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Methodology for Designing a Collaborative Business Model – Case Study Aerospace Cluster

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Abstract. Innovation is a key skill of companies. The academic literature on innovation in product development is well documented and abundant. However, the one according to innovation at the level of collaborative business models is less available and rarely addressed. We are going to focus on innovation in terms of collaborative business model, more specifically on companies operating in a cluster. In 2020, it is necessary for companies to collaborate. However, when the time comes to carry out collaboration, they encounter different challenges. In order to act and try to resolve them, we will propose the design of a collaborative business model specifically for companies operating in a cluster. In this article, we will present the state of the art at the level of clusters as well as business models. We will then present our problematic relating to the need to collaborate between the companies belonging to a cluster. As an example, we will be referring to the Quebec aerospace cluster. We will end with the presentation of a proposal for a collaborative business model, which was developed by using three business model representations and performed validation interviews with key people. The model will be presented according to the Osterwalder and Pigneur business model canvas. Ultimately, the collaborative business model will allow clustered businesses not only to collaborate more effectively with one another, but also to distribute the gains to all businesses in the cluster.

Keywords: Business model, Collaboration, Cluster, SME

1 Introduction

Competition between companies is no longer just local but has become international. One of the solutions to overcome competition is co-evolution [20]. Local companies must no longer compete with each other but collaborate to overcome the various external threats. If they want to survive in the business world, it is important for them to develop their capacity to innovate, both in their technological ideas and in their business models [8].

We know from the outset that businesses operate on a business model. We also note that collaborative business models are booming in the accommodation sector with Airbnb or in the transportation sector with Uber for example [16, 26]. We acknowledge that it is often difficult to apply this model to several companies looking forward for mutual collaborations. In addition, by adding the concept of manufacturing companies, it further complicates the realization of the collaboration. In order to encourage collaboration between manufacturing companies, we propose the design of a collaborative business model adapted to companies operating in a cluster. The model's design contains certain challenges, especially the achievement of collaboration in an area that is culturally very competitive.

We believe that an interesting option is to offer collaboration by sharing resources, human or material, or by sharing knowledge within the network. Group members could trade on a peer-to-peer trading platform, where each party could find its addition and its gain in value.

The first section of the article will present the state of the art in terms of clusters and business models. The second section will present the Quebec aerospace cluster as well as the tool used to design the collaborative business model. The third and final section will present the development of the collaborative business model and will be followed by the conclusion.

2 State of the Art

2.1 Cluster

Let's start with the state of the art at the cluster level. Even if the term industrial cluster had no formal definition, we observe that competitive culture is the main reason why it is difficult to build a network [1, 7, 12]. Trust is also a very important element in the formation and functioning of a network [1, 7, 13]. Cluster notion is often linked with the ecosystem notion. We can find a similarity between the ecosystems of fauna and flora and the industrial ecosystems [17]. Like animals, companies must co-evolve in order to survive in the business world [17]. We observe that there are four evolutionary stages of a business ecosystem such as birth, expansion, leadership and renewal. In case that there is no renewal, it is the death of the ecosystem [17]. We observe that the specialization of each company within a network allows it to reduce the overall transaction costs [12, 21].

As we go further, even if the term of industrial cluster is not clearly defined yet, we still observe that there are three reasons why companies participate in a network: collaboration in production channels, transfer of knowledge through human resources and partnerships with governments or different associations [1]. The first to propose a concrete definition of an industrial cluster is Porter who defined it as follows: "A geographic concentration of companies in a specific field" [23]. Porter also offers us a strategic agenda for a cluster, namely the choice of location, local engagement, improvement of the cluster and collective work [23]. We later observe that Porter spells out the advantages of clusters in a presentation to the international conference on technology clusters. Among the advantages, we find that clusters increase productivity,

through access to resources, institutions and a faster diffusion of best practices [24]. Clusters stimulate and allow innovation by improving the detection of opportunities and bringing easier experimentation [14, 24]. There is one important aspect for members to believe in the network: members must understand that they cannot achieve their goals alone. [13] It is also essential for them to know that each member can bring value to the ecosystem. [17] We observe that there are four key tasks for managing a network. The first task is activation where members are chosen [14]. The second task is the definition of the framework, establishing the rules, values and standards of the network [14]. The third task is to bring separate entities into a collective entity [14]. The last task is the synthesis phase which allows relationships to be maintained within the network [14]. Barely a year later, we can see a three-step methodology for effective collaboration in the supply chain [7].

1. Create commitment and understanding.
2. To remove the resistant forces to the collaboration
3. Constantly improve the capacities to collaborate

Since 2008 and probably related with the recession, the authors state that the rules of competition are subject to change and that managers must learn to collaborate more easily [7]. According to Lee's article, the advantages of the network create the possibility to decrease time to the markets. The network gives access to additional resources and allows itself to increase its strength [18]. The case study involved Korean companies network and the authors noted an increase in sales, a decrease in costs and an increase in the utilization rate of resource [18]. These are some benefits that we may be able to observe as part of our research project. However, we observe that the financing of the network has been a problem.

The labor problem is not only recent. SMEs typically do not have the human resources, research and development capacity or financial resources to obtain knowledge from outside [11]. Sharing, creating and knowledge diffusion within the network is an important aspect [17]. Therefore, the factors that influence the sharing of knowledge within the network are trust between members, the leading firm in the grouping, the density of SMEs in the grouping and the absorption capacity of the members [17].

2.2 Business Model

Looking into business models, after our readings we established that the authors had different visions of business models. We are going to present the business model according to Chesbrough, to Christensen as well as to Osterwalder and Pigneur. We will then present the literature on collaborative business models and finish with the presentation of the chosen tool which is the business model canvas.

2.2.1 Business Model According to Chesbrough

According to Chesbrough and to S. Rosenbloom, there are differences between strategy and business models, the latter of which determine how value will be delivered to

customers, while the strategy focuses on competition [7]. The authors describe the business model as the link between technical inputs and economic outputs, see **Fig. 1**. They also argue that making the link between the technical inputs and the economic outputs is the main difficulty in creating a business model. The ultimate goal of an innovative business model is to deliver value to customers.

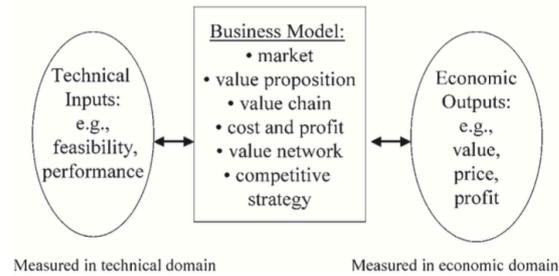


Fig. 1. Chesbrough business model

Still according to Chesbrough, poor technology combined with a good business model may prove to be more profitable than good technology combined with a poor business model [8]. The business model main components are listed above in **Fig. 1**, which refer to Chesbrough business model.

We note that these components are a more detailed version of the Business model box from the model presented in his 2002 article. They will certainly help us in the creation of our collaborative business model. Chesbrough says that companies must develop the capacity to innovate their business models as much as their ideas and technologies [8].

2.2.2 Business Model According to Christensen

Christensen, in an article written with two other authors, says that reinventing companies depends on their business model. The authors of this article argue that good business models can reshape an industry and lead to spectacular growth [27]. The authors believe that there is a lack of definition and understanding of business models. They believe there are four components to a business model [27]:

1. The client's value proposition: what work will the business model solve?
2. The profit formula: this combines the income model and the cost structure.
3. Key resources: the key assets of the business model, human resources, technologies, products, key elements that will create value for the customer.
4. The key processes: the operational and management processes which make it possible to deliver value to the customer such as the sales process, the manufacturing or financing processes.

The authors present their business model according to **Fig. 2**.

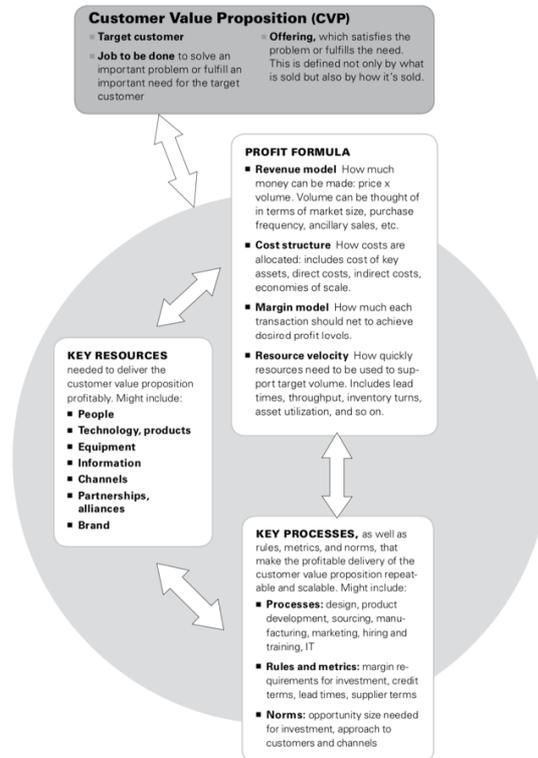


Fig. 2. Christensen business model

The authors emphasize that the new business model must inevitably meet an unmet need or the work of a client that has not yet been resolved. We believe that the elements of the Christensen model are a good complement to the Chesbrough business model.

2.2.3 Business Model According to Osterwalder and Pigneur

Here is how Osterwalder and Pigneur define a business model: “A business model describes how an organization creates, delivers and captures value.” [21]. We find that the business model canvas is a tool that will allow us to design and present our collaborative business model. Section 4.2 presents each of the nine blocks making up the canvas.

There are a few patterns regarding business models. The long tail pattern seems to be interesting for our project, since it consists in selling less and in smaller volumes, but more frequently [21]. This model focuses on selling niche products to a targeted market [21]. The book publishing industry has used this model, formerly publishers were targeting large volumes to a very large market. Today, we see the emergence of a platform where publishers focus on small volumes offered to a niche market [21]. Another interesting pattern is the multi-sided platform. This brings together different

groups of customers. A valuable platform for a group of customers is defined only if the other groups of customers are present [21]. We can observe the network effect through this pattern, the more people are on the platform, the more it will offer value [21]. An example of this pattern is Google's business model, it uses the keywords entered by users for free, in order to sell them by auction to advertisers or marketing people so that their advertisements reach the greatest possible number of people [21]. A sub-pattern of the multi-sided platform is freemium. This model offers a basic service free of charge and a premium paid service [21]. Users paying for the premium service must at least cover all costs related to this business model [21]. The last pattern that seems interesting is the open business model, which translates into organizations creating and capturing value by collaborating with external partners [21]. This model can take mainly two forms, outside-in by using the external ideas of the company or inside-out by using the internal ideas of the company [21]. This model brings new concepts and new perspectives. With this model, the organization is no longer forced to hire the most qualified resources in the field, it can collaborate with external resources [21]. The notion of control over innovation is also set to change, formerly companies wanted to control their innovations. With this model, companies can acquire the innovations of competitors by purchasing IP rights, for example to freely use a technology [21]. Otherwise, it is also possible to sell the innovations, in order to be profitable to the global market [21].

In the design of a business model, it is important to know your epicenter to determine where the transformation of the business model will come from. Models can be driven by resources, by value supply, by customer segments, by costs, or by more than one of these centers at the same time [21].

2.2.4 Collaborative Business Model

We note that business models, the collaborative economy and business as a service models are increasing in the following sectors: accommodation, transportation, home supplies and designer clothing [25]. The typical structure of the collaborative economy is to connect thousands of suppliers and customers through a technological platform [16]. We find some examples of collaborative business models such as Airbnb for accommodation, Lyft or Uber for transportation, Eatwith for social dinners, 1000tools.com for rental of tools between members, SnapGood for household supplies [16, 26]. Formabilio is an example of a collaborative business model in the furniture manufacturing industry who was the link between SMEs, designers and customers [6]. Unfortunately, this company no longer seems to be in operation since its website is no longer accessible. We can observe in those specific cases, Airbnb as an example with accommodation or Uber with transportation, that this kind of collaborative business work well, specifically because they were well designed. We can see in those cases that the service provider and the customer are well connected via a platform. It would be interesting to see how the model can be applied to a cluster of manufacturing SME. We also note that this model is not a trend in the manufacturing sector, which represents an opportunity for us.

Creating an open or collaborative business model presents certain challenges. A high level of interdependence between the focal enterprise and the other players will result in a lower probability of BMI [2]. A lower level of heterogeneity in terms of incentives between the players concerned will increase the probability of BMI's success [2]. Finally, the greater the number of changes to a BMI for the actors involved, the less likely it is to succeed [2].

An important aspect that is often overlooked is the exchange of knowledge. These, the more they are exchanged within the network, the more the network has chances of success [2]. In addition, we note that rather than going towards contracts and lawsuits, it is a guarantee of success than moving towards trust, reciprocity, sharing of rich information [2]. This should be a huge incentive for the creation of our collaborative business model.

For Boons and Lüdeke-Freund, they claim that a business model, from a sustainable development point of view, consists of four components: the value proposition, the supply chain, the customer interface and the financial model [3].

The authors make connections between collaborative business models and vehicle or bike sharing. From a sustainable development perspective, the authors argue that each pillar of government must be involved in order to offer incentives to encourage the use of the collaborative model [9]. According to our project, we could ask the government to have incentives in the form of tax credits for participants in our project.

We note that it is possible for SMEs to benefit from the collaborative economy. According to an article on knowledge in a business network, here are some of the possible benefits [5]:

- Use assets effectively
- Increase the quality of goods or services to customers
- Reduce product development time
- Reduce expenses
- Reduce the risk of failure for the development of a new product
- Increase internal capacity

These are important selling points when we are at the stage of presenting the collaborative business model.

We note that according to an article on the circular economy, the social context and culture are important aspects that affect the success of a business model [15]. In addition, new consumption habits must create new business models by promoting sharing, sustainable development and ecology [15]. For us, apart from ecology, the other two components should be used in the formation of our collaborative business model.

3 Problematic

3.1 Need for Collaboration Between Companies

Within the framework of this project, we will use the case study of the Quebec aerospace cluster. An important aspect of this cluster is its supply chain, see **Fig. 3**. The

principals are at the top of the chain, these are the companies that assemble complete aircraft or engines, while the Tier 4 company is at the bottom of the chain and is responsible for supplying the raw materials to it [19]. Before the 1990s, each client could interact with each of the different third parties, whether it be a Tier 1 or a Tier 4. After the 1990s, a change of mentality took place and the objective was to reduce the number of suppliers to principals [19]. The supply chain offered a model where the OEM did business with Tier 1 organizations, Tier 1 organizations with Tier 2 organizations, and so on.

Not all OEM companies have adopted this change in their mentality since its appearance in 1990, which means that some of them are still going through this change today [19]. They are also concerned that with increasing orders from airlines, the supply chain may not be sufficiently strong to meet demand. Among the effects noted, we observe that the OEM and Tier 1 wish to reduce the number of suppliers. They want to outsource certain operations that were formerly carried out inside their facilities. The supply chain is currently short of Tier 2 companies, which means that it is under-supplied in response to demand. In terms of SMEs, resource needs are becoming more specialized and labor retention is also an issue. The Quebec aerospace cluster companies must collaborate to ensure their survival.

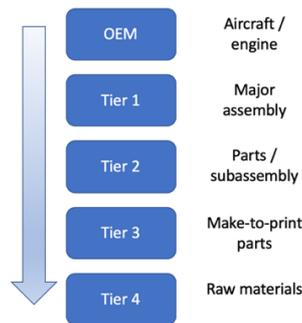


Fig. 3. Aerospace supply chain

3.2 It Is Time to Improve the Aerospace Supply Chain

The aerospace cluster is doing a good job. We are proposing to improve it and make it even more effective by promoting collaboration within it. From our readings, we observe some challenges related to the design of a collaborative business model during cluster operation. The competitive culture in the manufacturing sector and the trust between members are two important challenges who need to be considered within the design of our collaborative business model.

There is a lot of literature on the design of business models within the framework of a single business however, it is difficult to find any on the formation of a group of companies. The formation of this grouping based on collaboration brings other challenges. The grouping will undoubtedly promote innovation through collaboration, this implies that IP will be generated. We can consider the contribution of artificial intelligence during the realization of the project. Taking the collaboration through the sharing

of resources as an example, we also believe that it will be difficult to change the culture and mentality of stakeholders. It will be important to address these challenges when designing our collaborative business model.

4 Collaborative Business Model Proposition

In this section, we will present the methodology chosen to determine the basic models, in order to design the collaborative business model. We will then present the tool used, in order to represent the collaborative business model and we will end with the detailed presentation of the collaborative business model.

4.1 Methodology to Choose Base Business Model

For the design of the collaborative business model during a cluster operation, we will start with an idea of generation phase where we identified the most popular business models. We started with a list of the 20 most used business models. [22] We used the following criteria to refine the list of business models:

- Collaboration: the business model must promote collaboration
- The level of application of the business model in service mode
- The level of trust generated by the business model
- The scalable level of the business model
- A certain level of innovation

We finished with a list of ten business models that may be useful in designing our business model. The table of business models and scores can be found in **Table 1**. The business model with a score of 4 or more will be used to help us design our collaborative business model.

Table 1. Scoreboard business model first sorting

Business models	Collaboration	Service applicable	Reliability	Scalable	Innovation level	Score
Affinity club	1	0	1	0	0	2
Brokerage	0	1	0	1	0	2
Bundling	1	1	1	1	1	5
Cell phone	0	1	0	1	0	2
Crowdsourcing	1	1	1	1	1	5
Disintermediation	1	1	1	1	1	5
Fractionalization, Fractionalized Ownership	0	0	1	0	0	1
Freemium	1	1	1	1	1	5
Leasing	0	1	1	1	1	4
Low-touch	0	1	1	1	1	4
Negative operating cycle	0	1	0	0	1	2
Pay-per-use	1	1	1	1	0	4
Razor and blades	0	0	1	1	0	2
Reverse razor blades	0	0	0	1	1	2
Reverse auction	0	1	1	1	1	4
Product to service	0	1	0	0	1	2
Standardization	1	0	1	0	0	2
Subscription	1	1	1	1	1	5
Vested Outsourcing	1	1	1	1	1	5

We designed the business model using the Osterwalder and Pigneur business model canvas, in order to properly represent the collaborative business model on one page. This model was designed iteratively by conducting interviews with our research director, Mr. Gardoni, the vice-president of innovation and infrastructure at the industrial partner, Groupe Meloche and others key people of the Quebec aerospace cluster. We used the literature on business models, as well as the book Business Model Generation to design the business model [21].

4.2 Tool Presentation

The most commonly used tool for representing a business model is the Osterwalder and Pigneur business model canvas found in **Fig. 4**. This model proposes the representation according to nine blocks that involve the pillars of a business model that we will briefly present one by one.

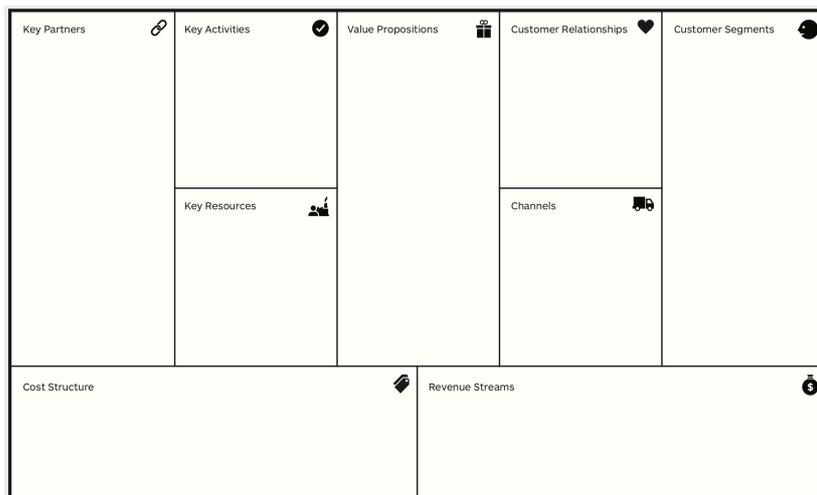


Fig. 4. Business model canvas

The value propositions is the core of the framework which is the heart of the business model. This value proposition offers problem solving and meeting customer needs. The value proposition can be perceived from the customer in a quantitative way, for example cost, speed of service or qualitative, through customer experience or design [21].

The customer segments are defined as the customer that is served by the organization. These are separated according to different needs, distribution channels or type of relationships. The customer segments can be a mass, a niche or a diversified type [21].

Channels are characterized as a method to deliver the value proposition to customer segments. Intimately linked at the marketing level, the channels can be direct, for example by organizing an online sales site or indirect by distributors. There are five phases linked to channels: awareness, evaluation, purchase, delivery and after-sales [21].

The customer relationship is the link between the organization and the different customer segments. This begins with the acquisition, retention and promotion of customers. Relationships can take many forms, personal assistance, communities, or co-creation to name a few [21].

The revenue structure is defined as a value proposition successfully delivered to customer segments. We can distinguish two possible income structures, transactions, linked to single payments per user, or recurring revenues which are payments linked to recurring value proposition transactions. The revenue structure can take the form of pay-per-use, rental or licensing. There are two mechanisms for determining prices: fixed, by a price list or dynamic, by negotiation or auction [21].

The key resources are the assets that will be used to deliver the items listed above. Key resources can take physical form like infrastructure or factories, intellectual like patents or other IP rights, or financial like bank loans or stocks. [21].

Key activities are carried out by key resources, which can take the form of production of goods or services, problem solving, a platform or even a network [21].

The key partners are those who will carry out the key activities that will be outsourced by the organization. We can distinguish four types of partnerships, strategic alliances between non-competitors, cooperation, alliances between competitors, joint ventures or buyer-supplier relationships. We can also observe three motivations for forming partnerships, namely savings linked to volumes, risk reduction and the acquisition of specific resources [21].

The last block is the cost structure which totals the costs related to the entire business model. Costs must obviously be kept to a minimum, in order to facilitate the profitability of the organization. There are two main structures that are driven by costs or by value [21].

4.3 Business Model within the Canvas

After meetings with our industrial partner, people in the industry, as well as our research director, we carried out four iterations of the collaborative business model. Of these four iterations, we were able to refine just one to get a collaborative business model. In our case, the model would be implemented by a focal company who will have to put more effort and involvement than any other members of the group. We established from the outset that one of the key activities of the business model will be the implementation of a peer-to-peer trading platform that will link supplying and consuming businesses. The model is shown in **Fig. 5**.

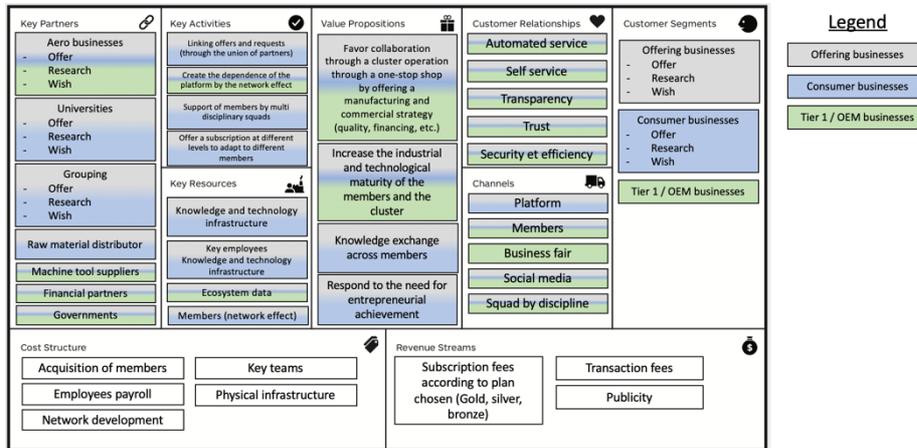


Fig. 5. Collaborative business model

The collaborative business model is based on four value propositions.

1. Encourage collaboration through a cluster operation with a unique counter by offering a manufacturing and commercial strategy. We can take the example of a quality or a commercial structure who would be shared by a mature member to another less mature member.
2. Increase the industrial and technological maturity of the members and the cluster. We can think of the accompaniment of a less mature member by a mature member on a given technology such as cyber security or automation. These technologies would be good subjects to be transferred from one member to another. We can also note that the accompaniment can be applied in different business processes such as marketing or manufacturing.
3. Exchange of knowledge through members. We can think that the exchange of knowledge will be as much at the technical level as commercial or at the level of business processes.
4. Respond to the needs of entrepreneurial achievement. According to our findings, we found that most of the SME owners were aging or that the next generation was not well prepared for the transition. We can think of an example of a franchise where the focal company would acquire the business for sale and position a person at the head of it and allow him to pursue an entrepreneurial dream.

About the customer segments, we have divided the companies concerned into three: the offering companies, the consuming companies and ultimately we would like OEM and Tier 1 companies to be able to interact on the platform. These three customer segments will be able to put opportunity cards such as offer, research, wish or informative cards on the platform. We will further see what are the opportunity cards and their different types.

As mentioned above, one of the key activities of the business model is the implementation of a peer-to-peer trading platform. This will link customers and providers. The tiles eventually added to the platform will be called opportunity cards. On the platform, members will have the possibility to choose what type of card they want to add between offer cards, such as an offer of a project or an availability on equipment. Then, we will find the research choice, where members can search for any type of object. The wish cards is where members can express their wish for example to start a project related to a certain type of technology. The last choice, the informative card, could inform the members about good news and different challenges, so everyone stay well informed.

Partners are also an important part in achieving the collaborative business model. We note that aerospace companies from different tiers will have an absolute impact. We find universities that often have key skills for SMEs. Subsequently, we can think of regrouping whether it be Aéro Montréal or the CRIAQ. Distributors of raw materials may also have an impact, for example by offering discounts to members of the group due to the achievement of critical mass. Equipment suppliers could also offer discounts on base prices. The financial partners will also be a great help since sometimes the grouping does not work due to a lack of funding [18]. Banks dedicated to entrepreneurs like the BDC or the FTQ fund could be potential partners. The government could also be a partner of choice, which could offer tax credits to member companies of the grouping who would carry out collaborative projects of two or more companies.

Regarding the relationships with the different customer segments, we are looking forward to be able to offer secure, efficient and ultimately automated relationships with the help of artificial intelligence. For channels, we offer the platform, the members of the grouping as well as social media. One of the key activities will be to link the different customers and providers. We also offer a personalized subscription depending on the level of involvement of the group member. In terms of resources, we note that the data from the pool will be important as well as the knowledge infrastructure.

The level of collaboration will be evaluated by certain criterias. We will track the number of collaborative projects and meetings created. We will also track the number of opportunity card of any type placed on the platform during the experimentation phase, which will allow us to evaluate the card's success rate and the waiting time before a card get assigned.

The level of performance will be evaluated with the criterias previously announced. From those criterias, we will put quantitative bracket to be able to track the performance of the collaborative business model. Before the experimentation phase begins, we will decide if the bracket will be measured in percentage or in number. At the end of the experimentation phase, we will evaluate every criterias and observe the different gap.

So far, we have not focused on the cost or revenue structure. We can however assume that the employees as well as the expenses related to the acquisition of members will be part of the costs. We note that subscription or transaction fees may be part of the revenue structure.

Even if we are at an early stage of our research project, here is the methodology that we think we will use for the project. We will try to find quantitative criterias that will

help us to evaluate the collaboration throughout the experimentation phase. We will then choose a platform that will be suitable for our research project. We will have bi-monthly meetings with the industrial partner to have a close look at the project progression which will allow us to address issues and solve them quickly. We will conclude the experimentation phase by interviewing the industrial partner, in order to get his feedback and to be able to adjust the collaborative business model according to the experimentation phase. We will validate the collaborative business model with some key people outside of our project from different enterprise size. We will conduct interviews with these people to question them about our collaborative business model. To conclude the validation phase, we will adjust our model based on the comments that we received from the interviews.

Conclusion

This article context is based on the problem of the aerospace supply chain of Quebec in term of collaboration. We propose to develop a business model with the framework of the business model canvas, in order to stimulate collaboration. One of the key activities of this collaborative business model will be the implementation of a peer-to-peer trading platform that could link the offering and consuming companies. The collaborative business model will allow the capacity of the aerospace supply chain to be increased, to allow a full use of resources and more efficient collaboration between members of the group. In the next articles, we will discuss the experimentation phase, as well as the validation of the collaborative business model.

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