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# **Establishing relationships with distant suppliers to explore discontinuous innovation**

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## **ABSTRACT**

A controversy exists in the literature regarding the type of suppliers to consider when leveraging external knowledge in order to explore discontinuous innovation (DI): familiar suppliers or distant ones. We argue that in pursuing DI, firms need to establish relationships with distant suppliers on cognitive and relational dimensions and that it requires a specific process. Based on a longitudinal study of a firm that developed such relationships and succeeded in exploring DI, we underline how firms can develop such relationships through an approach having three main characteristics: (i) building a documented mapping, coupling the concepts and their underlying technologies with the potential suppliers providing and mastering such technologies, (ii) having a structured and transparent process, supporting a mutual and progressive commitment and (iii) dedicating a specific entity separate from the rest of the and in the same time, connected to the experts that master the internal knowledge that will be combined with the external knowledge leveraged and to the top managers that will take the decisions regarding the further development of the opportunities of DI explored. By cooperating with distant suppliers simultaneously with the familiar ones, firms can achieve ambidextrous sourcing enabling an ambidextrous organization that pursues incremental and DI.

### **Keywords:**

Discontinuous innovation; early supplier involvement; distant search; open innovation; exploration; ambidextrous organization.



# **Establishing relationships with distant suppliers to explore discontinuous innovation**

## **Introduction**

In innovation driven competition, leveraging external knowledge and innovation capabilities is crucial (Quinn, 2000; Chesbrough, 2003; Enkel, Gassmann and Chesbrough, 2009; Gassmann, Enkel and Chesbrough, 2010; West, Salter, Vanhaverbeke and Chesbrough, 2014; Weiblen and Chesbrough, 2015). Several authors such as Laursen and Salter (2006) show that suppliers are one of the most important external sources of innovation. However there is a controversy about the type of supplier to partner with when pursuing innovation that requires a shift in the market and/or the technology: discontinuous innovation (DI) (Bessant et al., 2006). This type of innovation is highly risky and is associated with strong uncertainty. Some authors (Petersen et al. 2003; Ryu et al., 2007; Zirpoli and Becker, 2011) suggest that DI require leveraging knowledge from a selection of close, trustful and familiar suppliers, whereas others (Mukherji and Francis, 2008; Gassmann, 2006; Phillips, Lamming, Bessant, and Noke, 2006b; Schiele, 2010) claim that DI require leveraging new knowledge from new suppliers distant both on the cognitive (technological) and the relational dimensions. We intend to focus on the second option and the specificity of processes leading to such relationships. Thus we aim at bringing a novel analytical perspective to this controversy.

Establishing relationships with distant suppliers, new to the network of the firm and mastering knowledge distant from the firm's one, while stimulating, raises critical challenges. The identification of such suppliers, their attraction and selection, the building of trust required when dealing with uncertainty are complex issues. Indeed, the firm does not know the suppliers and

does not have the required knowledge for this selection. In order to shed light on such a process, we undertook a longitudinal study in a firm that developed this kind of relationships and succeeded in exploring discontinuous innovation. Based on this study, we underline three characteristics that we argue are crucial in the successful development of these relationships which resulted in DI: (i) building a documented mapping, coupling the concepts and their underlying technologies with the potential suppliers providing and mastering such technologies, (ii) having a structured and transparent process, supporting a mutual and progressive commitment and (iii) dedicating a specific entity separate from the rest of the and in the same time, connected to the experts that master the internal knowledge that will be combined with the external knowledge leveraged and to the top managers that will take the decisions regarding the further development of the opportunities of DI explored.

The article proceeds as follows. We first present the literature on organizational learning and open innovation that deals with leveraging suppliers knowledge. Then we specify the gap in this literature that we intend to address. We then detail the methodology adopted to collect and analyze data and present the case, and more specifically the process adopted by the firm studied to build such relationships. Last, we characterize this process and discuss these characteristics in the light of the existing literature, stressing our contributions on building relationships with new and distant suppliers to explore DI and therefore achieving ambidextrous sourcing and organization.

## **Literature Review**

In this section, we will highlight the rationale for leveraging distant suppliers' knowledge when pursuing discontinuous innovation and the challenges associated based on the literature on organizational learning and knowledge. This section ends by highlighting the open questions related to these challenges that remain unstudied in this literature.

Literature on open innovation (Quinn, 2000; Chesbrough, 2003; Almirall et al., 2010; Enkel et al., 2009; Gassmann, et al., 2010; West et al. 2014) highlights the benefits of having access to a diverse set of knowledge and its positive influence on the innovation performance. Laursen and Salter (2006) point out that leveraging suppliers' knowledge is a source of competitive advantage. Johnsen (2009) suggests that the supplier selection and the supplier relationship development are success factors to leverage the supplier innovation capacities. Schiele (2010) stresses the different implications of various kinds of relationships with suppliers. Long term relationships with a set of selected suppliers sharing a long history of collaboration and trust have been extensively analyzed (Takeishi, 2001; Petersen, Handfield, and Ragatz 2003; Van Echtelt, Wynstra, Van Weele, and Duyesters 2008) especially in the automotive industry (Lenfle and Midler, 2003; Wynstra, von Corswant, and Wetzels 2010; Zirpoli and Becker, 2011). Schiele (2010) considers that this type of relationships should favor incremental innovation rather than discontinuous ones. Indeed, DI require a shift in the market and/or the technology (Bessant et al., 2006; Tidd et al. 2013; Phillips et al., 2006a) and therefore the exploration of new knowledge (Danneels, 2002). Adopting a network perspective, other authors (Hughes and Perrons 2011; Mukherji and Francis, 2008) show that strong ties can create a kind of convergence through which firms might miss future opportunities that emerge outside the bundle of their relationships with their suppliers whereas weak ties give access to novel information by bridging disconnected groups, enabling the development of DI (Dhanaraj and

Parkhle, 2006). Thus, Phillips et al. (2006b) suggest that short term involvements with suppliers from outside the usual realm of the firm's network, maximize its chances of discovering ideas outside of its own core discipline. This type of relationships designated as "*strategic dalliances*" by Phillips et al. (2006b) are rooted in a firm's ability to "develop a broad range of non-committal supply relationships that it can dip in and out of or dally with, in concurrence with its longer-term strategic partnerships". Before going forward, let's specify the notion of distance between the firm and the suppliers, as it is addressed in the literature.

To better characterize how close or distant a supplier is from a company, we propose to introduce the notion of knowledge distance as articulated by Li et al. (2008). They propose to apprehend the knowledge distance through the cognitive attribute, or the substantial content of knowledge. It refers to differences in (i) scientific disciplines (biology, chemistry, physics, electronics), (ii) technology fields (the knowledge of a firm in the electronic technology is distant on the cognitive dimension from the knowledge of a firm in the pharmaceutical technology), and (iii) the product market level (knowledge on market segments). Therefore, the supplier knowledge can be close to the firm's one on the substantial content (science, technology, or product market level) or distant to it.

Besides this cognitive dimension, another way to think about the distance relates to the relational dimension. Ahuja and Lampert (2001) highlight that a firm can search for new knowledge outside its network or inside it. Either the supplier is new to the network and hence the relation did not exist previously or it belongs to the firm's network and hence the relation is already established or can benefit from an indirect link and a reputation effect.

In the following, we will consider suppliers distant on the cognitive level (a different knowledge base) and on the relational level (new to the network).

Gassmann (2006) observes that cross-industry innovations are rarely studied in the literature despite their importance. We intend to address this gap.

Several authors stress issues faced when establishing such relationships. Afuah & Tucci (2012) highlight the hurdles associated with the distant search being the exploration of “alternatives on new and different technological trajectories or markets» (p.357). They show that the decision makers tend to conduct local searches: alternatives that are in the neighborhood of its existing position (Katila, 2002; Katila & Ahuja, 2002). Building on the search literature and on the behavioral theories of the firm, (e.g., Cyert & March, 1963; Dosi & Marengo, 2007) they explain this dominant behavior by the managers limitations— cognitive, resource, information, and time— as well as his history

In addition, distant search may lead to causal ambiguity because the large number of alternatives and the little understanding of their consequences make it more difficult to tell which alternatives result in what level of problem-solving effectiveness. Furthermore, distant search often involves experimentation, trial, error and failure. The solution suggested by Afuah & Tucci is to outsource the problem solving to a supplier belonging to another neighborhood and for which therefore the search will be local. This moves/displaces the hurdle ahead: how does the firm will identify, select and build such relationships with these suppliers is not addressed by these authors.

A second issue relates to the actor who will be in charge of the establishment of these relationships. The literature on supply chain management highlights that the purchasing and sourcing function masters such capabilities and provides crucial information about suppliers (cost, performance, market availability, quality, and reliability) (Burt and Soukup, 1985).

However, Johnsen, Calvi, and Phillips (2011) distinguish two types of sourcing teams: the one



involved in innovation (advanced sourcing) the other involved in operations. Schiele (2010) highlights that in order to interact fruitfully with suppliers during the innovation process, buyers should establish an advanced sourcing department as a distinct organizational unit, and endow this unit with support tools, such as technology roadmaps. This unit should be involved in innovation meetings so as to link the procurement strategy with the innovation strategy of the firm. Johnsen et al. (2011) propose the notion of early purchasing involvement (mirroring the early supplier involvement) to highlight the benefits of enhancing the dialogue between engineering and purchasing in the innovation process (Atuahene-Gina, 1995; Handfield et al., 1999; Nijssen et al. 2002). Thus a specific and independent unit thanks to its independence from the rest of the organization can identify new potential suppliers and progressively involve them in the innovation process.

Hence, the organization adopted by the firm to identify and establish relations with the suppliers has been emphasized as a critical factor. However the appropriate processes have not been delineated.

## **Research question**

The literature mentioned above, that value establishing relationships with suppliers from outside the usual realm of the firms and that master distant knowledge in order to benefit from their innovation capacities and explore discontinuous innovations, did not address the process the buyer should set up to build such relationships neither who will be in charge of such a process. We will address this twofold gap (how and who) because we the establishment of these relationships raises critical challenges.

We argue that establishing relationships with distant suppliers in order to explore discontinuous innovation requires a specific process because it raises several critical challenges especially during the early phases: opportunity identification and concept generation and selection. We intend to investigate such a process and outline its characteristics.

## **Methodology**

We analyze the approach undertaken by a firm that developed DI by collaborating with new and distant suppliers. We conducted a detailed longitudinal analysis of this approach. Such a qualitative and longitudinal method is appropriate, as little research has been hitherto undertaken on this how question. Such a method is widely adopted to generate theoretical insights (Galunic and Eisenhardt, 1996; Adler et al. 1999; Carlile, 2002; Jacobides and Billinger, 2006; Kellogg, Orlikowski and Yates, 2006; Loch et al., 2008).

## ***Research Setting***

Domauto<sup>1</sup> (a pseudonym) is one of the ten largest suppliers in the automotive industry. The multidivisional firm decided to enhance its capacity to develop discontinuous innovation on the powertrain scope and especially in fuel efficiency and emission reduction. The objective was to address these challenges in a radically distinct manner from the current technologies and components already commercialized. For that purpose, the firm created an independent and dedicated entity: the innovation platform (IPL). IPL is composed of a core team (a leader, a marketing, and a technical managers) and an extended team of eight people (marketing and technical representatives from the four divisions involved in the powertrain scope: transmission

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<sup>1</sup>In 2014, the sales are about 12,7 billions of euros, the R&D budget is about 6% of the sales, it has 6000 RD staff distributed in 60 research and development centers in the world.

systems, electrical systems, thermal cooling systems and engine control). Six years after the creation of IPL, several DI aimed at reducing fuel consumption were identified and prototyped. The majority was developed jointly with distant suppliers. None of the concepts formulated existed before in the firm's technical road maps. The solutions developed to embody these concepts were radically different from the offers of the competitors as well as from the typical components requirements of car manufacturers

To achieve such a renewal of the innovation portfolio, this entity developed a specific approach towards new and distant suppliers in order to involve them in the design of novel solutions. We undertook a detailed analysis of the process structured by this entity to develop such relationships with distant suppliers.

### ***Data collection***

Our data collection focused on the process adopted by the entity to identify and develop a collaboration with these suppliers. Data was collected over 6 years and was gathered from multiple sources: observations, interviews, presentations, internal reports and public information. It started with the launch of IPL. The authors attended IPL's meetings on a regular basis (lasting three hours on average). In addition, informal interviews took place with the meetings attendees and lasted one hour on average. Other interviews were conducted with senior managers (R&D, marketing, etc.) at the corporate and division levels and also with the suppliers. Furthermore, during these 6 years, the researchers met (2 hour on average) on a quarterly basis with the IPL leader (who did not change) to share feedback with him on the operation of the unit. This research design secured the access to fine-grained data over several years. We could

access to the documents issued and associated to these projects, and also gathered data thanks to 42 interviews of 90 minutes on average and 50 meetings of 3 hours on average.

### *Data analysis*

The case studied corresponds to a theoretical sampling (Eisenhardt, 1989): it was not chosen for statistical reasons but rather because it was particularly relevant to the research question. In line with the paradigm of inductive research (Miles and Huberman, 1994; Eisenhardt, 1989; Corbin and Strauss, 1990; Suddaby, 2006) our aim was to generate insights on the process developed by a buyer to establish relationships with distant suppliers.

As Langley (1999) states, the researcher who have chosen to “plunge itself directly into the processes themselves, collecting fine grained qualitative data-often but not always in real time- and attempting to extract theory from the ground up” often come up with messy data and face a constant challenge in making sense of them. One of the generic modes of analysis of process data she suggests is the “temporal bracketing strategy” in which the time scale is decomposed into successive periods. There is continuity in the activities within each period and discontinuities at its frontiers. Developing process theory requires understanding pattern in events and the most common pattern found in the literature is the linear sequence of phases that occur over time to product a result. We adopted this temporal bracketing strategy and inductively derived phases from our data. Because qualitative analysis is an inherently dynamic process, multiple readings of interviews, field notes, and documentation were conducted in order to characterize the process set up. Regular presentations to the IPL leader enabled the verification of the researchers’ understanding accuracy.

## **Case study and analysis**

We present the data in a longitudinal way. We differentiate stages and focus on what was accomplished at each stage in order to develop the relationships with new and distant suppliers and explore discontinuous innovation. Then we characterize this process by highlighting three elements that differentiate this process from the one leading to the establishment of relationships with familiar suppliers in order to co-develop innovations.

### ***The case study***

At its launch, and during the first year, IPL organized workshops involving, beyond its team, internal resources and external experts (no suppliers at this stage) to identify innovation tracks or domains that could enable fuel consumption and emission reduction. For some technological domains, the company could leverage strong internal competencies whereas, for others, the search for external knowledge appeared as a priority. We focused on the latter and more specifically on the three following domains that were considered: supercharging system, injection system, and energy recovery system. Innovation in these domains has significant implications on fuel consumption and emissions. Named this way, these domains seem to correspond to already existing solutions rather than discontinuous innovations. However in order to radically change the performances, the innovation targeted should not mobilize the current technologies used for these solutions.

In the case study presented below, we focus on one specific domain: supercharging systems. . The objective of Domauto was to enter this market, which the company was not in, with a technology that differed from those mastered by the established players. Since it is a new

domain for the company, there is no existing technology roadmap. Thus, it corresponds to what is designated in the literature as discontinuous innovation.

Jointly with distant and new suppliers, IPL identified through an exploration process, a concept then a detailed design and a prototype that was favorably welcomed by potential customers (automotive assemblers OEMs). Therefore, it appears relevant to analyze this case to understand how a firm can establish relationships with new and distant suppliers to target discontinuous innovation.

In the followings, we will present the approach deployed to identify suppliers, initiate the collaboration with them, generate concepts, test the feasibility of the various solutions generated and assess them.

Even though we focus on the supercharging domain, the same process was adopted by the firm for the two others (injection system and energy recovery system). (see Figure N°1 to have an overview of the overall process that will be detailed below).

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Insert Figure 1 about here.  
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### Stage 1: From a domain to explore to a documented mapping of concepts and potential suppliers

The first stage was dedicated to gathering knowledge about supercharging systems by IPL team through documentary research. It enabled the team to come up with a better understanding of: (i) the existing solutions and their advantages and limits, (ii) the future solutions under development in the industry and the technological strategy of the main players, (iii) the current market and forecasts and the issues to be faced in the coming years. It resulted in a first list of functional specifications for a supercharging system targeting fuel efficiency and emission reduction. In addition, a detailed list of constraints was specified regarding the integration of this

potential innovation in the car. Then, a search formulation comprising the key functional specifications and the key constraints was delineated and kept along the process as a common starting reference.

The team didn't send a request for quotation to the company's current suppliers. There were at least two reasons for that. The first one is that the search formulation is too wide and could not be sent as such: it would have either attracted too many answers between which it would have been difficult to select one or none. The second was that, the objective being an innovative answer to the "search formulation", the decision was made to target new and distant suppliers. But how to reach and attract these players who are not used to work with the automotive industry? How to decide which to further interact with? The team needed to document further the possible concepts

For that purpose, creativity sessions were then undertaken and involved internal and external resources such as experts, future clients and drivers. They resulted in a set of 10 concepts related to various different technologies (turbocompressor, e-charger, etc). Then a mapping of these concepts was proposed. They were positioned along two axes: the type of technology (the type of energy used to compress the air, for example), and the level of maturity of the concept (do we observe products corresponding to this concept on the market or is it at a research stage?).

Then suppliers mastering these technologies were identified using semantic analyzes on patent databases and scientific articles in journals, etc. The objective was not to identify suppliers having a product to sell but the search targeted rather to types of company:

- technology providers that had accumulated a certain level of knowledge on the technology or had already developed a functional prototype ;

- suppliers with a solution using an interesting technology but in another industry than the automotive sector and which would already have relevant production capabilities for this kind of solution. An investigation of the necessary adaptation for the automotive industry was therefore required.

By screening through these criteria, 20 relevant suppliers were identified mastering 4 technologies required, able to develop solution in line with 6 concepts among the 10 generated. Table N°1 below summarizes the analysis conducted resulting in a coupled mapping of concepts and suppliers. This mapping highlights various technical strategies and positions the suppliers that have developed solutions corresponding to the concepts generated during the creativity sessions.

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Insert Table 1 about here.  
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Based on this mapping, 3 concepts that were neither already commercialized in the automotive industry nor in a too early research stage were selected along with 6 suppliers or technology providers associated. These suppliers were new and outside the usual realm of the firm's network and mastered distant knowledge. Indeed, so far, the company had partnerships with suppliers from the automotive industry sector and with academic teams specialized in knowledge familiar to the one mastered by the R&D departments of the company. These new suppliers were SMEs, start-ups or academic teams that were not used to work in automotive industry and mastered distant knowledge. At this stage, the selection did not involve the suppliers: the selection was based on an analysis based on public documents about their activities and skills.

Stage 2: Detailing/improving/deepening the search and selecting a concept and a supplier



The second stage required to go further and to acquire more knowledge on the implementation of these concepts into solutions and about the suppliers.

Organizing direct interactions with these suppliers offered the opportunity to challenge their willingness and capacity to develop a solution for the auto industry (that is beyond their familiar markets) and adapting their solution. Furthermore, the process followed until this stage has been shared with the suppliers during these interactions: the first search formulation, the 10 concepts generated, the set of concepts and suppliers mapping, etc. Therefore, it was not only an audition of the supplier and a presentation of the proposed solution in order to assess its capacities but a conversation on the opportunities the development of such a novel solution would bring to the firm.

Regarding the solutions, additional information was needed on the following dimensions: (i) the performance of the solution itself, (ii) the constraints related to its integration within a powertrain and then within a vehicle, (iii) the complexity of the solution's industrialization, (iv) the estimated costs, (v) the time required to have access to the solution and the time to market and finally (vi) the accessibility of the firm to complementary assets required to support the deployment of the solution. The objective at this stage was to gather information about the various issues that would be faced in developing the novel solution with the considered novel supplier.

Based on the knowledge gathered, the next stage was an assessment of the 3 preselected concepts associated with the 6 potential suppliers by the IPL team. The intent is to obtain a shared and documented assessment of the solution to focus on.

Furthermore, the outcome of this phase is to identify the business unit within the firm in which the development of the solution could be pursued since IPL does not have all the required

resources. The objective was to involve progressively these development players in the exploration process to prepare the transfer of the solution to be developed.

Based on this assessment, one medium-sized supplier mastering an interesting technology and ready to get involved in further developments of a solution in order to fulfill the requirements of the automotive industry was selected.

These stages (domain identification, concepts generation and selection, assessment of the pre-selected concepts and suppliers) form the "paper analysis" phase that ends with the selection of a set of concepts and suppliers. This process is quite different from traditional practices of contracting with suppliers: it is rather open given the multitude of options considered and the knowledge distance that impedes an easy assessment of their potential.

During the "paper analysis" phase, the investment is limited (below 10K€) and is based mainly on documentation and meetings. No contract is signed, only a non-disclosure agreement (NDA) for discussion.

### Stage 3: Realization of mock ups

The subsequent stage is dedicated to designing and building a functional prototype of the selected solution. For a mock-up tested on a subsystem bench, the investment is below 50K€. At this point, an agreement was signed with the supplier. Even-though, the big part of the work is undertaken by the suppliers at this stage, it is extremely rich in terms of knowledge generated and exchanged between both players. The supplier belonging to another sector, he ignores the adaptation required for the automotive industry. On the other hand, the firm, through IPL team, needs to understand further the technology embedded in the solution to help in the

identification of the adaptations. Many interactions took place in order that both players could acquire the necessary knowledge.

This joint exploration can eventually lead to a shift to a second concept of solution because the performance cannot be achieved with the first one besides other difficulties encountered.

However, the systematic study conducted in the previous stage with the identification of alternative concepts facilitates the shift to another set of concept and supplier without re-analysing the problem from the start.

For the second concept considered, the completion of the mock-up of the subsystem was conclusive. The next step was to develop a more complex mock-up to be integrated in a demo-car. Because the investment was higher (between 200 and 500K€), a contract was signed with the supplier. This stage can be considered as the last step before a NPD project is launched and goes along with an intensification of the relationships. Potential customers (meaning original equipment manufacturer, car assemblers) are also involved in order to take part in the exploration as well.

After the validation of the demo-car including the mock-up of the solution, and considering the promising performance of the solution and the positive reaction of car assemblers, a development project was launched and the solution was transferred to a division.

### ***The case study analysis***

Therefore the process set up by the firm to establish relationships with new and distant suppliers includes: (i) a broad exploration of technologies, market requirements and trends and creativity sessions that help build an exploration map on a domain on which the firm was not previously positioned and consider to enter with innovation based on a shift in technology; (ii) a first

selection among these concepts and a search for suppliers knowledgeable on the technologies underlying the pre-selected concepts; (iii) an identification of relevant suppliers and solutions and a selection of sets of concepts and suppliers with whom further development will be undertaken; and (iv) the realization of mock-ups at two different levels (the solution per se and its integration in a demo-car) to test the feasibility and the performance of the solution.

Below, we underline three characteristics of the process presented above: (i) building a documented mapping, coupling the concepts and their underlying technologies with the potential suppliers providing and mastering such technologies, (ii) having a structured and transparent process, supporting a mutual and progressive commitment and (iii) dedicating a specific entity separate from the rest of the and in the same time, connected to the experts that master the internal knowledge that will be combined with the external knowledge leveraged and to the top managers that will take the decisions regarding the further development of the opportunities of DI explored.

#### 1<sup>st</sup> Characteristic: A documented mapping of the concepts and the suppliers

When targeting DI associated with a shift in the technology, firms cannot articulate specifications at the beginning of the process. Indeed, the specifications result from an interactive coupling between the requirements of the firm on one hand and the potential of the technologies mastered by the suppliers on the other. In its search, the firm articulates the main functional requirements and the constraints, regarding interaction with the other subsystems for example, without narrowing the search funnel.

This formulation is not as precise as what is posted on a traditional open innovation platform. It does not neither compare to traditional specifications that can be advertised to current suppliers through traditional channels.

Consequently, the firm undertook creativity sessions based on this search formulation in order to generate concepts to which potential suppliers once identified could contribute.

Progressively, along the exploration process, new knowledge is developed and structured around various concepts that are documented and mapped. This mapping of the concepts (their pros and cons), the technologies and the suppliers is built and shared with potential suppliers who thus extend their knowledge and get benefits to their involvement in such a relation despite an uncertain context. This mapping plays a crucial role at two stages: for the identification of the new suppliers and during the interaction with them helping bridge the knowledge distance.

## 2<sup>nd</sup> Characteristic: A structured and progressive process

Considering the discontinuous nature of the innovation targeted, the firm cannot be very specific on the content to be delivered. However, the firm deployed a structured process that was very helpful in coping with the double uncertainty characterizing the exploration of DI with new and distant suppliers. Indeed, it was explicit on the stages and the set of solutions competing at each stage as well as on the decision mode. It is a progressive process involving increasing interactions and commitment. With this transparent and shared reference, players have some visibility to reduce the uncertainty they are encountering. In addition, the relation can stop at each stage and each party could decide to go its separate way. As a matter of fact, in the firm analyzed, several relationships with new and distant suppliers were stopped at the initiative of either party after having cooperated during one or two phases. Because of this eventuality, the nature and degree of information shared are focused on the project at stake. The interactions are

restricted to the scope of the technology the supplier was selected for and which is specified in advance. NDA is signed before meetings and confidentiality agreements are clearly defined before the beginning of the development of a mock-up. The suppliers commit resources until the next stage. Hence, the investment for each stage is clear for both parties. Exclusivity is not required. The relationships established are thus characterized by a limited and a progressive commitment.

These relationships with suppliers are also different from traditional ones because of their premises and objectives. First, the expected result is unusual. It is not a commercial product developed jointly but rather the validation of a solution concept that would fulfill a functional need and the realization of a mock-up of this concept enabling to assess its technical feasibility, its performances and potential on the market. Second, the selection of the solutions requires a knowledge that the firm does not have. The documented mapping and the structured process help address these specificities.

### 3<sup>rd</sup> Characteristic: A separate, dedicated and connected entity

In the firm analyzed, a specific entity was in charge of: (i) generating new concepts, (ii) identifying new suppliers, (iii) establishing relationships with these suppliers, (iv) organizing the joint study of a set of selected concepts, and (v) coupling between technical solutions, needs, potential partners and the competitive positions of the firm.

This entity was separated from the rest of the firm. This independence made the search for new suppliers outside the usual realm of the firm possible. They experimented new and specific search tools for that purpose. Despite separate, the entity could rely on a network of experts within the firm to ensure the combination of existing internal knowledge with externally

acquired one. Access to these experts is of tremendous value due to their knowledge of system specifications, technical, industrial and costs constraints. Even though the entity is the prime contact of the new supplier, it favors direct relationships between the supplier and the relevant experts within the company. Though in charge of developing relationships with new suppliers to enhance DI, the entity tended to leverage external knowledge but also combine it with internal knowledge distributed in different business lines, so as to come up with novel systems and architectures.

Its role is to introduce the supplier to the project team that will further develop the innovation.

Thus, the dedicated entity helps reduce the complexity of the firm to the new supplier.

The entity reports to top managers of the company who can approve the strategy on these novel domains. The technical and the strategic issues are worked on simultaneously enabling the company to move forward and commit if the technology is promising. When a joint exploration with a new supplier succeeds and the prototype reaches the expected performance, the top management who is aware of this partnership can rapidly get involved in supporting the transfer of the project to the appropriate business line and pushing the detailed development and then the launch of this novel product or system.

Though dedicated to early phases of concepts generation and proof of concepts, the entity was in charge of transferring the novel solution, once ready for industrial development to the business line that will produce and commercialize it. It organized regular meetings with clients to show the various concepts considered and includes their feedbacks in making the decisions about which to further develop.

## **Discussion**

Based on the case study of a firm that succeeded in establishing relationships with new and distant suppliers in order to explore jointly discontinuous innovation, we highlight the process and the organization deployed and we underline three characteristics that, we argue, help answering the question: how do firms establish such relationships? We will in the following, discuss these characteristics presented above, with the literature on organizational knowledge and open innovation, stressing thus our contribution.

By specifying these characteristics, we complement the work of Afuah & Tucci (2012) about the conditions under which transforming distant search into local search is possible. They pointed out the problem framing and the ease with which the final solution can be evaluated. We specify these elements by highlighting the way the problem can be framed, through the coupled mapping of the concepts, the technologies and the suppliers (first characteristic), and the organization (structured and progressive process on one hand, and dedicated and connected entity on the other) through which the firm can evaluate the solution sourced (second and third characteristic).

#### ***A documented mapping of the concepts and the suppliers***

Technological discontinuities trigger the start of a fluid phase where alternative technologies compete for dominance (Abernathy and Utterback, 1978; Utterback, 1994) and where there isn't a stabilized definition for a product or a technology. Therefore, it is difficult and possibly not appropriate to articulate specifications to be addressed to suppliers. Hence, we highlighted the critical role played by the search formulation that supported the creativity session as well as the coupled mapping of the concepts, technologies and suppliers in the establishment of the relationships with new and distant suppliers targeting discontinuous innovation. Focusing on functional rather than on technical specifications is not specifically new in the literature on innovation. The benefits of maintaining a fuzzy front end during the early phases of the



innovation process were also previously highlighted (Khurana and Rosenthal, 1997; Reid de Brentani, 2004). A similar approach was highlighted by researchers in design theory (Krippendorf, 2006) as well when they emphasized that design is about monitoring and coupling two processes: one divergent, that enables the exploration of novel ideas in a wide space of possibilities and the other convergent, that specifies the boundaries (constraints) that form the scope of the issue to be addressed. We emphasize that it is specifically critical in the case of new and distant suppliers and that the mapping enables it.

This combination of a rather broad exploration process with a convergence process is also highlighted in the innovation management literature. Liker et al. (1996) show the benefits of involving suppliers in the simultaneous development of several solutions in parallel that they have designated as *set-based design* as opposed as to the development of one solution or *point-based design*. This is efficient when time constraints and uncertainty are high. However they have studied suppliers belonging to the suppliers' base of the firm for co-development initiative whereas we focus on an upstream phase and co-exploration with new and distant suppliers.

Therefore, we complement this work by emphasizing that the mapping tool help to conduct the development of several concepts in parallel and to quickly switch from one potential solution to another one when an issue cannot be overcome.

Indeed, suppliers are new and belong to other networks in which the firm is not embedded. They are therefore difficult to identify. The mapping supports and structures this search: it is a reference all along this process.

Furthermore, the suppliers master a knowledge/technology that the firm does not. It is therefore difficult to assess and evaluate the opportunities that it represents. On the other hand, the suppliers do not master the constraints of the automotive industry. Therefore, the mapping

supports the development of knowledge that both players need to do in common. It is a shared element all along the process that bridges the knowledge distance.

### ***A structured process supporting a progressive commitment***

We highlighted the process especially the fact that it is structured and progressive. Considering that the objective was to co-explore DI, it was not possible to rely on a traditional project development process. However, a structure was put in place in order to organize such an endeavor. It was critical in reducing the uncertainty associated for both players. This result is coherent with the characteristics of DI processes that are highly iterative involving probing and learning (Lynn, Paulson and Moronne, 1996). It is as well in line with the work of Maniak and Midler (2008) and Seidel (2007) when they underline that exploring DI requires periodic revisions of the perimeters and the involvements. It is as well coherent with the findings of Fixson and Lee (2012) in their empirical study of the emerging US automotive airbag industry: they showed that the best knowledge search strategy is one that during the fluid phase looks inward into the organization but outside of the mastered technology area, and later during the take-off phase shifts to looking outward from the organization. Since DI are generally developed during the fluid phase, we showed a process combining the leveraging of internal knowledge and the search for new technologies from potential suppliers outside the firm. Therefore, we complement this work.

We highlighted as well the progressive dimension of the process. Indeed, the combination of a broad mapping, a focused prototyping with selected partners and iterations to test several concepts identified, leads to dedicate limited and progressive resources to the trials.

This result complements the research of Phillips et al. (2006b) on “*strategic dalliances*” that emphasizes the low commitment of the partners without however addressing how some of these nascent relationships evolve towards stronger ones. Indeed, the relationships characterized by Phillips et al. (2006) allow the firms to assess the potential of several technologies and competencies through a wide variety of partnerships. While agreeing on the benefits of this approach when targeting DI, we argue that transforming some of these temporary relationships into sustainable ones is crucial for succeeding in developing DI. We show that, in contrast to the large number of partners considered, only a few mock-ups were developed with a selected set of suppliers. A structured process enables the progressive transformation of these relationships from nascent to sustainable if functional, economic, industrial and strategic conditions are fulfilled. This is critical because the suppliers are new: how to attract them to build relationships with a firm in an unknown sector? In the other hand, the firm does not know these players and needs as well a progressive process to reduce the uncertainty. The structured process we highlighted framed a progressive commitment from both sides and contributed to reducing the double uncertainty generally associated with this type of innovation and nascent relations.

#### ***A dedicated entity combining several roles -***

We highlighted the independence of the firm from the sourcing and purchasing function and in the same time its connectedness to the rest of the firm especially to the experts in order to leverage external knowledge as well as internal one and combine them. Therefore, the entity plays the role of a *tertius iungens* or a broker between the supplier and the firm (Obstfeld 2005; Crespín-Mazet et al., 2013). It plays the role of boundary spanner (Tushman and Scanlan, 1981). or gatekeeper (Tushman and Katz, 1980) because it targets the external search activities while

preparing their integration and combination with internal resources. By involving progressively members from the rest of the firm (R&D, sourcing, etc.), it prepares the transfer of the innovation to the division where it will be developed further. By highlighting the boundary-spanning role of this entity, our work is in the same line of thought as Monteiro and Birkinshaw (2016) who studied the role of a dedicated scouting unit of a multinational corporation in the search and the use of external knowledge by the home organization. They highlight the role of this entity in the external knowledge translation, its transformation and combination with internal knowledge to ensure the matchmaking with internal needs. However, while Monteiro (2008) mention that the role of transferring the innovation development to the most appropriate division is critical the question has not been studied.

The dedicated entity studied also present similarities with an advanced sourcing entity (Schiele 2010; Johnsen et al. 2011) in identifying, selecting and involving suppliers during the concept phase. Schiele (2010) underlines two roles for such an entity: the strategic coupling and the organization of the interactions with suppliers. He also emphasizes that this distinct organizational unit should be endowed with tools, such as technology roadmaps, and be involved in the innovation strategy of the firm. As in the case of DI these roadmaps do not exist, we show that this dedicated entity was indeed involved in the creation of such roadmaps by interacting with the suppliers and the customers,. The involvement of the entity in the definition of a technical strategy of the firm on these new domains was not considered previously in the literature addressing opportunistic behavior leading to a set of relationships with novel suppliers. On the contrary we note that a strategic rationale was articulated and refined along the process. The entity was in charge of identifying opportunities and building a strategy: it thus identified and explored a portfolio of exploratory projects rather than a single project. It did not focus on

one solution to be developed. This portfolio approach is critical considering the uncertainty associated to DI. In that perspective, the entity differs from a tiger team or an autonomous project (Clark & Wheelwright, 1991) as documented in the literature on new product development in being responsible for a portfolio of early stage exploration projects. It is thus a specific organization.

We stress various roles fulfilled by such an entity and how these roles while complementing each other achieve the establishment of relationships with new and distant suppliers and the joint exploration of DI that can be developed further by the firm. We underline similarities and differences with various dedicated units studied in the literature on innovation. In doing so, we contribute to the debate in the literature about whether the development of relationships with new supplier targeting DI should be managed by a separate unit or by the current organization.

***Targeting new and distant suppliers: an enabler for organizational ambidexterity***

The innovation targeted by the firm studied involved radically new technologies for the firm and thus presented characteristics of DI according to Bessant et al. definition. Indeed, in order to develop offers that reduce fuel consumption and emissions, the firm explored solutions based on technologies that did not belong to its knowledge base. This led the firm to work during the innovation process with suppliers who mastered this knowledge and that did not belong to its current network. The firm established new relationships with these suppliers who dedicated resources and innovation capacities to these joint and risky explorations. This situation is different from the one generally addressed by NPD literature focusing on early supplier involvement (Petersen et al. 2003; 2005; Van Echtelt et al., 2008) and which emphasizes generally the long-term commitment to the buyers. On the contrary, the relationships studied are

similar to what Phillips et al. (2006b) designate as “*strategic dalliance*” with regard to their characteristics and the suppliers involved: new suppliers, low commitment, easy to break off, short term orientation, temporary relations, etc. We complement the work of Phillips et al. (2006b) by addressing a specific outcome resulting in a specific kind of cooperation. It is not about developing jointly a product ready for commercialization, but a prototype embodying a new concept and a new technology on the basis of which the technical feasibility and functional performances will be assessed.

These new relationships were developed in addition to long-term relationships involving suppliers belonging to the traditional network of the firm. Our analysis reinforces the work of Hughes and Perrons (2011) and Noke et al. (2008) by stressing the coexistence of two types of relationships: temporary with new and distant suppliers and long term with a set of preferred suppliers. This simultaneous development of two different types of relations with two categories of suppliers leading simultaneously to incremental and DI can be considered as a peculiar implementation of the ambidextrous organization (Tushman and O’Reilly, 1996; O’Reilly and Tushman, 2013). The exploration of new concepts and technologies is undertaken jointly with new suppliers mastering knowledge critical for the development of these novel solutions. This way of managing exploration compares to network ambidexterity as characterized by Rothaermel and Deeds (2004): a form in which exploration is externalized through the relationships with external players. This form of organizational ambidexterity is different from the structural (Tushman and O’Reilly, 1996) and the contextual (Gibson and Birkinshaw, 2004) forms.

## **Propositions**

Our research was based on a single qualitative and longitudinal case study which is relevant considering that few research have been done on the process of establishing relationships with new and distant supplier to explore DI the type of research question dealing with “how to establish relationships with suppliers from outside their usual realm that master distant knowledge in order to explore DI?” In the following, we articulate propositions based on our results and that could be tested on a larger and more diversified sample.

***Proposition 1a:*** *In a double uncertain and risky context of exploring DI with new and distant suppliers, buyers that build a documented mapping of the concepts and the suppliers increase their ability to establish relationships with new and distant suppliers. It helps selecting the one to go further with.*

***Proposition 1b:*** *In a double uncertain and risky context of exploring DI with new and distant suppliers, buyers that share a documented mapping of the concepts and the suppliers helps bridging the knowledge gap, visualize the several strategic options considered and decide whether a common development is valuable.*

***Proposition 2a:*** *In a double uncertain and risky context of exploring DI with new and distant suppliers, buyers that have a structured and transparent process, with short decision cycles at each stage, increase their ability to establish relationships with new and distant suppliers.*

***Proposition 2b:*** *In a double uncertain and risky context of exploring DI with new and distant suppliers, buyers, buyers that propose a limited and progressive commitment increase their ability to establish relationships with new and distant suppliers.*

***Proposition 3:*** *In a double uncertain and risky context of exploring DI with new and distant suppliers, buyers that dedicate an organizational entity separate from the rest of the firm while connected to it with access to the relevant technical specialists as well as to the top management,*

*increase their ability to establish relationships with new and distant suppliers and to leverage their knowledge.*

## **Conclusion**

Previous research has extensively analyzed close and long-term relationships with a selected set of suppliers. However, relationships with suppliers new to the firm's network and with distant knowledge have been less studied, despite the benefits underlined by the literature particularly for discontinuous innovation. Furthermore, cooperation between buyers and suppliers during the early phases (exploration, concept generation, preliminary prototypes) of NPD or co-innovation as coined by Maniak and Midler (2008) has been less studied than the co-development.

In this research, we focus on the establishment of relationships with distant suppliers targeting the exploration of discontinuous innovation. Based on a fine-grained longitudinal study of a buyer that succeeded in developing DI as a result of cooperation with such suppliers, we suggest inductively three characteristics of the process set up: (i) building a documented mapping, coupling the concepts and their underlying technologies with the potential suppliers providing and mastering such technologies, (ii) having a structured and transparent process, supporting a mutual and progressive commitment and (iii) dedicating a specific entity separate from the rest of the and in the same time, connected to the experts that master the internal knowledge that will be combined with the external knowledge leveraged and to the top managers that will take the decisions regarding the further development of the opportunities of DI explored.



We argue that these characteristics were success factors for establishing such relationships and led to the explorations of DI.

These results are a contribution to the literature on open innovation and NPD by specifying the process and the organizational setting to build relationships with distant suppliers on technical and relational knowledge while targeting DI. It has to be stressed that these new relationships coexist beside the long-term relationships with a set of suppliers involved in the development of current products that continued. Thus, it is an implementation of ambidexterity within established firms.

Hence, the contribution of this research is twofold. First it is a fine-grained longitudinal case analysis of a company establishing relationships with a new kind of supplier in order to generate discontinuous innovation. It discusses similarities and differences between the new relationships analyzed and the notion of *strategic dalliances* introduced by Phillips et al. (2006b). Second, based on this case study, it articulates three success factors characterizing the process and the organization that were set up and that, we argue, contribute to the establishment of these new relationships.

Further research can focus on testing the success factors in a larger sample through a quantitative approach in order to expand these findings.

This research has also managerial implications documenting the process and the tools developed to establish relationships with distant suppliers. The organizational setting that we characterize for an entity in charge of managing this process can be helpful for firms trying to design organizations to develop relationships with new suppliers (either SME or suppliers not belonging to the usual supply chain) and target discontinuous innovation.

Our research has limitations associated to the methodology adopted and based on a single case study in one sector and specific context. The context of the automotive industry that was studied may present specificities with regard to the complexity of the product, the length of the development cycle, the manufacturing requirements and the relationships to customers, as first tier suppliers are in a B to B context. Furthermore, our research studied how a large firm established relationships with new and distant small and medium size firms in order to co-explore new knowledge by leveraging theirs. We do not address the negative effects that can be encountered while dealing with suppliers especially in the case where the latter have high bargaining power that could result in expropriating the buying firm from the benefits of the cooperation. However, the research question we addressed can be examined in different contexts involving firms with different sizes or evolving in different sectors. The work opens new avenues for research on this understudied and more and more emphasized kind of relationships.

## References

- Adler, P., Goldoftas, B., and Levine, D. (1999). Flexibility versus efficiency? A case study of model changeovers in the Toyota production systems. *Organization Science*, 10, 43-68.
- Afuah, A., C. L. Tucci. (2012). Crowdsourcing as a solution to distant search. *Academy of Management Review*, 37 (3): 355-75
- Ahuja, G., and C.M. Lampert. 2001. Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. *Strategic Management Journal* 22: 521-43
- Almirall, E., and Casadesus-Masanell, R. (2010). Open versus closed innovation: A model of discovery and divergence. *Academy of Management Review*, 35: 27-47.
- Atuahene-Gina, K. (1995). Involving organizational buyers in new product development. *Industrial Marketing Management*, 24, 215-226.
- Bessant, J., Lamming, R., Noke, H., and Phillips, W. (2006). Managing innovation beyond the steady state. *Technovation*, 25(12), 1366-1376.
- Burt, D.N., and Soukup, W.R. (1985). Purchasing's role in new product development. *Harvard Business Review*, 63 (3), 90-97.
- Carlile, P. (2002). A pragmatic view of knowledge and boundaries: boundary objects in new product development. *Organization Science*, 13 (4), 442-455.

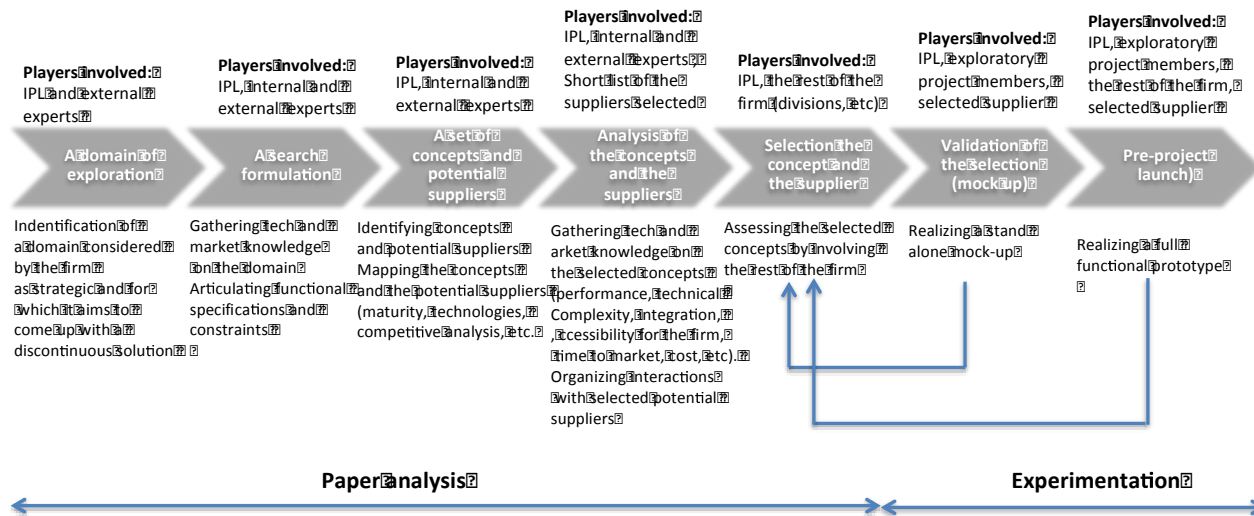
- Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business School Press, Boston, Mass.
- Corbin, J., and Strauss, A. (1990). Grounded theory research: procedures, canons and evaluative criteria. *Qualitative Sociology*, 13, 3-21.
- Crespin-Mazet, F., Goglio-Primard, K., Scheid, F. (2013). Open innovation processes within clusters – the role of tertius iugens, *Management Decision*, 51, 8, 1701-1715
- Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- Dhanaraj, C., and Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review*, 31 (3), 659-69.
- Dosi, G., & Marengo, L. (2007). On the evolutionary and behavioral theories of organizations: A tentative roadmap. *Organization Science*, 18: 491–502.
- Eisenhardt, K.M. (1989). Building theory from case study research. *Academy of Management Review*, 14 (4), 532–550.
- Eisenhardt, K.M., and Tabrizi, B. (1995). Accelerating adaptive processes: product innovation in the global computer industry. *Administrative Science Quarterly*, 40, March, 84-110.
- Enkel, E., Gassmann, O. and Chesbrough, H. (2009), Open RD and open innovation: exploring the phenomenon, *RD management*, 39(4), 311-316
- Fixson S. and Lee WH (2012), Shifting grounds: how industry emergence changes the effectiveness of knowledge creation strategies – the case of the US automotive airbag industry, *Technology Analysis & Strategic Management*, 24:1, 1-19
- Galunic, D.C., and Eisenhardt, K.L. (1996). The evolution of intracorporate domains: divisional charter losses in high-technology, multidivisional corporations. *Organization Science*, 7 (3), 255-283.
- Gassmann, O., Enkel, E. and Chesbrough H. (2010), The future of open innovation, *RD management*, 40, 3, 213-221
- Gassmann, O. (2006), Opening up the innovation process: Towards an agenda. *RD Management*, 36, 3, 223-228
- Handfield, R.B., Ragatz, G.L., Petersen, K.J., and Monczka, R.M. (1999). Involving suppliers in new product development. *California Management Review*, 42, 1, 59–82.
- Hughes, M., and Perrons, R.K. (2011). Re-shaping social capital in buyer-supplier relationships. *Journal of Business Research*, 64, 164-71.
- Jacobides, M.G., and Billinger, S. (2006). Designing the boundaries of the firm: from make, buy or ally, to the dynamic benefits or vertical architecture. *Organization Science*, 17 (2), 22-44.
- Johnsen, T.E., Calvi, R., and Phillips, W. (2011). *Purchasing and Supplier Involvement in Discontinuous Innovation: a Literature Review*. Working paper.
- Johnsen, T.E. (2009). Supplier involvement in product development and innovation – taking stock and looking to the future. *Journal of Purchasing and Supply Management*, 15 (3), 187-197.
- Katila, R., and G. Ahuja. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal* 45: 1183–94.
- Katila, R. (2002). New product search over time: Past ideas in their prime? *Academy of Management Journal*, 45: 995–1010.

- Kellogg, K.C., Orlikowski W.J., and Yates, J. (2006). Life in the trading zone: structuring coordination across boundaries in postbureaucratic organizations. *Organization Science*, 17 (1), 249-261.
- Keupp, M.M. and Gassman, O., (2009). Determinants and archetype users for open innovation. *RD Management Journal*, 39(4):331-341.
- Krippendorf, K. (2006). *The semantic turn. A new foundation for design*. CRC Press, Taylor and Francis Group, LLC.
- Khurana, A. and Rosenthal S., R., (1997), Integrating the Fuzzy Front End of New Product Development, *Sloan management review*, 38(2):103-120
- Langley, A. (1999) Strategies for theorizing from process data , *Academy of Management Review*, 24 (4), pp 691-710.
- Laursen, K., and Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, 27, 131-150.
- Lenfle, S., and Midler, C. (2003). Innovation-based competition and the dynamics of design in upstream suppliers. *International Journal of Automotive Technology and Management*, 2/3, 269-286.
- Liker, J. K., Sobek, D. K., Ward, A. C., & Cristiano, J. J. (1996). Involving suppliers in product development in the United States and Japan: Evidence for set-based concurrent engineering. *IEEE Transactions on Engineering Management*, 43(2), 165-178.
- Loch, C.H., Solt, M.E. and Bailey, E.M. (2008). Diagnosing unforeseeable uncertainty in a new venture. *Journal of Product Innovation Management*, 25, 28-46.
- Miles, M., and Huberman, A.M. (1994). *Qualitative Data Analysis*. Sage Publications, Beverly Hills, CA.
- Monteiro, L. F. (2008). *Connecting the dots: Uncovering the technology scouting process*. Unpublished PhD Dissertation, London Business School (University of London). London, UK.
- Monteiro, L.F., Birkinshaw, J., 2016. The external knowledge sourcing process in multinational corporations. *Strategic Management Journal*.
- Mukherji, A., and Francis, J.D. (2008). Mutual adaptation in buyer-supplier relationships. *Journal of Business Research*, 61(2), 154-61
- Nijssen, E.J., Biemans, W.G. and de Kort, J.F. (2002). Involving purchasing in new product development. *R&D Management*, 32 (4), 281–289.
- Noke, H., Perrons, R.K., and Hughes, M. (2008). Strategic dalliances as an enabler for discontinuous innovation in slow clockspeed industries: evidence from the oil and gas industry. *RandD Management*, 38 (2), 129-139.
- Obstfeld D. (2005) Social Networks, the Tertius Iungens Orientation and Involvement in Innovation, *Administrative Science Quarterly*, 50, 100-130
- O'Reilly C., M. Tushman. (2013). « Organizational ambidexterity : past, present and future ». *Academy of Management Perspectives.*, 27(4), p324-338
- Paananen, M. 2009. Exploring the relationships between knowledge sources in the innovation process: Evidence from Finnish innovators. *Technology Analysis Strategic Management* 21: 711–25.
- Petersen, K.J., Handfield, R.B., and Ragatz, G.L. (2005). Supplier integration into new product development: coordinating product, process and supply chain design. *Journal of Operations Management*, 23 (3-4), 371-388.

- Petersen, K., Handfield, R., and Ragatz, G. (2003). A model of supplier integration into new product development. *Journal of Product Innovation Management*, 20 (4), 284-299.
- Phillips, W., Noke, H., Bessant, J., and Lamming, R. (2006a). Beyond the steady state: managing discontinuous product and process innovation, *International Journal of Innovation Management*, 10 (2), 175-196.
- Phillips, W.E., Lamming, R.C., Bessant, J.R., and Noke, H. (2006b). Discontinuous innovation and supply relationships: Strategic dalliances. *RD Management* 36 (4), 451-461.
- Quinn, J.B. (2000). Outsourcing innovation: the new engine of growth. *Sloan Management Review*, 41 (4), 13–28.
- Reid, S.E. and De Brentani, U., (2004) The Fuzzy Front End of New Product Development for Discontinuous Innovations: A Theoretical Model, *Journal of Product Innovation Management*, 21(3), 170-184
- Schiele, H., (2010). Early supplier integration: the dual role of purchasing in new product development. *RD Management* 40 (2), 138-153.
- Seidel, V.P. (2007). Concept Shifting and the Radical Product Development Process. *Journal of Product Innovation Management* 24(6).
- Suddaby R. 2006. From the editors: what grounded theory is not. *Academy of Management Journal*, 49 (4), 633-642
- Takeishi, A. (2001) Bridging inter- and intra-firm boundaries: Management of supplier involvement in automobile product development. *Strategic Management Journal*, 22, 5, 403–433.
- Tidd J. et al. (2013) *Open Innovation Research Management and Practice*, Imperial College Press 250 p
- Tushman, M.L., Katz, R., 1980. External communication and project performance: An investigation into the role of gatekeepers. *Management Science* 26, 1071-1085.
- Tushman, M.L., Scanlan, T.J., 1981. Boundary Spanning Individuals - Their Role in Information-Transfer and Their Antecedents. *Academy of Management Journal* 24, 289-305.
- Utterback, J.M. (1994). *Mastering the Dynamics of Innovation*. Harvard Business School Press
- Van Echtelt, F.E.A., Wynstra, F., Van Weele, A.J., and Duyesters, G. (2008). Managing supplier involvement in NPD: a multiple-case study. *Journal of Product Innovation Management*, 25, 180-201.
- Veryzer, R. (1998). Discontinuous Innovation and the new product development process, *Journal of Product Innovation Management*, 15, 304-321.
- West J., Salter A., Vanhaverbeke W., Chesbrough H. (2014), Open Innovation: the next decade. *Research Policy*, 43(5), pp 805-811
- Wheelwright, S., and Clark, K. (1992). *Revolutionizing Product Development*. New York: Free Press.
- Weiblen, T., Chesbrough, H. W. (2015). Engaging with Startups to Enhance Corporate Innovation. *California Management Review*, 57(2), 66-90.
- Wynstra, F., von Corswant, F., and Wetzels, M. (2010). In Chains? An Empirical Study of Antecedents of Supplier Product Development Activity in the Automotive Industry. *Journal of Product Innovation Management*, 27, 625-639.
- Zirpoli, F., and Becker, M. (2011). The limits of design and engineering outsourcing: performance integration and the unfulfilled promises of modularity. *RD Management*, 41(1), 21-43.



**Figure N°1: Overview of the process**



**Table N°1: Mapping of the concepts of solutions and the potential suppliers**

Type of Energy	Energy recovered from exhausted gaz	Electrical Energy	Mechanical Energy (belt drive)	Pneumatic Energy
<b>Maturity of the technology</b>				
<b>In production</b>	- Turbo-compressor <b>Suppliers: A1, A2, A3</b>		- Compressor <b>Suppliers: B1, B2, B3</b>	
<b>Prototype</b>		- Electrically assisted turbo <b>Suppliers: C1, C2</b> - E-Charger <b>Suppliers: D1, D2</b> - Super generator <b>Suppliers: E1, E2</b>		
<b>Proof of concept Research</b>	- Thermo-kinetic compressor <b>Suppliers: F1, F2, F3</b>	- Air Booster <b>Suppliers: G1, G2</b>		- Compressor <b>Suppliers: H1, H2, H3</b>