Structuring SMEs Collaborations Within a Cluster

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Abstract. Innovation is not limited to products and services; it is also used in a company's processes such as interactions with its environment, i.e., open innovation. According to our research, there are few approaches to effectively enable and support collaboration between manufacturing companies, even if they are in the same industrial cluster. We selected a platform to structure collaboration between companies, based on a business model framework. We tested this platform with two partners in the Quebec aerospace cluster that knew each other. To evaluate the collaboration, we identified the criteria to quantify collaboration effectiveness, such as the number of topics or projects discussed, the number of meetings created or the success rate of the knowledge exchange. Experimentation was carried out over five months, with detailed observations of collaboration's evolution. This platform initiated several collaborations between the two partners and increased the partners' technological knowledge maturity. However, several obstacles, such as difference of vocabulary and intellectual property exist and hinder communication. These could become troublesome when partners who don't know each other. Resolving these difficulties is the purpose of our future research.

Keywords: Collaboration · Platform · Knowledge exchange · Open innovation

1 Introduction

In today's environment, collaboration is a key aspect of business survival [5]. Collaboration can take several forms such as resources, manufacturing or business processes sharing [12]. Collaboration and open innovation can be beneficial and are already used in few industries such as technology, energy, and accommodation. However, the capacity of a firm to open up to innovation processes is determined by the firm itself and not by its operating market [22]. Manufacturing industry, specifically aerospace could benefit from more collaboration. One question emerges: how to structure collaboration between firms in the same cluster? Literature presents few tools to structure collaboration within the manufacturing industry even less in cluster-based sectors such as aerospace. According to our research, setting up a platform can foster collaboration [14]. Platforms and open innovation use innovation to create value and increase firms' competitiveness [14]. Few

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literatures present business exchange platform. Its objective is to support collaboration between manufacturing firms in the same cluster. First section will present state of the art on collaboratives models linked to open innovation. Second section will present the pre-experimentation with the platform and the industrial partner's choice, and the collaboration's criteria to assess the platform. Third section will present the methodology and the monitoring method, and the collaboration's criteria results. The last section will present points to improve, strengths and project benefits.

2 State of the Art

2.1 Collaboration Needs Between Companies Operating in the Same Cluster

Collaboration between manufacturing SMEs is difficult mainly because the competition minding is deeply embedded [15]. Competition's rules are changing, innovation cycles are getting shorter, managers must learn to collaborate more efficiently [9]. Firms strategics activities such as research and development and innovation are usually done within the firm itself, with minimal external intervention, this minding is outdated [10, 21]. Nowadays, human resources are volatile, firms cannot afford to innovate on their own [32]. SMEs facing a lack of resources make them more open to collaborate [32]. Collaboration between SMEs can increase their market competitiveness [24].

The project was conducted within the Quebec aerospace cluster, which regroups manufacturing SMEs. SMEs are more agile, innovate faster and react quicker to solve problems but they often lack resources [21]. Firms have reciprocal benefits operating in cluster, such as stimulate innovation by having suppliers, universities, and SMEs to collaborate creating new knowledge and sharing technologies infrastructures [8, 21, 26]. Easier access to resources and an efficient diffusion of the best practices are other benefits [26]. Group's ability to solve problem is better than the members alone [23]. Literature presented above suggests that collaboration is difficult between manufacturing firms but can bring major gains.

2.2 Collaboratives Models

In recent years, collaboratives models have been changing as the collaborative economy and business as a service model increased in these sectors: accommodation, transportation, and home supplies [30]. Lyft or Uber for transportation sector and SnapGood for household supplies are some examples [19, 31]. Collaborative economy's structure is to match suppliers and customers through a platform which make collaboration easier [19]. These examples can be used as starting point to support collaboration between firms. Successful platforms share online collaboration characteristics such as common goal's pursuit between participants [13]. Manufacturing sector's collaboration is not widespread. Formabilio is a collaboration example between manufacturing firms. One of its objectives is to link furniture manufacturing SMEs, designers, and customers [5]. Using this as a foundation, our first paper proposed a collaborative business model for same-clustered manufacturing firms. Designing this model, we took in consideration that more exchanges within the network, more the network have a success chance [2]. A

key feature while creating our model was trust and reciprocity, two pillars to sharing rich information [1, 9, 15, 17]. Our model sits on four value propositions presented below. The first three values propositions will be addressed in this paper [27]:

1. Foster collaboration by a unique counter offering a business strategy.
2. Increase industrial and technological maturity of the members and cluster.
3. Fostering knowledge exchange between the members.
4. Respond to an entrepreneurial achievement need.

These value propositions can provide benefits to SMEs such as effective assets' use, development time and expenses reduction [4]. Literature suggests that collaboration is crucial to firms' survival, but only few articles present options to support it.

2.3 Open Innovation Materialized with a Digital Platform

Two types of knowledge exchange define open innovation: outside-in and inside-out. Outside-in is defined as: opening innovation processes to external firms. Inside-out is defined as: allocating developed knowledge, not used it internally, to the outside of the company thus others can use it [6]. Open innovation's future will be more collaborative and include more participants [6]. Literatures suggest that open innovation is less used in SMEs. SMEs face various challenges to acquire external knowledge such as organizational structure, culture, financial resource's availability, collaboration's costs, and intellectual property right management [12, 16, 28]. Long term, external technology acquisition will be a necessity for companies to remain competitive [22]. Literature also suggests that collaboration between firm can be improved using a platform [13, 19]. Platforms can facilitate collective ideas' development between partners utilizing external knowledge by giving a common interface to innovators to interact [16, 29]. A study of 254 platforms shows that digital platforms can be found under different categories: sharing, new and used item purchased, lease, donation and borrowing [13]. Platforms facilitate peer to peer business by sharing assets or services [19, 31]. Firms that own the platform play a vital role, such as coordinate partners and favoring value creation by sharing knowledge and resources [14]. Leader's platform position will be reinforced if the partners activities are complementary from one to another [14]. Both types of open innovation are experimented in this project. Literature suggests that platform can support collaboration between firms. The platform leader has an important role in its success. However, there is limited literatures on manufacturing firms that collaborate through a platform.

3 Pre-experimentation Phase

3.1 Selection of the Platform

Few platforms were available to support collaboration and implement our collaborative business model. The main feature is the use of tiles, called opportunity cards and they are used to support collaboration between the partners. Four types of opportunity card are

available on the platform: wish, research, offer and information. Cards are also labeled according to categories: business, production, knowledge, or technological watch. The card's title and owner can be found on the card. Some platforms already available can be studied. The platform has to be flexible and must allow more execution and less administrative requirements. It must also facilitate communication between participants. The platform facilitates agile management. The evaluated platforms are an Excel file, a web portal development, a Trello board and a Smarsheet table. To select the more suitable platform for our application, we used six quality criteria. The criteria were adapted, initially they were used to evaluate e-learning platform [25].

1. User experience: the platform is easy to navigate.
2. Communication: the platform has email, chat and other communication options.
3. Availability: the platform is available for free and run with few plug-ins.
4. Content management: the platform makes it easy to track cards and their progress.
5. Administration: the platform makes it easy to manage members and their rights.
6. Accessibility: the platform can be consulted from any browser.

To these criteria, five-point Likert scale was added, strongly disagree had a value of 1 and strongly agree had a value of 5. Scores have been assigned by project's members. Each platform has their pros and cons: Excel table has few communication's options. Web portal will be costly to design and make it usable. Trello offers options to communicate but does not offer a user right management feature. Smartsheet is similar to Trello, but its navigation is more complicated. After the criteria analysis, Trello will be used for experimentation with the higher score of 23 on 30. Figure 1 present the different scores for each platform.

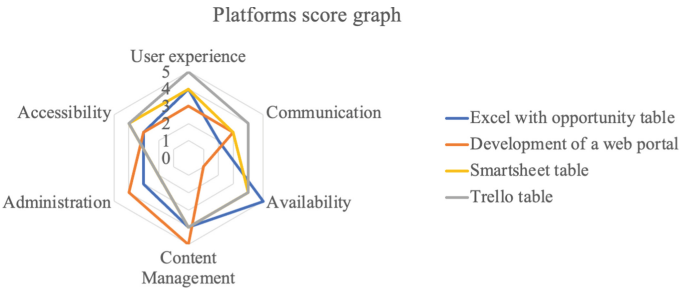

Fig. 1. Platforms score graph

3.2 Industrial Partners

The two Quebec based partners are Groupe Meloche Inc and APEX Precision. Groupe Meloche works in aerospace since 2008 and supplies structural and aircraft engine parts to Tier 1 companies. APEX Precision specializes in metal transformation and products assembly such as aerospace. The partners choice can influence collaboration's quality

and efficiency. Partners were motivated to collaborate, to increase their maturity, to solve problems quicker and to perform knowledge exchanges.

3.3 Presentation of the Collaboration's Criteria

The collaboration's criteria were chosen to evaluate experimentation's success. Each of them will be presented and a summary table presenting minimum and maximum targets will follow. The number of collaborative projects created, or themes addressed quantify the interest level and allow to see if any discussions are initiated on a card. This criterion is independent of meetings created. Projects created can be discussed in follow-up meetings. The partners can have discussions on a card without having a knowledge exchange. This criterion's score will increase by one point if the partners have a discussion on a card. The number of meetings created quantifies the number of meetings between the partners generated by this project. The score will increase by one every time the partners have a meeting triggered by the project. Independent meetings won't be counted. The number of cards describes the number of cards added on the platform. This criterion's score will increase by one every time a card is added. The rate of a card knowledge exchange success represents the discussion about a specific card which lead to a knowledge exchange between partners. The knowledge exchange is qualified by a transfer of information from one partner to the other, which can be oral or written. The score will increase by one in case of knowledge exchange. The rate of a card success quantifies whether the knowledge exchange previously described has been beneficial by the receiving partner. In that case, this criterion's score will increase by one point. The waiting time of a card quantifies the time until a card is assigned to a partner. This criterion aims to determine whether partners are active and consult the platform. The attribution date minus the deposit date will be defined has the card's waiting time. Table 1 presents each criterion with minimum and maximum targets. The targets' criteria were established by the project's members during an iteration process.

Table 1. Collaboration's criteria minimum and maximum targets

Collaboration's criteria	Min. target	Max. target
Collaborative projects created or themes addressed	3	9
Number of meetings created	6	12
Number of cards	12	24
Rate of card knowledge exchange success	50%	75%
Rate of card success	25%	50%
Waiting time in days of a card	14	21

4 Experimentation Phase

4.1 Methodology and Monitoring

The experimentation phase will be performed with internal validation using a real case. The objective is to support collaboration between the partners presented above. Phase's duration was of five months. Meeting's frequency was established to one meeting every two or three weeks, but various factors influenced its frequency. More meetings were held at early, middle and closing stage. At least one partner's member was required every meeting. During meetings, the first point was validation criteria's review and monitoring graphs' analysis. Active card's review was also conducted, any development or additional information's need were discussed. At this stage, decision to involve technical people on a specific card was made. New cards were discussed to confirm an equal partners' comprehension. The fourth point was the blocking points, which could slow the progress. These blocking points were addressed, and an action plan was established. The improvement points were the penultimate meeting's point. They were divided into two categories: improvements applicable now or applicable in a future phase. The following points were the next steps, the questions, and the varia point.

4.2 Collaboration's Evaluation

Table 2 presents the experimentation's results by criterion with their minimum and maximum targets. The number of collaborative projects created, or themes addressed is beyond the maximum target. The criterion's evolution shows that it is directly related to the meetings between the partners. Information's exchanges took place mostly in the meetings, which shows that they are inevitable in knowledge exchange. The number of meetings created is between the targets. A meeting took place every two or three weeks. The meeting's frequency was decisive in the knowledge exchange between the partners. The more meetings were held in the project, the more knowledge exchange between the partners was happening. The number of cards is within targets. The cards put on the platform were considerably higher at the beginning. Both partners had many wishes, information to seek, to offer or to share at this stage. Card's addition on the platform is independent of having meetings. This means that the platform was used even though there was no meeting scheduled. The rate of card knowledge exchange success is a bit over the maximum. The knowledge exchanges began around week five. A correlation between knowledge exchange and cards' number was observed. When many new opportunity cards were created, knowledge exchange's level decreased until subsequent meeting, since it was performed during meetings. The rate of card success was evaluated only at the end of the experimentation phase to gather as much information as possible. The criterion's result is a bit over the maximum target. The last criterion evaluated is waiting time in days of a card which is beyond the maximum. This criterion is less suitable for the project. Only two partners participated in the project, every active cards were reviewed during the meeting, independently if the card was assigned or not. However, if the number of partners on the platform grows, this criterion will become more important.

Table 2. Collaboration evaluation's criteria results

Collaboration's criteria	Min. target	Max. target	Result
Collaborative projects created or themes addressed	3	9	20
Number of meetings created	6	12	10
Number of cards	12	24	24
Rate of card knowledge exchange success	50%	75%	83%
Rate of card success	25%	50%	53%
Waiting time in days of a card	14	21	21,58

5 Feedback on the Experimentation Phase

5.1 Improvements Points

To increase collaboration's quality, one aspect to improve is communication which is the cement of innovation [18]. Knowledge exchange happened because of the partners' interactions, and these are related to creativity and innovativeness [3]. The two main communication channels were emails and bi-monthly meetings. The vocabulary used by the partners was different which made the communication harder. Adding live chat, video calls, an expert's contact list, a term lexicon on the platform would be good options to improve collaboration and communication's effectiveness. In contrast, communication overuse may cause platform's participants creativity to decrease [18].

Intellectual property rights are another aspect to improve while using the platform. Separate intellectual property rights already owned from the partner from those which are created by the partners is important [1]. Patent can be used as a tool to promote collaboration between firms [7]. In this project, the exchanged information's was not sensible. Involving more partners on the platform to create new knowledge implies to exchange sensible information, causing intellectual property rights to become a major problem. Gassmann and Bader knowledge area for managing intellectual property right model would be a good foundation by presenting background, side ground and post ground knowledge areas throughout a collaboration timeframe [11]. Using Trello, it was impossible to set a confidentiality's level, so that the confidential cards were only seen by people who had access to it. In our case, confidentiality was not a problem since only two partners were involved. Again, involving more partners, confidentiality would become an issue. Having a list of the card's visitor would represent a good addition to track card's history. The addition of filters by partner, by projects or card confidentiality's level would be beneficial for collaboration.

The reciprocal trust between partner allows them to share their strengths and weaknesses. Again, more partners using the platform could create trust issues. An important aspect to keep in mind is that we want to support collaboration between firms through human interaction, which is a very important collaboration's factor. Setting up acceptance criteria for new platform partner can mitigate this point. The criteria could cover soft and hard skills to accept a partner. For larger companies, it may be more challenging to join this type of platform. Organizational structures will have to change and adapt

to promote collaboration and make it more efficient [9]. Dedicating a person to support collaboration in their organization is an option. Their tasks would be to create connections between outside knowledge and to apply it inside and vice-versa. Some card's related functionalities can be improved to support collaboration between the partners through a platform. Adding more details in the card, such as a precise question or problem to be answered and make a better attachment's use would also be beneficial. These improvements will allow the partners to respond to an opportunity card more effectively and have a faster and more efficient exchange of knowledge. Making this platform scalable and increase partners' number will lead to exponential new knowledge creation. Consequently, the platform value will increase [14].

5.2 Strong Points

The platform's manager plays a vital role in its success and this project confirms it. The platform leader oversaw meetings planning, updated the platform and the cards and kept the participants in line with each other. As a result, more meetings took place with this project than without it. The meetings helped support collaboration. The two partners knew each other before, which helped to support collaboration. Partners belonging to the same industry and with similar issues also helped the collaboration. Their company's profile and their openness to collaborate, even if they are sometimes competitor, also helped supporting collaboration. Participant's personalities that collaborate must be compatible to have a successful collaboration. This project showed that the partners' interactions and their capacity to build trust between them directly impact the collaboration's result. The partner's and their technical expert's availability and exchanged information's level remain strong point. The platform's choice also seems to be a strong point. From the 6 criteria used to choose the platform, 4 of them helped support collaboration. On the other hand, communication and administration criteria slowed collaboration. In general, the platform was suitable to support the collaboration between firms.

5.3 Project Benefits

On the industrial side, this project made two same-clustered firms to collaborate. Through a platform, this project has shown that opportunities to collaborate were multiple and increased shared opportunities between partners. Knowledge exchanges' subject were various, business processes, manufacturing processes, human resources or market trend were among them. The partners also increased their businesses and manufacturing maturity faster by accessing to additional knowledge, which would have not been possible without taking part in this project. The firm's culture is usually an aspect that can slow down collaboration [9]. In this project, both partners promoted the same culture, which facilitate the collaboration [20]. On the academic side, this article demonstrated that is it possible for SMEs to use open innovation through a platform. Setting up a platform enhanced knowledge exchanges and increased the members' maturity. Collaborative business model shows that it is possible for firms operating in the same cluster to collaborate. This project reinforces literature on the fact that platform leader, culture, and partner's availability are key features to a successful collaboration. This paper suggests a platform to support the collaboration in the manufacturing sector between same-clustered

firms. It contributes to the literature on collaboration between SMEs. It also suggests 6 criteria to determine collaboration success through a platform.

6 Conclusion

This project's objective was to demonstrate whether it is possible to structure collaboration between same-clustered firms. Indeed, we selected a platform which improved collaboration and communication and we evaluated them according to 6 criteria. Open innovation played a key role supporting collaboration between firms. Platform leader's implication, firms' culture, and availabilities have contributed to support collaboration. Partners' number and project's duration represent some limitations. This project was also limited by its operating environment, the Quebec aerospace cluster. In terms of future perspectives, including more firms from different size and looking at their interactions represents an opportunity. Developing tools to encourage communication and trust between partners would also be beneficial. Firms' collaboration effectiveness and compatibility would also be a helpful tool to develop. Intellectual property rights management between partners operating in the same cluster and collaborating is also a future perspective.

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