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Open innovation in automotive SMEs suppliers: an opportunity for new product development¹

Innovación abierta en PYMES proveedoras de automoción: una oportunidad para el desarrollo de nuevo producto

I. INTRODUCTION

Nowadays companies are operating in an uncertain and dynamic environment that is characterized by changing customer preferences and rapidly changing technologies. One of the strategies adopted by companies to better adapt to changing environments is the shift from a closed to a more Open Innovation (OI) model, whereby external collaboration becomes more and more important. Chesbrough (2003) coined the term OI, and after a decade of research he redefined it as “a distributed innovation process, based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms, in line with the organization’s business model” (Chesbrough and Bogers, 2014). This OI model has been widely reported in the literature on innovation management research, but when analysing the state of the art of OI in depth, we see that most of the references and case studies are relevant to large companies, leading many researchers to argue that OI in small and medium enterprises (SMEs) has been barely studied.

SMEs are critical to the economy as engines of economic and social development. According to the Annual report on SMEs in the EU

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EXECUTIVE SUMMARY

The main goal of this study is to determine which open innovation practices can be especially useful to SMEs in the automobile sector in the development of new products and services. We aim to encourage practitioners to study and implement open innovation practices as a way of satisfying the changing needs of the market and remaining competitive. In order to do this, we describe in detail one specific open innovation practice that we consider to be a useful tool for systematizing new product development processes: joint development.

RESUMEN DEL ARTÍCULO

Este artículo tiene como objetivo general el análisis de las prácticas de innovación abierta que pueden ser implementadas por PYMEs proveedoras de servicios en el sector de automoción. Para ello, ilustramos, a través de los resultados de un estudio de casos múltiple, su utilidad para satisfacer las necesidades cambiantes del mercado y seguir siendo competitivos. Finalmente describimos en detalle una de estas prácticas que puede contribuir a la sistematización del proceso de desarrollo de nuevos productos: los co-desarrollos.

2014/15 (Muller et al., 2014), more than 99% of all European business are SMEs, and SMEs in the non-financial sector provide 67% of total employment and 58% of value added in the private sector in the EU. Shorter product lifecycles, rapid technological progress and increased competition are the main characteristics of the contemporary dynamic environment that has forced SMEs to innovate and launch new successful products to sustain their competitiveness. It can be said that the flexibility of SMEs, their simple organizational structure, their speed in decision-making and their receptivity are the essential features that allow them to be innovative and to keep abreast with environmental disturbances and rapidly changing markets. Many international studies reveal that new product development (NPD) is a successful tool for SMEs in order to satisfy the changing needs of the market and remain competitive.

This paper links two crucial aspects that firms need to remain competitive, namely OI and NPD, and analyses them in the context of SMEs and the automotive industry.

This paper links two crucial aspects that firms need to remain competitive, namely OI and NPD, and analyses them in the context of SMEs and the automotive industry. For successful NPD, SMEs find themselves confronted with the need to collaborate (Rogers, 2004). This need is caused by the fact that SMEs need to innovate to compete, but at the same time they need to focus on their core competences for reasons of efficiency. Bommer and Jalajas (2004) found that many creative ideas surface as the result of informal communications among workers and between workers and customers. Some studies have reported that SMEs are great idea hunters because they are skilled at opportunity recognition (O'Connor, 2006). Moreover, while formalized practices seem to be important for NPD success, product development practitioners consider that more flexible and informal practices are best practices in some specific stages of the NPD process, such as opportunity identification (Nicholas et al., 2011).

In this sense, the goal of this paper is to explore how OI practices in SMEs fit into the automotive industry. More specifically, this study will focus on joint product development and show through case studies of SMEs in the automotive industry how OI started, the challenges related to cooperation management, and the benefits arising from this OI practice in relation to NPD.

This paper is structured as follows. The next section reviews previous research on OI practices and NPD in SMEs. Our research

methodology is then described, providing a detailed explanation of how the empirical study was developed. Follow that, we present the findings of our empirical study. The paper concludes with implications for practitioners and a description of main limitations of our work and areas for further research.

2. OI PRACTICES AND NPD IN SMES

When OI was launched as a new concept by Chesbrough in 2003, it was tightly linked to other concepts such as new product development, the innovation funnel, and business-model change in large companies. Gradually the scope of open innovation has broadened, introducing new concepts such as open business models and open services innovation (Chesbrough, 2011). Vanhaverbeke and Chesbrough (2013) show that open innovation can be applied to many more situations than just NPD. One such example is that in many manufacturing industries companies produce and sell commodities. Greco et al. (2015) carried out an extensive literature review of the papers that analyse the relationship between OI practices and innovation performance. They emphasize that OI is not only linked to product innovation but also to process innovation. Mazzola et al. (2016) extends the breadth of OI actions to include not only innovation indicators but also customer performance and financial performance.

According to Huizingh (2011), OI practices are “the processes that managers start when deciding ‘when, how, with whom, with what purpose, and in what way should they cooperate with external partners’”. A typology of OI practices is not presented in this paper because it is beyond our scope, but in Rodríguez-Ferradas (2014) the reader may consult a detailed description of an OI practice typology based on an in-depth review of the literature on this issue. The link between specific types of OI practices and NPD is a relevant gap in the literature of OI. Which OI practices are the most suitable, given the characteristics of the company and the context of their NPD process? This is a question that has not yet been answered for the extensive number of different OI practices that are reported in the research literature, leading relevant reviews of the OI literature to make statements similar to Huizingh (2011), who says that “*What is missing is a decent cookbook, an integrated framework that helps managers to decide when and how to deploy which open innovation practices.*”

KEY WORDS

Open innovation, New product development, SMEs, Automotive, Case study

PALABRAS CLAVE

Innovación abierta, Desarrollo de nuevo producto, PYMEs, Automoción, Caso de estudio

NPD is a multi-stage, multi-disciplinary process that involves numerous development stages such as generating ideas, screening ideas, defining concepts, defining product performance specs, finalizing the product design, technical testing, market testing, assessing market potential, developing a business plan, developing prototypes, securing approval from senior management, and launch (Owens, 2004).

The NPD literature has grown rapidly in recent years. Since most NPD research has examined the process only in large organizations and SMEs differ from large firms in several important areas of innovation management, it is not clear whether this research can be applied to SMEs (Huang et al., 2002). With some exceptions, therefore, there is a lack of papers that address the problems and tools needed for the implementation of NPD activities in SMEs. However, the innovation process in this context has characteristics that suggest a specific approach.

Large firms have advantages in terms of resource factors, while small firms are attributed with behavioural advantages. Some examples of the resources owned by large firms that favour NPD are information services, large pools of qualified people and the specialized staff in research facilities (Tether, 2002). Thanks to these resources, large firms are also more likely to support formal systems and organizational structures. While SMEs tend to have a less formal process for developing new products, informal strategic planning and strategy communication and fewer resources generally, their advantage over large firms is that they are able to get closer to their customers in the sense that more employees in the firm have the opportunity to directly observe and interact with them (Murphy and Ledwith, 2007).

However, in the case of large firms a high degree of formalization, can also be constraining because slow the process, blunt initiative and de-motivate creative and energetic staff (Wagner et al., 2002). According to Christensen et al. (2005) there are at least three reasons why SMEs face challenges in collaborating with larger firms. Firstly, due to changing market needs and technological uncertainties, the bargaining power of SMEs might diminish, as they would need to redesign and make several changes to their products, which would lead to high overhead costs. Secondly, due to opportunistic behaviour on the large firm side, SMEs might reap lower economic benefits from alliances. Finally, due to differences



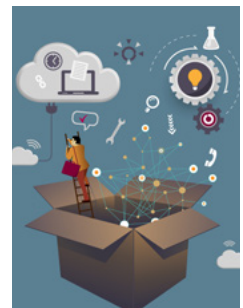
in languages, norms and traditions between large firms and SMEs, the level of communication and trust would be low. These challenges are especially relevant when a SME is dependent on a few strong customers, as is normally the case in the automotive sector. But very little is known about informal partnerships between large firms and SMEs for NPD. One of the few existing references on research on NPD in SMEs found that the quality of executing NPD activities is associated with the firm's resources and skills, and therefore better-resourced SMEs have a higher level of quality in implementing NPD activities (Huang et al., 2002).

Our aim is to encourage academics and practitioners to study and implement OI practices as a way to improve the innovation performance of SMEs in terms of NPD in order to satisfy the changing needs of the market and remain competitive. Therefore, in this work we explore how SMEs, through OI practices, can build a symbiotic relationship with large companies from which interesting opportunities for NPD can emerge.

3. METHODOLOGY

We chose to conduct our research via an exploratory approach, aiming to broaden the current understanding of the relationship between OI practices and NPD for SMEs. Qualitative research is a more exploratory and inductive method than quantitative research, and we decided to apply a multiple case study method, which is useful for replicating findings across a group of cases because the phenomenon under investigation is still quite unclear and we are looking for a deeper understanding of the relationship between OI practices and NPD for SMEs.

The next decision we made was to identify the sample of companies for the multiple case study. At this point of our research we took advantage of our university's collaboration with Volkswagen Navarra, one of the subsidiaries of the Volkswagen consortium in Spain, thanks to the Cátedra de Empresa Volkswagen Navarra–Universidad de Navarra. We found that the opportunity to explore the relationship between OI practices and NPD in a group of SMEs from the automobile sector could be a fruitful field of research. Some authors that have recently explored the field of OI in the automotive sector found that OI is appropriate for the automotive industry, and that it will be a crucial factor in the coming years (Ili et al., 2010). However, the situation of SME suppliers in terms of the implementation of



OI practices with their main customers in the automotive sector, the Original Equipment Manufacturers (OEMs), still remains unexplored. The automobile industry has a huge direct and indirect economic impact on the European economy. The European Automobile Manufacturers' Association (ACEA) reports that in 2013 the turnover generated by the automotive sector represented 6.9% of EU GDP. Moreover, a total of 12.9 million Europeans are employed in the automotive sector. It is also worth noting that the automotive industry is the largest private investor in R&D in Europe, investing over €32 billion in R&D and applying for 9,500 patents per year. Moreover, this is a sector that has a special presence in the literature related to case studies on OI practices in Europe, such as the ones described in Ili et al. (2010) and Lazzarotti et al. (2013).

We contacted the innovation group at Volkswagen Navarra, whose committee helped us to identify SME suppliers that worked with different OEMs and that were also especially proactive in terms of OI activities. They proposed eight SME suppliers; we contacted them and seven of them agreed to collaborate in this research.

In **Table 1**, we present the main characteristics of these seven SME suppliers. We have not included their names for reasons of confidentiality. It is relevant to emphasize that we did not work with component suppliers; our focus was on suppliers to departments such as logistics, quality, maintenance and process and installation. This was done in this way because component suppliers are large companies whose contracts and requirements come from the headquarters of the OEM, so their profile is outside of the scope of this study.



Table 1. Main characteristics of selected SMEs for the multiple case study

SME SUPPLIER	SIZE (# OF EMPLOYEES)	% EMPLOYEES WITH UNIVERSITY DEGREES	YEARS IN BUSINESS	ACTIVITY	INNOVATION RESOURCES
SME 1	9	22%	40	Electronic repairs for industrial customers	2-3 people partially dedicated to innovation activities
SME 2	17	10%	14	Mechanical and electrical maintenance services and some development for process automation.	1 person exclusively and 2-3 partially dedicated to innovation activities
SME 3	40	20%	8	Automated transmission lines primarily for the automotive sector (90-95% activity) and also offers maintenance of these facilities	3 people exclusively dedicated to innovation activities
SME 4	21	96%	14	Artificial vision systems applied to industrial environments, medical and animation and custom software development.	7-8 people partially dedicated to innovation activities
SME 5	128	20%	55	Design, manufacture and commercialization of innovative storage and logistics solutions.	1 person exclusively and 10 partially dedicated to innovation activities
SME 6	5	80%	12	Consultants and integrators of IT solutions and peripherals. For specific projects also mechanical designs.	2 people lead the innovation activities (but they also develop day-to-day activities) and the rest participate in some degree.
SME 7	67	15%	10	On-site services for maintenance of electro-mechanical systems	4-5 people partially dedicated to innovation activities

After providing the seven suppliers with information about our research objectives and how it was going to be developed, we arranged to conduct face-to-face interviews with these seven SMEs, using a semi-structured interview format. During the interviews the researcher was taking notes, which were later transcribed and sent to the interviewees for their review and approval.

Each of the interviews was planned with the contact person at each SME and the researcher went to the agreed place to carry out the interview. In some of the interviews more than one person participated in order to provide richer information about the subjects of our research. We interviewed people that were experts in innovation at each SME and the profiles of the interviewees are described in **Table 2**.

Table 2. Profiles of the interviewees

SME SUPPLIER	NUMBER OF INTERVIEWEES	INTERVIEWEE PROFILE
SME 1	1	Managing director
SME 2	3	Managing director + Head of innovation + Head of robotic area
SME 3	1	Project manager (at the company since its founding)
SME 4	1	Managing director
SME 5	1	Technical Sales Manager
SME 6	2	Managing director + Technical manager
SME 7	1	Director of the technical office

The semi-structured questionnaire designed for the interviews included three sections. The first one was focused on collecting information that would allow us to characterize each SME. The second section was centred on the description of their first OI practice, which allowed us to understand all the factors that pushed or hindered their early experiences and the benefits of implementation. Finally the third section was focused on the subsequent evolution of OI practices, looking for further relationships with their partners and any sign of systematization that could link NPD and OI practices. The semi-structured questionnaire used by researchers in these interviews is included in Appendix A.

3. FINDINGS

Concerning the OI experiences of the seven SMEs, **Table 3** summarizes the different OI practices that they reported and the kind of partners they collaborated with for each practice (Abbreviations in the table mean: Uni = university; Cust = customer; Comp = competitor).

From Table 3 we can see that all seven SMEs have been engaged in OI practices, and that three of them had implemented three or four different OI practices. Moreover, the motives that pushed them towards OI were primarily the need to meet customer demands (as was the case for SME1, SME2, SME3 and SME4), to keep up with competitors (SME5) and to open new markets (SME6). In addition to these motives, we also found that SME7 looked to improve the performance and efficiency of an internal process.

In spite of being a small sample of SMEs, we find that the implemented OI practice typology covers all the NPD process stages from op-

Table 3. OI practices reported by SMEs from the multiple case study and type of partners

IMPLEMENTED OI PRACTICES	SME1	SME2	SME3	SME4	SME5	SME6	SME7
Innovation contests					Uni, Cust.		
Inward licensing of IP					Comp.		
Joint development	Cust.	Cust	Cust	Cust	Cust, Suppliers	Cus.	Suppliers, Cus.
Joint venture				Supplier			
Lead user method				Cus.			
Outsourcing R&D						Cus	
Outward licensing of IP						Cus	
Regional innovation clusters				Comp		Comp	

portunity identification to commercialization, which could mean that SMEs can use OI practices all throughout their innovation process. What all the SMEs that participated in our research have in common is the implementation the OI practice of joint development, and all of them have implemented this OI practice with customers (and in two cases also with suppliers). Through joint development, SME1, SME5, SME6 and SME7, which are services companies, were able to develop their own innovative products.

SME5 is the only SME in our sample that has implemented an innovation contest, and moreover they did it twice and reported a systematic model of their NPD process for using this OI practice. To the best of our knowledge, this is the first reference in the literature to an SME that has implemented this type of OI practice.

In the following section we focus on joint development, as we believe that it is especially relevant to SME suppliers in developing new products, and because it was used across all SMEs in our sample.

4. JOINT DEVELOPMENT

Joint development is defined in the OI literature as collaborations over the value chain that are targeted at a certain product or market. They can take the form of joint research projects, consortia or programs with an exchange of knowledge, people and resources (Rohrbeck et al., 2009).

Engaging with market-based partners such as customers and suppliers can help to better specify market requirement for innovated goods, services or processes and to spread the costs and risks of the innovation process (Mina et al., 2014). Moreover, joint development provides an opportunity to access knowledge and technologies, and thus increase the innovativeness of the company. When working with customers, this practice not only gives SMEs a better understanding of their customers, it also helps customers forge a stronger and more personal relationship with the company.

A number case studies on joint development in large companies have been analysed in the OI literature, examples of such being the IBM Microelectronics Joint Development Alliance consortia (Pisano and Verganti, 2008), the Nokia joint development agreement with Nordea Bank and Visa International (Dittrich and Duysters, 2007), and the Deutsche Telekom project to develop a ‘speech-based classifier’ together with Siemens and four other partners (Rohrbeck et al., 2009).

In **Table 4** we summarize the examples of joint development practices implemented by the seven SME suppliers that participated in our research.

Table 4. Joint development practices implemented by SME suppliers

SME	OBJECTIVE	PARTNERS	START OF THE COLLABORATION	BENEFIT
SME1	Development of a system of sensors to solve the problem of measuring humidity at an OEM's final inspection facilities.	Customer OEM	Informal	1) Show their added value services beyond usual repair tasks 2) Development of their own system of sensors 3) The project results were shared with other subsidiaries of the OEM
SME2	Automation system for assembling doors on the car assembly line	Customer OEM	Informal	1) Before the collaboration, SME2 only offered services in mechanical and electrical maintenance; after this project, they added process automation services to their portfolio of services 2) The project results were shared with other subsidiaries of the OEM
SME3	Solutions to maximize the number of car bodies that could be stored in a specific part of the OEM's workshop	Customer OEM	Informal	1) Trust between SME and the customer has increased, and the SME now has more direct information about the customer's needs

SME4	Artificial vision system for quality inspection	Customer OEM	Formal	1) The project results were shared with other departments of the same OEM and also with other subsidiaries of the same group
SME5	Development of an innovative glue that could substitute welding in some products	Supplier	Informal	1) A technical success but the volume of consumption was too low to assume the cost of production 2) A strengthening of the relation with supplier and new opportunities for joint development
SME6	Development of an innovative solution for registering batches of medicines	Customer (Pharmaceutical company)	Formal	1) New product development 2) The SME gained market visibility and opportunities for diversification
SME7	Hardware-software system to register and automatically transfer the working parts of their technicians in customers facilities	Hardware supplier + Software supplier + Customer OEMs	Informal	1) Development of a product that can be patented, and while improving the efficiency of its internal processes there is the possibility of licensing the product to other companies

From our study we can highlight some of the aspects of the implementation of joint development practices in these SMEs. Five of these seven companies launched joint development initiatives in an informal way; in other words, thanks to the geographical proximity of the partners, while these SMEs were providing other services to their customers, some of their contacts in the customer companies asked for their collaboration, starting with a typical sentence such as, “take a look to see if you can give me some ideas about how to solve this problem”. From this informal mechanism joint development initiatives were launched, but in some cases there have been problems later on in relation to intellectual property rights and cost sharing. This result confirms Bönthe’s (2006) suggestion that firms’ appropriability problems have a negative impact on inter-firm trust.

Because of their limited human resources, these SMEs find it very challenging to manage these OI practices in parallel with their day-to-day activities. SMEs also perceive that large companies are very slow to take decisions, and this slows down the progress of the collaboration. Another important issue is that all SMEs interviewed found that their relationships with OEMs were mainly unidirectional in that the OEM posed a challenge and invited them to bring innovative ideas. But in going in the other direction, the suppliers

encountered many barriers to proposing their own innovative ideas to their customer OEMs. Because of this, the SME suppliers request that there be a person in charge of managing these ideas within the OEM.

In terms of the main benefits that the SMEs obtained from their joint development practices, one noteworthy result is that SME suppliers found that this practice strengthened their relationship with their customer and/or supplier because after these collaborative experiences mutual trust in sharing problems and needs increased, and this has generated new OI opportunities. All the SMEs found that geographical proximity facilitated opportunities for OI between OEMs and SME supplier. Therefore, the figure of the resident technician is positively valued by SME suppliers in enhancing trust and the exchange of tacit knowledge that led to the emergence of opportunities for NPD. This result is in line with existing empirical studies on the determinants of inter-firm trust that highlight the relevance of geographical proximity for the emergence of trust. Dyer and Chu (2000), for instance, state that there is more face-to-face communication between suppliers and OEMs in Japan than in the U.S. or Korea, which may positively affect trust. Moreover, empirical research reported by Bönnte (2006) suggests that incoming knowledge spillovers from customers positively affects suppliers' trust.

Moreover, thanks to the implementation of this type of OI practice, four of the seven analysed SMEs have developed innovative products or services for their portfolio and have gained visibility with new potential customers, even though most of them have been developed in an informal process of NPD.

5. CONCLUSIONS

This study aims to understand how SME suppliers from the automotive sector open their innovation processes and their relation with NPD. From the results of our study we suggest to managers of SMEs that different OI practices can be more suitable for NPD in SMEs collaborating with different kind of partners. While joint development seems to be more suitable for customer-supplier collaborations, the innovation contest seems to be a better fit for company-university collaborations and the regional innovation clusters are practices that SMEs find suitable when innovating with competitors that are in geographically close to them.

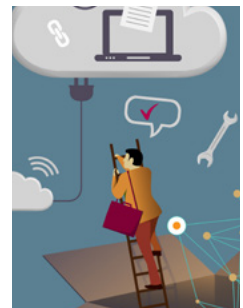


On the other hand, managers from OEMs need to be aware of the barriers that their SME suppliers find in implementing OI practices with them. A good example of these barriers is the informal mechanism used to launch joint development initiatives, which later on caused problems related to intellectual property rights and cost sharing. Moreover, SME suppliers found that there are many barriers to proposing their own innovative ideas to customer OEMs due to the lack of somebody in the OEM who plays the gatekeeper role. Therefore, we suggest that researchers explore the benefits of implementing a more formalized mechanism and specific roles in their organization to receive and evaluate proposals for OI initiatives with SME suppliers and later on launch and manage these OI practices. Finally, we would like to encourage SME managers to open their NPD process through the implementation of joint development practices, as it is not only an opportunity to increase their trust in their customers and suppliers but it is also a way to increase the exchange of tacit knowledge that will push the emergence of opportunities for NPD.

6. LIMITATIONS AND FURTHER RESEARCH

Obviously, given the exploratory nature of this study, the research has several limitations that suggest caution in generalizing the conclusions reached. The main limitations are the qualitative methodology followed in the empirical research, the limited set of companies analysed and the focus on the automotive sector.

Further research on OI practices in SMEs is needed to shed light on the benefits and drawbacks that different typologies of OI practices can offer to SMEs in NPD. More extended studies that include the use of quantitative data analysis tools are also recommended.



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NOTES

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