the interviews with companies, this was also the main types of innovation brought up. However, for 70% companies, there was either a plan

of gradual innovation including organizational or marketing and sales innovation, or a linked process of upgrades in these departments in parallel with other innovations.

Organizational methods and marketing and sales also seemed to be types of innovation that some firms were not sure were considered innovations during interviews. Some of the firms interviewed mentioned these types in passing or as a question as they were not sure that these would be included as innovations.

All companies interviewed were working on several innovative projects at the same time. The Laval companies all mentioned the strong culture of innovation that exists internally. While an important driver of their innovation is the desire to remain competitive, all companies cited an intrinsic internal value of innovation and improvement that forces them to stay on top of global trends and technologies.

Indeed, all the companies interviewed are in a constant process of research, upgrading and improvement in their innovation process. The companies were very clear on the need to stay on the lookout for innovation as well as the necessary will and the indispensable internal culture of innovation. This intrinsic internal value of innovation by companies allows them to remain competitive at the global level.

Additionally, while the firms interviewed often had innovation at their core, the need for innovation was also often interconnected to the need to find solutions to a lack of qualified workforce.

One firm interviewed explained their dilemma related to the difficulty of finding skilled personnel and the need for innovation:

> "We've had massive growth, especially with sales outside of Canada. We're innovating our products and processes. We're currently moving to manufacturing 4.0 and we're automating and robotizing our manufacturing plant simultaneously. Though it doesn't solve all our problems; we still need operators who know what they're doing. It's a bit of a challenge though because we're stuck in a bit of a cycle. We need more qualified employees, it's been an issue for us since before the pandemic, so we've been trying to make up for that with automation and robotizing, but because we need people our development is slowed. Our main priority is expanding our production capacity and our workforce."

All companies interviewed were facing challenges in recruitment, but all of them were also still working actively to innovate and, sometimes, even to find ways around the labour shortage they are experiencing.

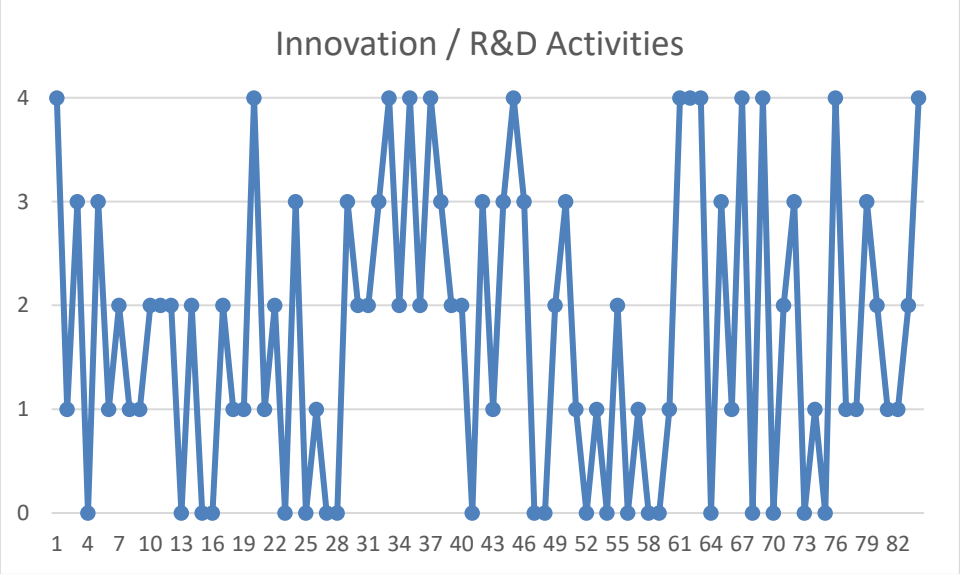

Figure 3. Number of Innovations per Company

The tendencies towards innovation can be observed more fully by looking at Figure 3 which notes the number of innovation types for each participating company. This Figure enables us to

better visualize the number of innovation types per company, but also for the entire sample. We can clearly observe the high number of companies with more than one type of innovation.

This was also confirmed during the qualitative interview process: as mentioned previously, all companies were working on a number of innovative projects at the same time; a strong driver for this innovation was the desire to remain competitive and an intrinsic internal value of innovation and improvement that forces them to stay on top of global trends and technologies.

> "We have a lot of projects in place right now! We've really wanted to initiate change since 2018. It started with a digital transformation and now we're working on a mega project to enhance the value of the data we collect: we want to better understand the data and make sure we train all of our employees to be able to understand what's going on whether it's in the plant, but also in finance or in marketing. We want to make sure we build collaborative tools that allow us to implement efficient and productive business processes, but also to keep pace with international technological advances."

Hence, analyzing Figures 2 and 3, and acknowledging that all firms stated innovations in their activities during interviews, we can deduce from these results that the Laval region and its manufacturing cluster are indeed innovative.

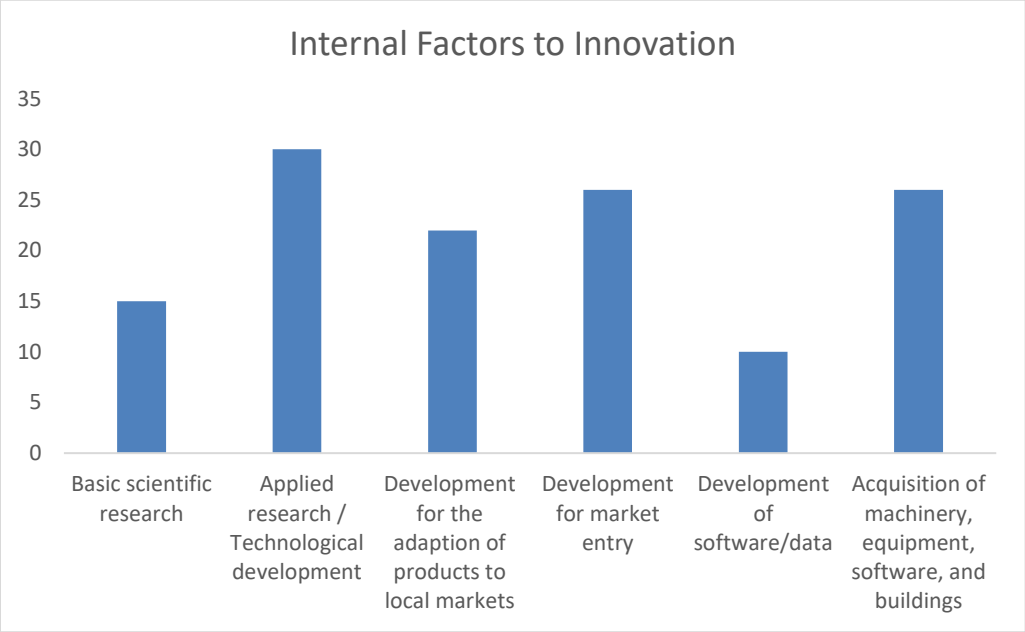

Figure 4. Internal Factors of Innovation

Simultaneously, Figure 4 shows us the internal factors linked to the innovation of the firms surveyed. For most firms, their main activities are "real world" elements such as applied research / technology development or the acquisition of new machinery, equipment, software, or building that pushes their innovation forward.

Interestingly, when asked about the type of IP preferred by the firms in the cluster, registered trademarks were the most popular answer with 22 firms opting for the option, closely followed by patents and disclosure agreements (both at 20 firms), trade secrets (17 firms), and, lastly, registered industrial designs (8 firms). Remarkably, 23 firms also stated that they have more than

two different types of IP, demonstrating how active the companies in the cluster are when it comes to production.

Furthermore, we can note a tendency towards a need for development for market entry and adaption of products to local markets. We can conclude from these results that for a number of firms, innovation is linked to international business development which, in turn, drives innovation.

When conducting interviews, companies confirmed this by also going further and detailing interesting elements behind their push for innovation. While some are driven by their design or engineering teams (or other departments) to be creative and set the tone for the whole enterprise, for others, it is an essential evolution to solve the issues they face; a way to rise above the challenges they encounter. These vary greatly from company to company, but the desire to stay on top, the need to keep up with their competitors, labor shortages, and even requests from their customers were the most common answers.

Companies were also proud to mention that there is a strong culture of innovation in Canada, in Quebec and, more specifically, in the Laval cluster of companies, which encourages the continuous updating and evolution of their innovation.

External factors were often, of course, at play, companies repeatedly cited the need to stay on par with global competitors, following worldwide trends (including fluctuations in supply and demand) and advances in technology, and pressures such as government regulations, supply chain issues, and requirements from suppliers and buyers.

The COVID-19 pandemic was especially complicated for some, creating phenomenal increases in demand, but also problems in supply chain procurement. All these internal and external pressures forced companies to innovate in order to stay competitive.

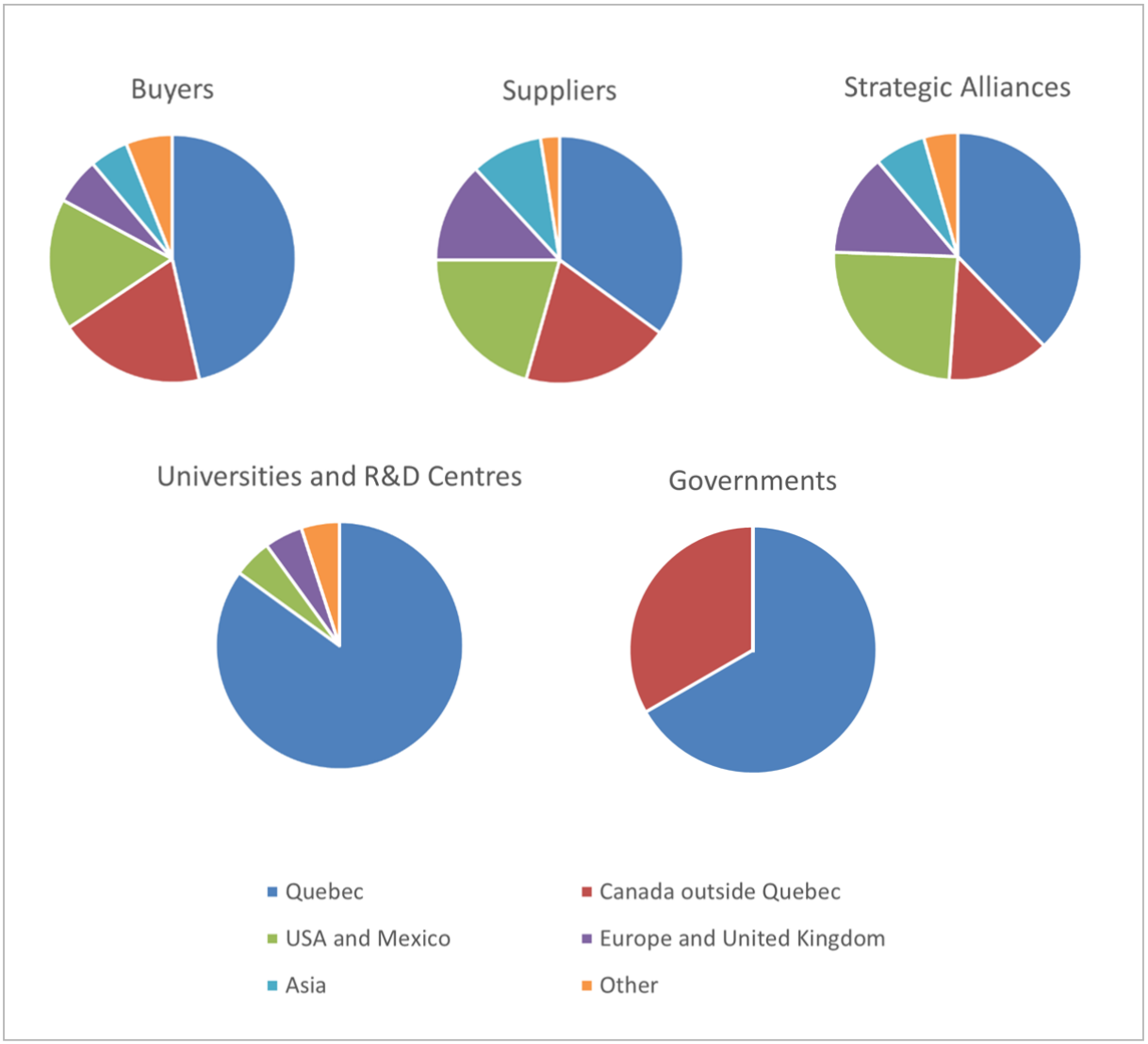

Figure 5. Collaborations and Linkages of the Laval Manufacturing Cluster

Figure 5 shows us very clearly that the firms in the Laval manufacturing cluster are well connected both locally, in Quebec, but also outside of the province: in the rest of Canada, and

internationally. While most partnerships are local to the province of Quebec, more than half of partnerships with buyers, suppliers, and strategic allies are, in reality, out of the province. On the other hand, the vast majority of partnerships with universities and R&D centres are concentrated in Quebec, with a small portion in the USA and Mexico, Europe, and other regions.

For governments, partnerships are exclusively with Canadian and Quebec governments, which means that companies have not sought out alliances or support from governments outside of Canada when working internationally.

However, while the firms responding to the survey were only able to give us a glimpse into their business partnerships, during interviews, companies were very much interested in letting us know how essential, needed, and desired partnerships are. This confirmed the essential role of linkages at both firm- and cluster-level and provided support for proposition 3.

Moreover, networking and partnerships were recurring elements mentioned in terms of assistance to which they would like to have greater access to. Many mentioned the desire to create partnerships and exchanges with other business leaders or complementary firms. There is a desire to build relationships and determine if there are issues that can be alleviated through this type of exchange or by creating partnerships through synergies with other firms.

However, only one of the businesses interviewed that mentioned increased networking and partnering as a desired outcome had sought out networking opportunities, more specifically in the form of a networking group where this person had the opportunity to build relationships, share, and create partnerships with participants.

This networking group was not a Laval-specific networking group. On the one hand, this is positive; it enables the creation of linkages and knowledge sharing outside the confines of the

satellite city, giving the opportunity for more diverse knowledge exchanges. On the other hand, a Laval-specific networking group would allow dialogue on resolving challenges specific to firms located in the satellite region that firms in a more urban metropolitan area might not be faced with. This interviewee praised the benefits and stated the necessity for these connections and linkages as a method of expanding networks and connections in the region, he mentioned:

> "I am part of a great group of business leaders, and not only does it help me a great deal, but it also drives R&D and innovation in the company. To be able to attend webinars, trainings, etc. and to be able to share with other companies is very necessary. It's mutual support, but it also allows for cross-fertilization. I would like to see something like that in Laval: an official industrial cluster. There isn't really a formal one in Laval, but it would be nice to have a local sounding board. It would open doors for us and allow us to create links between companies, but also to create bridges with university R&D centers, which is something we'd like to do, but are finding more difficult than expected."

Another pointed out a desire to see greater focus on regional development and innovation:

> "I would like to see better support: a real vision for Laval. We shouldn't just look at the whole of Canada, not even just Quebec, the vision should include the region of Laval too! I would like to see more from the region... there would assuredly be economic spin-offs. The region needs to look at what works well outside, in other regions, even in other industries and find a way to do something similar here. That's how the region will be competitive and encourage businesses to move here and people to move here. We need to propel the region's economy that way."

	Product or Service Innovation	Process Innovation	Organizational Innovation	Marketing Innovation
Collaborations with Buyers	**0.28***	0.15	0.04	**0.30****
Collaborations with Suppliers	0.15	**0.40*****	**0.19***	**0.29****
Collaborations in Strategic Alliances	**0.33***	0.01	0.22	0.24
Collaborations with Universities and Research Centres	0.03	-0.01	**0.36***	-0.09
Collaborations with Government	-0.07	0.17	-0.09	-0.11
Internal R&D	0.18	0.09	-0.06	-0.10
Acquisition of Machinery and Equipment	0.02	0.08	**0.23****	-0.08

***** Significant at a level of 1%, ** at a level of 5%, * at a level of 10%.**

Table 3. Type of Innovation v. Type of Collaboration

In fact, Table 3 shows us just how valuable collaborations are and describes the different types of innovation according to the different levels of collaboration, showing us a clear link between these alliances and the resulting innovation.

Various types of collaboration seem to influence the different types of innovation, an interesting observation that sheds a bit of light on the ways business innovation sometimes comes about. Therefore, we can see when analyzing the table that collaborations with buyers will tend to yield

product or service innovation as well as marketing innovation, while organizational innovation is more fluid and can stem from collaborations with suppliers, with universities and research centres, or through the acquisition of new machinery and equipment.

These observations are in line with the realms that the business collaborators are in and can indicate which types of partnerships can be put forward with the aim of promoting certain types of innovation. Given these findings, policymakers could support different types of collaborations in order to foster innovation.

In fact, interviews also confirmed the role of these relationships not only in innovation, but in the evolution of firms and, in turn, of the cluster. Firm interviews also named international factors such as global competitors, international buyers, suppliers, and clients, or even global industry trends as a push towards innovation and sometimes even as a push towards the creation of strategic alliances for the purpose of staying competitive in the market or the industry.

These international links have been a push towards a dynamic continuum of innovation and modernisation at firm-level, which, in turn, retains the cluster's life cycle towards a phase of renewal. Therefore, these observations provided support for propositions 2 and 4.

Another interesting result from the survey was the clear need for a skilled workforce. When asked about the main challenges faced by the companies pre-COVID and since the start of the COVID-19 pandemic, 58% of the companies responded that human resources were one of their top three challenges pre-pandemic and 49% responded that human resources were one of their top three challenges since the COVID-19 pandemic.

Additionally, when asked about their top priorities for the future, attracting new talent and improving the HR structure were the most popular answers.

To validate this further, all the companies interviewed during the qualitative data collection stage mentioned the shortage of labor as one of the biggest challenges they face in their development. While for some, the global pandemic caused by COVID-19 slowed their activities and thus provided a short respite from their pressing labor needs, for the vast majority, the opposite occurred, and their labor needs were exacerbated dramatically.

The businesses interviewed were clearly in need of assistance in coming up with ideas and ways to find that crucial, qualified workforce and this challenge was forcing them to innovate in one way or another to alleviate this burden. While some are turning to foreign labor (some firms mentioned being part of recruitment missions to France and Mexico), others had no choice but to increase part of their level of productivity and efficiency through technological advances such as robotization, automation, and the implementation of new integration systems. Some firms are doing both.

One thing is certain: the time and resources spent on this problem has already caused them to slow down dramatically their development and innovation, and has caused them excessive costs, demonstrating the clear role of talent and workforce within any ecosystem, but especially in the case of innovation ecosystems.

Unsurprisingly, one of the firms interviewed mentioned that the pressure to find qualified employees has made it a constant focus for their HR department:

"For us, finding people has been so complicated in recent years, it has created a need for our HR department to find new ways of enticing people. For the moment, they are working on different packages, but we've just increased salaries in the manufacturing plant significantly in hopes of closing that gap. That is their number one priority and focus, and they are constantly looking for new people."

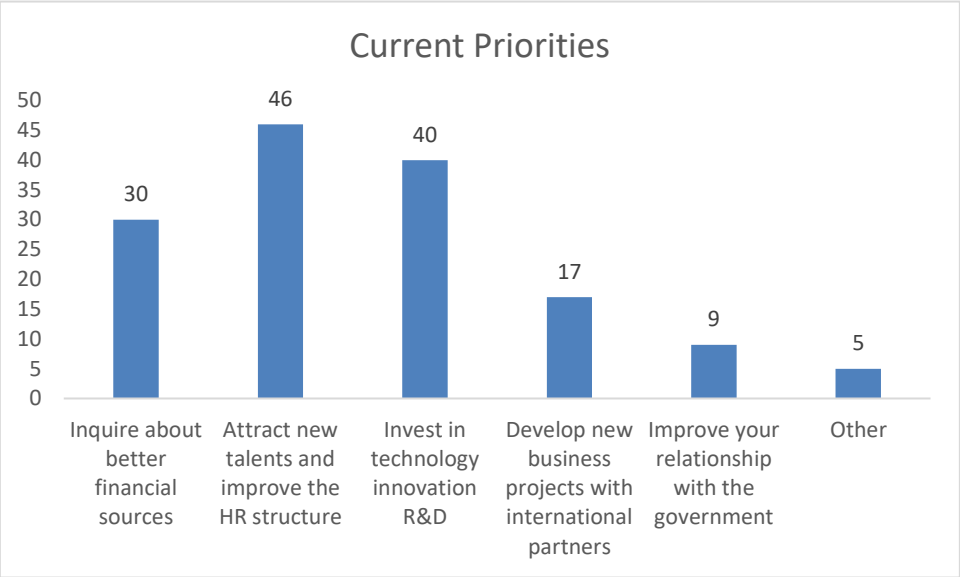

Figure 6. Current Priorities of Firms in the Cluster

In fact, the current priorities mentioned by surveyed firms can be seen in Figure 6 with a top three of: talent attraction, investments in R&D and innovative technology, and inquiry about financial sources.

Incidentally, proposition 1 is confirmed through the validation of regional innovation in the cluster as well as the collaboration and linkages of the cluster, and the diverse ecosystem that the region enjoys.

Firms interviewed were very eager to discuss assistance (financial or otherwise) they have received in the past or that they would like to have access to with the purpose of increasing their rate of innovation.

Although this was not the case for all the companies, most of the companies had, at one point or another in their existence, been entitled to and/or benefited from government grants, tax credits, or financial aid.

The only company that mentioned not having benefited from these aids is a subsidiary of an American company whose financial resources were greater than it might have seemed when looking solely at their revenue in Canada.

The most popular forms of support were financial tools, salary subsidies and, since the COVID-19 pandemic, subsidies and grants related to the pandemic:

Financial Tools to Encourage Entrepreneurship, R&D, and Innovation

Financial aids were frequently mentioned by companies as a lever for innovation. These grants, tax credits, and loans lift a huge financial burden during the start of a new business, the development of new technologies, and in the implementation of new processes and technologies such as automation and robotization technologies, and even the development of new products and processes.

The sampled firms were very clear on the fact that these aids have a huge impact on their business, but especially on their tendency and capacity for innovation. Without this government support, these companies would not necessarily have the vital resources to be as innovative as they are today.

Whether this support is in the form of funds and grants, low-interest loans or tax credits, companies explained that these items take an immediate burden off their shoulders and allowed them to try new processes, implement new systems or innovative designs.

Moreover, firms mentioned that while these financial tools were great to have, their value was much greater than simply adding a monetary cushion in their activities; they also pressed the fact that these financial incentives were a great promotional tool to foster entrepreneurship and innovation.

Wage Subsidies

Some wage subsidies offered by government programs allow companies to hire more people than they could without them. These grants are a financial aid that removes a tax burden for developing companies. Indeed, the problems of labor shortage put an enormous pressure on the shoulders of the human resources departments of companies. These financial incentives allowed them to shift some of that burden.

> "Wage subsidies help us a lot. We are in a labor shortage situation and our HR department is suffering enormously, but with the aid we are entitled to, for example, with Emploi-Québec, it has allowed us to increase salaries a little and attract new employees, but in the long term, we have to find another solution because this shortage really prevents us from continuing to grow and innovate."

However, the subsidies were often not enough to ease the need for skilled workforce, and some were firms stated the lack of programs or inefficiency of programs to support companies in their search.

COVID-19 grants and subsidies

The pandemic has put a lot of pressure on businesses. The required adaptation was lightning fast, and companies have had to implement new processes and procedures to ensure that their facilities are safe for employees.

Such adjustments require considerable financial investment and resources. In addition, the upheaval caused by the pandemic created logistical challenges for some companies.

Certainly, while some Laval businesses saw a significant increase in demand for their products during the pandemic which exacerbated their labour needs, for others, the opposite occurred, and their revenues were reduced. Subsidies and grants supported companies in both situations. Companies that saw an increase in demand were able to use these grants to implement new processes, while companies that saw a decrease in revenue were able to keep their employees even with the decrease in revenue.

These supports not only impacted the company's human resources, but potentially also had a significant impact on the pivot some companies had to make during the pandemic. At least one company mentioned having to change their model (and even their product offering) because of the pandemic. This financial assistance allowed the company to retain employees and modify their operations to adapt to the current situation.

Although financial aid is an essential element in the development of innovation for businesses, other programs and aid have an equally important impact on businesses and the ones that surfaced the most were the desire for a formal cluster and a streamlined business approach in Laval were the main strategies cited by firms.

The creation of a formal industrial cluster

The linkages and partnerships created by the companies were recurring elements that interviewed companies mentioned in the assistance to which they would like to have greater access. Many mentioned the desire to create partnerships and exchange knowledge with other business leaders or complementary businesses. There is a desire to build relationships and linkages to determine if there are issues that can be alleviated through this type of knowledge exchange or if new knowledge can be created through partnerships with complementary businesses. However, as mentioned previously, only one of the businesses that mentioned networking and partnerships as a desired outcome was partaking in networking activities.

For this reason, mentions of such ideas as the creation of a "formal" industry cluster and knowledge exchange programs to discuss both with the city and between companies were repeated several times. Businesses would like to have access to a service that would allow them to not only share with their peers, but also to network, discuss issues relevant to their situation, expand their network, and establish partnerships in hopes of generating new knowledge creation or to share knowledge.

For firms in Laval, the formalization of an industry cluster comes in the form of an official organization that gives the region a platform to strategize and, in turn, to promote the region, and enhance the visibility of the cluster and the innovation linked to it.

Some floated the idea of looking at other successful regional ecosystems and replicating their success through similar processes or creating linkages with similarly successful regions.

An official cluster would allow Laval to be promoted, to encourage innovation, and to encourage innovative companies to establish themselves in the region. In addition, industry-specific events

would be facilitated through such an initiative, another element that companies would like to see in Laval.

The creation of a formal cluster would also support a concerted effort in the industry that would allow for better communication with the city. Some businesses mentioned that since they had been talking to the city and building relationships with city staff, their relationships were improved, and they felt they had created a good working relationship with the city. In contrast, many businesses had not developed a relationship with the city, and this was clearly demonstrated by their lack of knowledge about the supports, activities, and services available in the region.

The creation of an industry cluster would allow for better communication channels between companies, but also with the city, and thus "work together to make things happen" as stated by one firm.

Streamlined Business Approach

Another key element cited by many was a streamlined business approach. Having a streamlined application process in place would make it easier for businesses to apply for assistance or services and generate a better relationship with the region's business community. The need to keep laws and processes up to date may seem tiresome but is essential to keep the ecosystem current and innovative.

> “I think Laval has one of the oldest urban planning codes in Quebec. If you want to expand, it's complicated. If you want to get permits, it's complicated. It's not very clear and even getting help from the city is complicated! Things need to be more straightforward and simpler to encourage businesses to grow and new businesses to come here.”

Without streamlined processes and a business-focused approach, companies may decide to move to a more development-friendly region. A region that is focused on developing its industries and allowing for ease of approach encourages the attraction and retention of investment and the development of businesses and industries in the region.

These elements of support to companies and the firms' desire for more assistance shows clear support for proposition 5. While firms appreciated and saw the value in the financial support that was available to them, they wanted to see more nonfinancial support in the city to encourage innovation.

5.1 Barriers to Innovation

The interview portion of the study also enabled us to delve deeper and shed light on barriers to business innovation faced by businesses in the region and several obstacles to their innovation emerged. An interesting note is that the elements brought forward were mentioned by all companies.

The need for connectivity through the regional development of Laval with elements such as transportation infrastructure development like public transportation, cycling paths, better connections to other cities, high speed internet, and more was brought forward significantly by the firms. Many businesses felt that regional development can help or hinder the development of innovation for a company either directly or indirectly. Connectivity enables firms within a region ease of access, better amenities including necessary technological elements such as high-speed internet, and more. Whereas lack of regional development hinders the development of innovation through these same elements.

For example, many considered their location to be excellent and easy to access for people with cars, but the lack of public transportation makes it much more difficult for their employees without access to a car, hence exacerbating their lack of qualified workforce:

> "We have a lot less interest because of the location of our plant. We're in the industrial park and there's no public transportation here, it's very underserved. There's not even bus service at night and we need night service because our employees are on shift and our plant is open 24 hours. This makes it even more difficult for our business and our employees and we definitely have a lot less applications. We even have people cancel their interviews at the last minute when they realize it's too much of a hassle to get to us if they don't have a car."

Lack of connectivity, in this case for public transportation, can greatly impact their ability to find and retain workers. Without transportation that provides easy access to their offices or factories, the number of applicants can be much lower than expected.

Many even mentioned that they believe that such changes to the city would be in everyone's best interest as a better transportation network would make the city more attractive to young families and encourage the development and growth of Laval in a positive way.

Firms felt that Laval has to compete with Montreal because of its proximity and they felt that it was much harder for them to be able to do so because of this challenge. Businesses saw a clear link between the lack of transport infrastructure and the lack of workforce and believe that if more young families moved to a city such as Laval, there would be less of a workforce shortage for them.

It is important to note that the companies interviewed were all on the medium to larger end of the spectrum for SMEs. Of those who shared their revenues with us, the smallest company had

revenues of about $10M per year, while the rest of firms willing to share their revenue had revenues of over $50M.

Therefore, many of the companies had a certain lack of knowledge about the services offered to businesses by the region. Many of them had never used the city's services because they considered them to be geared more towards small businesses and startups. Some of them even mentioned the help they received from the city during their very beginning and considered this help as absolutely essential to their development.

> “In fact, I used Laval's services at the very beginning of my business, when my startup was in my garage, and it was just me! The help I received from the city at that time was fundamental to the development of my business. Without that help, I don't think my business would be where it is today; I probably would have had to close at some point. That's what allowed me to innovate and grow. When you're just starting out, with a totally innovative concept, it's hard to find financial support. This was absolutely essential for me in order to start an innovative company.”

On the other hand, large companies didn't think they could find help in the city. Instead, what they would like to see from the city is closer collaboration and communication with businesses. One company mentioned a desire to have an organized industry cluster with the help of the city, another suggested more trade shows and industry events, and yet another wanted access to the city's networks as they are eager to build bridges with university research centers, something that they wanted to do, but had not been able to for lack of connection.

Companies also described difficulties with standards and regulations. Many of them finding the standards complex, the bureaucracy difficult, and even consider that certain rules are idiosyncratic and prevent the growth and innovation of businesses.

This thoroughly parallels the elements raised in proposition 6 and likewise lends support to this proposition. There are clear regional elements that obstruct the development of innovation that might not be mentioned in another cluster or another region, but that we know to be true for Laval and its manufacturing cluster. Hence, in order to support the growth and success of the cluster, policymakers need to listen to these firms and implement changes that are adapted to this specific situation.

On the other hand, businesses that had had discussions with the city were very pleased with the interactions they had had. Companies described these interactions as “passionate, good listeners, good conversationalists, willing to help...”.

Overall, the companies interviewed are constantly innovating and have found ways to avoid some of their challenges. There seems to be a real atmosphere of R&D and innovation among firms in the region and their desire to constantly be evolving and innovating is clearly reflected in the regional ecosystem.

Nevertheless, while they have been able to manage so far, they have a visible desire for support and collaboration with their region to go even further.

5.2 Future Business Priorities

Companies are of course all concerned about the challenges they face during the COVID-19 pandemic. However, one thing is certain, all companies are actively trying to find solutions to their problems, whether caused by the pandemic or not, and these solutions are often found in innovation, but more importantly, in continued innovation. For many, the pandemic has only exacerbated some of their existing problems, such as labour shortages. Therefore, it is important for these companies to continue to take stock of these difficulties.

For firms, the answer, and thus their future priorities, lie in the continuous improvement of their processes and their product or service line, as well as in the application of patents. These improvements often take the form of innovation in automation, but also the implementation of systems and processes focused on efficiency and productivity. In addition, companies have the desire to promote this innovation and the changes made to gain recognition from their customers and in their industry for the innovations they have introduced.

It is also important for some to strengthen their value chain through different processes such as the vertical integration of certain suppliers, not only manufacturers, but also raw material producers. For others, diversification of suppliers and markets is the way forward. One company explained that the pandemic put things in perspective for them:

> “We really had to rethink our value chain and expansion plans with the pandemic. It really put things in perspective for us. You can't continue with one supplier or one export market. We've had to rethink our supply chain and, for our future plans, we're looking at what new markets to expand into.”

The delays and pitfalls created by the pandemic have forced many to rethink their value chain and international networks. The problems created have intensified supply and/or sales issues for companies, putting them on alert to review and improve their networks.

5.3 Summary of Findings

Consequently, looking at all this data, we can see the clear patterns of innovation throughout our analysis. As mentioned previously, the firms interviewed, while all in the manufacturing sector, are also in different industries (aerospace, life sciences, etc.) making them a diverse representative of their industry and a heterogeneous cluster ecosystem. Beyond the fact that the cluster is innovative through the number and types of innovation in the region, the facts that the cluster is heterogeneous, seeks collaborations with both private and public sector organizations, and that the firms show an active desire for regional development demonstrates a dynamic ecosystem that has a wish for continued growth. Furthermore, their clear focus on talent attraction and retention undoubtedly shows the importance and the need for access to education institutions in the ecosystem which according to some interviewees could be bonified. Their clear yearning to create more linkages and to collaborate with the city expresses the cluster's need to thrive and renew itself with new innovations. At the same time, barriers to innovation need to be mitigated and city officials need to cooperate with the cluster to ensure the continuation of a vibrant ecosystem.

Chapter 6

Discussion

This study investigates the factors that promote cluster innovation in satellite cities and the aspects that influence said innovation, adding to the discourse on the subject. Therefore, this research tried to shed some light on the matter by delving into the factors affecting innovation in a specific satellite city, Laval, for its manufacturing cluster that is situated in the peripheral region of a large metropolis, Montreal, in Canada and the firms located in the region. This analysis gives us a better understanding of the factors that impact cluster innovation in satellite cities and the way that they can help or hinder the region.

Through this study, we determined that the geographical location of satellite cities can highly influence cluster innovation in the region. According to research (Caragliu et al., 2016; Eder, 2019; Xu et al., 2022) and confirmed through the interviews we performed, satellite cities face different challenges to that of metropolitan areas in the form of lower connectivity (both infrastructure and network), less R&D, smaller number of actors hence also lack of economies of scale, and scarcity of human capital.

In fact, satellite cities must contend with issues because of this geographic proximity to a large urban area as human capital or actors from the peripheral region might be attracted to the metropolis because of this proximity and will often opt to work or move to the metropolis. One of the peripheral region's challenges is to attract and retain this workforce and these actors. This was top of mind for firms in the Laval manufacturing cluster and there was what felt like a very pressing need from the firms to find solutions as it was hampering their growth and, potentially, harming the cluster's innovation.

However, our findings suggest that a cluster in a satellite city can absolutely thrive, grow, and innovate even through these challenges, suggesting the importance and high impact of certain positive factors onto the cluster; this potentially complements the research (Alderman, 1998; Eder, 2019; Lee & Rodriguez-Pose, 2013; Shearmur & Doloreux, 2016) that asserts that firms in more remote regions happen to be less studied, have more traditional sectors, and less prioritized innovation metrics. For example, on the subject of innovation metrics: our findings suggest that there is a definite appetite for IP in the form of patents (a more traditional innovation metric), but that other options such as registered trademarks, disclosure agreements, trade secrets, and registered industrial designs were also types of innovations preferred by firms in the cluster; potentially confirming the differential in the prioritization of less studied IP and demonstrating the need for further studies focusing on the subject.

As stated in the literature, the presence of diverse firms has had a significant impact on the growth and innovation in the region (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019). Additionally, the presence of elements benefitting the cluster positively such as a proximity to universities, both local and international linkages of firms, some involvement from policymakers, a culture of entrepreneurship, etc. influence the outcome and success of the region (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019) and that is evidently the case for Laval.

Porter (1998) states:

> To maximize the benefits of cluster involvement, companies must participate actively and establish a significant local presence. They must have a substantial local investment even if the parent company is headquartered elsewhere. And they must foster ongoing relationships with government bodies and local institutions such as utilities, schools, and research groups.

Porter's statement rings true in this case. Firms in the Laval manufacturing cluster demonstrated their desire to improve and collaborate with both private and public organizations. They were open to participate in surveys and interviews, expressed that they wanted a more targeted approach for the region, inquired about a collaborative platform and the creation of new linkages, and more. As per the literature (Boschma & Frenken, 2009; Eder, 2019; Roelandt & Hertog, 1998; Xu et al., 2022), the public sector is a facilitator that can work positively for the business community in the region and, in our case, Laval économique demonstrated a wish to play this role that was also deemed necessary by the businesses in the cluster.

In fact, we were able to explore the innovation of a cluster in a peripheral region because of this common desire for openness and an inclination to collaborate on getting a better understanding of regional needs to foster innovation. They all seem to want to be part of the development and improvement of their region and to be involved in the growth and success of the cluster.

It is also important to remember that, in the past, clusters in satellite cities have not been studied as much as those in larger metropolitan areas because less urban areas tend to have more traditional sectors which are less studied, because of the wrongful assumption that more remote areas do not innovate, or because they are overlooked as they lack of what is considered "typical" when innovation is studied (Alderman, 1998; Eder, 2019; Lee and Rodriguez-Pose, 2013; Shearmur and Doloreux, 2016). However, our results were in line with authors that believe in regional innovation in satellite cities (Alderman, 1998; Eder, 2019; Lee and Rodriguez-Pose, 2013; Shearmur and Doloreux, 2016): we found that, as per our findings in the Laval cluster, that satellite cities can be innovative, but, even more importantly in the case of innovative clusters in satellite cities, they aim to keep innovating.

Exploring the impacts of different factors on the cluster confirmed our hypotheses and showed us how significant their impact can be on the growth of innovation and success of a peripheral region. Our findings are in line with cluster innovation research that suggests that a cluster has a better chance of remaining innovative through access to a rich ecosystem, local and international linkages, financial and nonfinancial incentives, and policies adapted to the cluster and the region. All of these elements also ring true for clusters in satellite regions and seemed to be on the radar for the firms interviewed.

Moreover, even though the companies mentioned financial assistance in their development and in encouraging their innovation, it is rather the non-financial elements that they focused on during our discussions with them (this is in line with studies such as Brenner & Schlump 2011; Eder, 2019; ISED, 2023; ITF, 2018; Roelandt & Hertog, 1998; Uyarra & Ramlogan, 2012; Xu et al., 2022) and three themes emerged in our analysis that could be of interest to policymakers to enable continued growth of innovation in satellite cities:

Initiating channels of communication with companies

Businesses would clearly like the opportunity to collaborate with the city and the best way to meet this need would be to open channels of communication with them. Things like creating a business or industry roundtable would allow businesses to be heard, but more importantly, to feel that there is collaboration with the city. The perception of firms in the cluster was that it may not be possible to address every demand (and priorities often change from business to business and over time) but creating clear channels of communication can build a relationship with businesses, reassure them, and give them peace of mind that they are being heard. Businesses also felt that this would awaken public officials to the realities of the cluster and create a direct

line of communication for collaboration and a better understanding of the policies needed for this specific cluster, where such channels would also allow the city to obtain the opinions and ideas of key stakeholders directly. A relationship with businesses would allow the City of Laval to better position itself on the “real” issues that impact businesses directly and thus eliminate unnecessary assumptions or ideas. In this way, according to firms interviewed, the city could be more responsive to the needs of its business community.

While “channels of communication” are not an area of focus in the literature, the role of linkages and that of the government or the public sector are recurring themes mentioned and the specific example of the Laval manufacturing cluster demonstrates well how diverse the role of the public sector can be to encourage and promote the growth of innovation. In parallel, this confirms the need of a personalized approach by policymakers when it comes to supporting regional innovation ecosystems (Babkin et al., 2013; Brenner & Schlump 2011; Eder, 2019; Seyfang & Smith, 2007).

It would be hard to determine the tangible value of the implementation of such channels, but the repercussions on the business community might allow policymakers in the region to gain a greater sense of trust, and a direct signal from the cluster on their needs to facilitate continued innovation. While this cannot be confirmed by our study, and while it would be hard to measure and government interference is a contested subject, we do know through research that the support of government and the facilitation they can provide can be a helpful factor, especially in satellite cities, in the support for cluster growth (Boschma & Frenken, 2009; Boschma & Gianelle, 2014; Eder, 2019; Roelandt & Hertog, 1998; Seyfang & Smith, 2007; Xu et al., 2022) and, in the case of our study, firms were in open agreement that they would like to have more government interference.

Creating an Industry Cluster

Related to the first point and equally important, firms believed that the creation of an industrial cluster in the Laval region would be an excellent way to promote and publicize not only the companies in the region, but also the region itself. They posit that the creation of a cluster would help companies create relationships, expand their networks, and even do some problem solving on challenges that they face as part of a satellite city. Clusters are also a great form of advertising for the region and have the potential to attract new businesses to the cluster.

It is an excellent form of networking both among the companies that are part of the cluster and with external stakeholders. According to our research respondents, these clusters equip companies in their development efforts and strongly encourage innovation through external exchanges and problem-solving, and the creation of partnerships.

As we know from research and as we've noticed in our study, both local and international linkages are essential to support knowledge creation, knowledge-sharing, and to fortify innovation (Boschma & Gianelle, 2014; Liao & Yu, 2013; Turkina and Van Assche, 2018), making the idea of a formal cluster platform that encourages and facilitates these exchanges a proposal of interest for the region.

In addition, interviewees wanted to explore the idea of additional events and trade shows in the region potentially as a promotional feature of the formal cluster entity; acting as a tool for the cluster to create further local and international linkages between firms and the cluster.

We have observed through this investigation that the networks created by firms in a cluster can indeed lead to collaboration and innovation and research also confirms the benefits of linkages created (Boschma & Gianelle, 2014; Eder, 2019; Liao & Yu, 2013; Turkina and Van Assche,

2018). Such endeavours would provide “temporary spatial proximity” by enhancing the possibilities of contact and interactions and ensuring the presence of firms in “global pipelines” as per Eder (2019) and seems to be corroborated by the Laval firms interviewed at a pragmatic level. Thus, we can assume that this suggestion would fare well in the case of a cluster in a satellite city and research shows that international linkages can benefit the entire cluster (Liao & Yu, 2013; Turkina & Van Assche, 2018), backing the potential success of this idea.

Development of the transportation connectivity in the region

The element most cited in the interviews with Laval companies is without a doubt the need to develop the region's transportation network (public transportation, bike paths, etc.). Although this element is the most complex to implement, it is also an extremely important component not only for the development of businesses, for the development of the region, but also for the development of business innovation and cluster growth in the region because, according to Laval firms, this element has the biggest impact on talent acquisition.

According to respondents, a better transportation network would allow not only the region and businesses to benefit from these improvements, but also for professionals, allowing them a better quality of life and more options. Several companies mentioned that this perceived lack of transportation infrastructure slowed down their innovation activities in a substantial way as it impacted negatively their capacity to attract and retain talent. Although this element does not necessarily appear to be of consequence at first glance, we know from the literature the impact of regional access on firms and the workforce: lack of connectivity can isolate a cluster, keep the skilled workforce away, and render the region unattractive to investors (ITF, 2018; Porter, 1998). Consequently, the lack of connectivity can hinder the development of the region and, thus, that

of its businesses, its cluster, and its innovation. Additionally, as per Menzel and Fornahl (2007), governments usually make large investments in the case of a mature, successful cluster, such as the Laval cluster, however, we can surmise from the remarked lack of infrastructure by firms that this could also be impacted by their location or their specialization, but further research would be needed in this area to confirm if a city's status as a satellite city impacts the perception of need for infrastructure by government.

Nevertheless, the firms felt that lack of manpower is severely accentuated by the lack of public transportation as the number of applicants for jobs is often reduced when companies do not have public transportation near their manufacturing plants or offices. Even with an excellent location, the lack of transportation makes the already difficult process of finding workers even more complex. This perpetuates a vicious and complex cycle that hinders recruitment, but also the retention, of skilled labor. Of course, other elements are involved in the labor shortage that companies are experiencing, but the need for transportation exacerbates this great challenge, hinders their development and innovation. On the hand, this lack of workforce has also pushed some firms in the Laval cluster to innovate in different ways: by focusing on automatization and robotization, and by looking to improve processes and methods; changes that enhance their innovation and that of the cluster.

As stated previously, while we know that policy can be a contentious subject in research, interestingly firms in the Laval manufacturing cluster were hoping for more government intervention. The consensus seemed to be that there was a need for support at all levels of government for different purposes. At the federal and provincial level, the needs were for

startups, R&D, immigration and labour, and internationalization, while at the municipal level, the needs were for zoning, processes, linkages, and infrastructure/connectivity. Firms were quick to praise or point out which policies would benefit them and bring about socioeconomic benefits to the region.

Consequently, we can see a definite trend and intersecting synergy between all three themes which are all correlated and linked in one way or another. Our results demonstrate the impact of cohesion between actors and stakeholders, whether in the private or public sector, with everyone having the goal of innovation and development for the cluster.

Our results show that even without the "perfect" conditions, firms in the Laval cluster were able to grow and innovate, even in conditions that they believe could be improved upon. This is in line with research and could partially be explained by the fact that firms in the Laval cluster had to find ways to innovate because of their distance from the dense urban core and other actors (Eder, 2019). However, when taking a close look at their situation, we also notice that the region also greatly benefits from factors already in place and favourable to satellite cities such as access to incentives, and proximity to a high number of universities and a large workforce in close radius; these elements, as denoted in the literature, facilitate the development of the cluster and its innovation and can give satellite cities a step up compared to some of their counterparts (Caragliu, et al., 2016; Carlsson et al., 2014; Eder, 2019).

In fact, this distance from the core could explain the significance of linkages, especially international linkages, that were developed by firms within the Laval cluster. Firms clearly depend on a local and international array of connections to maintain their supply chain, R&D, and more, but we found that there is also a strong link between the type of linkages and the type

of innovation. As previously stated, Eder (2019) mentions that with the right linkages and networks in place, “firms […] can be innovative if they are well integrated in global pipelines.”

By being exposed to different relationships, international or otherwise, we know that there are positive knowledge spillovers for clusters (Boschma & Gianelle, 2014; Eder, 2019; Liao & Yu, 2013; Turkina & Van Assche, 2018), and this seems to be confirmed not only by the amount of innovation created in the Laval cluster, but also by their stated aspirations to form even more networks and linkages.

Hence, as explained by Eder (2019), the belief that more traditional industries and more remote locations do not innovate is simply misguided. The example of the Laval manufacturing cluster reveals that not only does a more traditional industry cluster in a satellite city can, in fact, innovate, but that it also innovates in many different ways, through many different types of innovation, and that this cluster in particular wants to continue doing so in the future.

Despite the large amount of research on the phenomenon of clusters, this study observes a particular case, that of a cluster in a satellite city, a subject that has not been studied to the same breadth and extend. This study enables us to better comprehend the inner workings of a cluster in a satellite region and to be privy to its opportunities and challenges, as well as the needs of the firms evolving within that ecosystem. Our findings are not only in line with previous literature on clusters, but also confirm that there is a positive impact of certain factors on the development, growth, and innovation of a region. Moreover, this study confirms the important impact of linkages, whether local or international, on the development of innovation in the region.

The implications of the results garnered from this study could be of interest even beyond the lens of cluster research. Indeed, this study confirms that innovation can be fostered through

collaboration and that the positive effects of knowledge spillovers and knowledge sharing can be further promoted through firm involvement in the cluster. Additionally, public officials and policymakers could find the results of this investigation of interest as the economic development of regions outside of urban cores is a challenge of note. Public and private collaboration, government support and policy, additional research, and specific action goals could provide the right effects to provide the right infrastructure and ways to further regional innovation.

It is important to ensure an understanding of the reality faced by the cluster in order to safeguard its continued innovation and growth.

Chapter 7

Conclusion

The goal of this investigation was to examine the ways clusters in satellite cities stay innovative. The data gathered was done by collaborating with Laval économique by surveying firms in the Laval manufacturing cluster and by interviewing ten innovative companies about their operations, their collaborations, their experiences, and their needs for the future.

When studying the literature, we were able to determine that, while the exact specifications of whether or not a cluster will be successful cannot be guaranteed, some overarching elements, albeit different depending on the ecosystem and its needs, seem to encourage the growth and development of clusters. We understand through literature that these can be summarized as a rich ecosystem, access to talent and education, linkages and networking, incentives (both financial and nonfinancial), local conditions, a culture of entrepreneurship and innovation, some public/policy involvement, and more can all affect innovation in a cluster and that these elements are even more essential when discussing clusters in satellite cities.

This investigation confirms that factors such as a rich ecosystem, local and international linkages, and government support have a positive effect on a cluster and that clusters in satellite cities face particular opportunities and challenges because of their geographical location next to large metropolises. It quickly became apparent that while companies in the cluster are innovative, they also desire additional support at all levels of government and view government intervention amicably for their sustained progress and development.

However, this investigation also demonstrated the clear dichotomy that exists in the case of clusters in satellite cities; that it is possible to be innovative and successful, in part because of the location next to a metropolis (access to a greater talent pool and universities, proximity to a diversity of actors, lower operational costs, etc.), while also having to deal with challenges that are specific to their status as a satellite city (competition for talent with a larger, sometimes more attractive neighbour, lesser infrastructure development, reduced name recognition, etc.)

We attempt to address the gaps in the literature on innovation in satellite cities by expanding the research on the subject, but also by examining a specific satellite city, Laval, through the lens of its cluster and firms, and providing insights into factors influencing the innovation and success of the cluster and possibly informing policymakers on the support necessary for the cluster to thrive.

Hence, this study contributes to the literature by adding to the discussion on innovation in clusters, but more specifically supplements to the literature on innovation in clusters in satellite cities; a subsegment of the subject that has not had a lot of scrutiny.

We build on existing literature to bring new insights, using a mixed methods research, to the subject and confirm that innovation also happens outside of large urban centres and that clusters in satellite cities are in a distinctive position as their location comes with opportunities and challenges unique to their situation. Using a mixed methods research design enabled us to quantify the innovation in the Laval cluster while the qualitative research portion of the study enabled us to dive deeper into the requirements of the cluster, especially at firm-level, in order to correlate these elements to the facilitation of successful innovation in the cluster. In doing so, we

confirmed the factors necessary to innovation in satellite city clusters while also going further and expanding on the reasons why these elements are beneficial for the cluster to flourish.

7.1 Limitations

There are several limitations in this study that must be considered as they impacted the data gathered and the results obtained.

During this investigation, data was collected through the survey and interviews of a sample of Quebec companies in the Laval manufacturing cluster only which means that these firms are in specific conditions that may not apply outside of the city, province, or even the country. Elements such as the remoteness of the satellite city, the amount of municipal support, the economic and political stability of the country, and more could all impact satellite cities in unique ways.

Likewise, the only perspective included in the data collection was that of private firms, no government/public sector officials, industry associations, or universities in the region were interviewed for the purposes of the research. Perspectives of non-private entities might vary to that established in this study. This perspective was also self-reported through a survey which means the firms surveyed were the ones in control of the information they shared, or their personal assessments or views might have influenced their answers.

The cluster established in the Laval region is a manufacturing cluster which can comprise of a diverse group of companies and can intersect with other industry or industry subsectors. Hence, data collection in the manufacturing sector could include companies that, while operating in the manufacturing sector, also operate in industries such as aerospace, life sciences, automotive, and

more. This might impact the company's assessment of aspects such as government support, access to funding, ease of creating networks and linkages, accessibility to a qualified labour force, etc. Additionally, other clusters, even those also located in the Laval region, may have different perceptions and experiences of the issues examined.

Firms surveyed and interviewed were also at different stages of their development, affecting the way they answered questions and, subsequently, our results and analysis. Companies at different stages face different challenges and opportunities and are in need of different kinds of support.

Finally, data collection was done in autumn of 2020, at the height of one of the COVID-19 waves and during lockdown in the province of Quebec and throughout Canada. While this gave us an opportunity to study firms, the peripheral region in which they evolve, and the ensuing innovation generated during the pandemic, it also affected the way interviews were conducted and influenced people's responses to questions in both the survey and the interviews. This impact is hard to define as of now as we do not know if the data collected is representative of the long-term effects of the pandemic; this will only be determined in years to come.

7.2 Future Research

This research was an exploration of cluster innovation in satellite cities and the effects of factors on firms' innovation. This study has added some analysis on a subject matter that is becoming more prevalent, but still lacks the consideration and examination required to better understand the impacts of the geographical location of peripheral regions.

Research on satellite cities needs more work and future research focusing on a comparative analysis between similar satellite cities would assist in giving us a better understanding of the

factors affecting regional innovation and would enable a useful contrast of discoveries to determine similarities and differences affecting satellite cities in two different regions.

As we studied a manufacturing cluster, another comparative avenue would be to compare two different sectors to determine if findings hold true across industries in the same satellite city. This would enable us to determine which factors are cluster-specific and which factors are regional. Or a direct comparison of the Laval manufacturing cluster with another manufacturing cluster located in a metropolitan area, could be warranted to determine how innovation is affected in each location. This would create a more in-depth look at the more location-specific factors that affect regional innovation and advantages and disadvantages of remoteness and urban density.

Remoteness is an aspect that plays a huge role in the factors influencing satellite cities and this element is not studied nearly enough and, consequently, could be another area of much needed investigation. In fact, the definition of "satellite city" or "peripheral region" and the distance in which they need to be separated from the metropolitan core is unclear and varies greatly according to the research and the study. The role of "remoteness" of a region and its impacts on regional innovation and the firms situated in the region is a factor to be considered in future research.

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Appendices

Appendix I: Laval Innovation Survey

Section 1 Enterprise information

Name of the enterprise: _____

Quebec Enterprise Number (NEQ): _____

Address: _____

Postal code: ######

Year of judicial foundation: aaaa

Principle NASICS code (6 digits): ######

Section 2 Economic Information about the Company

What is the type of firm?

- Headquarters
- Subsidiary or joint venture of Canadian firms
- Subsidiary of a foreign firm
- Joint venture of Canadian and foreign firm
- Other (please specify) _____

What is the number of employees?

- 1 to 4
- 5 to 19
- 20 to 99
- 100 to 499
- 500 or more

What is the average sales revenue of the firm? If your company is a subsidiary, please only indicate the sales of the subsidiary located in the Laval region.

- Less than $100k
- $100k to $499k
- $500k to $999k
- $1M to $5M

- $5M to $10M
- $10M to $25M
- $25M or more

What is the average rate of annual sales growth?

- Less than 0%
- 0% to 0.99%
- 1% to 4.99%
- 5% to 9.99%
- 10% or more

What are the main destinations of sales? [multiple choices]

- ■ Québec
- ■ Canada outside Québec
- ■ USA and Mexico
- ■ Europe and UK
- ■ Asia
- ■ Other countries and regions (please specify) _____

What are the main destinations of capital investment? [multiple choices]

- ■ Québec
- ■ Canada outside Québec
- ■ USA and Mexico
- ■ Europe and UK
- ■ Asia
- ■ Other countries and regions (please specify) _____

Section 3 R&D Investment

What was the average percentage of R&D investment spent by your company to annual sales from 2018 to 2020? Please answer according to your company's usual average investment.

- Less than 1%
- 1%-4.99%
- 5%-9.99%
- 10%-20%
- More than 20%

What is the percentage of R&D employees in the company?

- Less than 5%
- 5%-9.99%
- 10%-19.99%
- 20%-30%
- More than 30%

As of October 2020, did your business hold any of the following types of Intellectual Property?

	Yes	**No**
Basic scientific research		
Applied research/technology development		
Development for adapting products to local markets		
Development for market launch		
Development of software/data		
Acquisition of machinery, equipment, software & building		

Does your firm engage following R&D activities?

	Yes	**No**
Basic scientific research		
Applied research/technology development		
Development for adapting products to local markets		
Development for market launch		
Development of software/data		
Acquisition of machinery, equipment, software & building		
Other		

As of October 2020, did your business hold any of the following types of Intellectual Property? [multiple choices]

- **Registered trademarks**
- **Patents**
- **Registered industrial designs**
- **Trade secrets**
- **Non-disclosure agreements**
- **None of above**

How relevant are the following drivers for the expected R&D investment change? Please rate on a scale from 1(irrelevant) to 5 (highly relevant)

	Irrelevant 1	**2**	**3**	**4**	**Highly relevant 5**
Demand change from customers					
Exploiting technological opportunities (technology push)					
Maintaining R&D as a fixed proportion of net sales					
Competition from companies located in • **Québec** • **Canada outside Québec** • **USA and Mexico** • **Europe and UK** • **Asia** • **Other countries and regions (please specify)**					
Improving the company's productivity					
Meeting product market regulation and other legal frameworks					
Other (please specify)					

Where are your partners in R&D activities located? (multiple choices)

- Not applicable
- Québec
- Canada outside Québec
- USA and Mexico
- Europe and UK

- ■ Asia
- ■ Other countries and regions (please specify)

Section 4 Enterprise innovation and collaboration

Which innovation activities did the firm conduct from 2018 to 2020? [multiple choices]

- ■ Introducing new products and services
- ■ Improvement of production process, distribution method and service support
- ■ Changes in organizational methods (IT system upgrade, HR management restructure, business model change, forming a new partnership, acquisition of automated production equipment,…)
- ■ New ways of marketing and sales
- ■ Other (please specify) _____

What is the dominant force driving the innovation activities of the firm?

- Mainly within the firm itself
- Collaboratively, your firm together with other businesses or organizations
- Mainly from other businesses or organizations

What types of partners has the firm collaborated with in innovation activities from 2018 to 2020?

- Not applicable
- Buyers of products and services
- Suppliers of equipment, materials, components or software
- Strategic alliances (joint venture partners, consulting firms, market competitors, etc.)
- Universities and R&D centres
- Government
- Other (please specify)

Where are the business partners of the firm located?

	Does not apply	Quebec	Canada outside Québec	USA and Mexico	Europe and UK	Asia	Other
Buyers							
Suppliers							
Strategic alliances							
Universities and R&D centres							
Government							

Section 5 Business challenges

What were the most critical challenges faced by your company before Covid-19? (max 3 choices)

- Finance
- Human resources
- Technology R&D
- International partnership
- Government relations
- Other (please specify) _____

What are the most critical challenges faced by your company since Covid-19? (max 3 choices)

- Finance
- Human resources
- Technology R&D
- International partnership
- Government relations
- Other (please specify) _____

Section 6 Future strategy

What are the priorities of your future business strategy? (multiple choices) **(max 3 choices)**

- Inquire about better financial sources
- Attract new talents and improve the HR structure
- Invest in technology innovation R&D
- Develop new business projects with international partners
- Improve your relationship with the government
- Other (please specify) _____

Which of following strategies would you consider in order to develop your business abroad? (multiple choices)

- ■ Not considering going abroad
- ■ Explore new destinations for export and investment
- ■ Strengthen the relationship with existing foreign suppliers and clients
- ■ Acquire foreign equity through M&A or joint venture
- ■ Establish strategic alliances with foreign partners on new projects
- ■ Attract international talents and improve the team diversity
- ■ Other (please specify) _____

Appendix II: Laval Innovation Interview Guide

Date:

Time of the interview:

Place:

Interviewer:

Interviewee:

Name of company:

Type of firm:

Average revenue of the firm:

Explain - brief summary of research and confidentiality.

Questions:

1. Which innovation activities has your firm conducted since 2018?

2. What has been the driving force behind the R&D and innovation activities in your company?

3. What do you feel has been the greatest factor contributing to the development of innovation in your business?

4. What were the biggest challenges faced by your company before COVID-19? Since COVID-19?

5. What strategies are your priorities for your future business strategy?

6. Has your business taken advantage of any of Laval's resources for businesses (financial, advisory, training, mentoring, etc.)?
    a. What was the outcome of this assistance?
    b. Do you feel like these resources helped your business in its development and innovation?
    c. How do you feel that your business's innovation has been impacted?
    d. Which aspects of your business were the most impacted by the resources made available?

7. Did your business request assistance such as grants, subsidies, or loans from other sources (federal or provincial government, external financing, etc.)? Why did your business decide on this option?

8. Are there any elements that you would like to be available to your business in order to increase your innovation?

9. How can policy makers of your region help your business increase its innovation?

10. Are there other elements that you feel would help your region grow and innovate?