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Luís Filipe Silva

ISCA-UA, University of Aveiro,
Email: filipersilva@sapo.pt

António Carrizo Moreira

DEGEIT, GOVCOPP, University of Aveiro,
Email: amoreira@ua.pt

Alignment in Collaborative New Product Development. Comparing Small and Large firms

Abstract: This paper aims at investigating how Alignment is performed by Small and Medium-sized enterprises (SMEs) and large firms and its impact on Collaborative New Product Development (CNPD). Also, this study considers the influence of innovation on inter-firm alignment. This study was performed through six in-depth interviews. Case studies were used to describe the reality of study. The results show that the greater intensity of alignment stems from the sharing of strategic information between firms involved in the initial phases of CNPD, influenced by the trust and commitment created in the supplier-client relationship when generating radical innovation. Also, results show that the larger intensity of alignment in CNPD is not influenced by firm size, despite being greater in the reality of large firms. This study complements the existing literature on alignment by investigating how firms align upstream according to their size. Likewise, this study contributes to reduce the knowledge gap about the influence of innovation generated in CNPD on the intensity of alignment.

Keywords: Alignment, Collaborative New Product Development, New product Development, Inter-firm alignment, Inter-firm collaboration, SMEs, Large Firms

1 Introduction

Business dynamics has been promoting collaboration between suppliers and clients in the development of new products (Faems et al., 2005; Noke and Hughes, 2010; Un and Azarkawa, 2015; Hofman et al., 2017; Silva and Moreira, 2017, 2018; Saragih and Tan, 2018). Within this framework, collaborative new product development (CNPD) relies on inter-firm alignment (Kim, 2006; Martins et al., 2012; Handfield et al., 2015; Chaochotechuang and Mariano, 2016; Tafti et al., 2019). Alignment is defined in several ways, being commonly described by how firms share, combine and integrate activities (Papp, 2001; Lee, 2004; Chen and Huang, 2014). Several studies have analysed alignment to assess the catalysts increasing its intensity (Luftman, 2000; Papp, 2001; Acur et al., 2012; Martins et al., 2012; Chaochotechuang and Mariano, 2016; Tafti et al., 2019).

Market alignment involves trust and commitment, the sharing of strategic information and inter-firm involvement, which influences CNPD. The frequent communication and the degree of sharing and integration of technical information are crucial for firms to succeed in the market, especially when developing CNPD. Product complexity, flexibility and large adaptation investments contribute to a greater intensity of product alignment which makes CNPD an important aspect for firms to gain competitive advantage (Zhou et al., 2005; Brettel et al., 2012; Morita et al., 2015; Chaochotechuang and Mariano, 2016; de Matos et al., 2017; Gonzalez-Zapatero et al., 2017; Pae, 2017; Tafti et al., 2019).

Alignment also promotes the efficiency of development of new products, cost and relationship improvement among players, flexibility and time-to-market (Fawcett et al., 2008; Khan et al., 2012; Zhao and Lavin, 2012; Melander et al., 2014; Sjoerdsma and Weele, 2015; de Matos et al., 2017; de Medeiros et al., 2018; Tafti et al., 2019). In this context, alignment can be regarded as an opportunity for companies to increase the efficiency of CNPD by sharing knowledge between suppliers and customers (Lavie and Rosenkopf, 2006; Tallon and Pinsonneault, 2011; Zhao and Lavin, 2012; Gonzalez-

Zapatero et al., 2017). However, the benefits generated by alignment vary according to the degree of involvement between CNPD actors and the type of shared resources (Fawcett et al., 2008; Lamberti et al., 2017). Consequently, the benefits generated by the greater intensity of alignment result from the joint creation of value based on the sharing of resources (Fawcett et al., 2008, Khan et al., 2012, Melander et al., 2014). On the other hand, alignment can represent a challenge for companies, generating complementary business areas or streamlining the relationship with different stakeholders (Tallon and Pinsonneault, 2011; Khan et al., 2012; Pae, 2017).

Most studies analyse alignment in large firms (LFs) (Campbell and Avison, 2005; Stanko, 2007; Pero et al., 2010; Khan et al., 2012; Sjoerdsma and Weele, 2015), thereby overlooking the reality of small and medium-sized firms (SMEs), which makes it impossible not only to compare alignment according to firm size but also to analyse the differences between those two groups of firms. Moreover, the literature analyses alignment from the standpoint of adjustment between the business strategy and information systems (Luftman, 2000; Campbell and Avison, 2005; Tallon and Pinsonneault, 2011); however, it does not study alignment according to the innovation generated in CNPD. The literature states that product complexity leads to supplier-client alignment (Spekman et al., 1998; Wynstra and Ten Pierick, 2000; Petersen et al., 2003; Melander et al., 2014). However, most research on this topic focuses on the analysis of high-tech industries, that are repeatedly taken into account in several studies – e.g. in the automotive, pharmaceuticals, electronics, IT and chemical industries (Spekman et al., 1998; Handfield et al., 1999; Petersen et al., 2003; Martins et al., 2012), thereby not stretching the understanding of alignment to other industries. Thus, taking into account both the importance of SMEs for national competitiveness and the absence of studies involving SMEs regarding alignment, this paper seeks to complement previous literature on the alignment of CNPD in upstream activities, first addressing SMEs and then comparing SMEs with LFs, seeking to analyse how those types of firms influence the intensity of alignment. Also, this paper considers the influence of innovation through alignment and extends the focus of study to other industries.

This paper studies CNPD in upstream activities, according to the following variables: objective of the use of external technologies by *focal firms*; innovation generated; and typology of the firms involved. The study of alignment is based on the following variables: market alignment, technological alignment and product alignment.

By taking into account the relationship between SMEs and LFs with their suppliers in CNPD activities, this paper seeks to answer the two following questions: (a) How does alignment occur in CNPD activities? (b) How different is alignment between SMEs and

LFs according to the innovation generated?

This paper is divided into seven sections. The following two sections provide the theoretical support and research methodology. Section four addresses six case studies describing the reality under study. Section five provides a discussion on the studied cases. Section six sets out the main findings and implications. Section seven lays down the limitations and future research.

2 Literature Review

2.1 Inter-firm Collaboration

Collaboration refers to the way firms articulate their activities (Wognum et al., 2002; Soosay et al., 2008; Melander et al., 2014; de Matos et al., 2017; Lamberti et al., 2017; Silva and Moreira, 2017, 2018), based on trust and commitment (Spekman et al., 1998; Powers and Reagan, 2007; Khan et al., 2012;). Therefore, CNPD determines the activities

to be developed by the firms (Handfield et al., 1999; Billington and Davidson, 2013; Gonzalez-Zapatero et al., 2017; Hofman et al., 2017; Pae, 2017; de Medeiros et al., 2018) and the alignment required for their combination according to the innovation generated (Pero et al., 2010; Brettel et al., 2012; Chaochotechuang and Mariano, 2016; Tafti et al., 2019). Specialisation promotes upstream co-development of differentiated products, especially among LFs (Koberg et al., 2003; Pae, 2017). Another standpoint states that suppliers are involved in CNPD to increase the efficiency of the activity of their clients – both SMEs and LFs (Ettlie and Reza, 1992; Soosay et al., 2008; Hilletofth and Eriksson, 2011). Other studies state that both SMEs and LFs look to the specialisation of suppliers when they intend to diversify their portfolio (Van de Vrande et al., 2009; Pero et al., 2010; Hossain, 2015). In this context, the literature states that suppliers are involved in CNPD in order to differentiate client products or to increase the efficiency of creating new products (Ettlie and Reza, 1992; Hilletofth and Eriksson, 2011), while collaboration to diversify the clients' product portfolio creates improved products (Pero et al., 2010). Therefore, alignment in CNPD may differ according to firm size and the type of innovation generated.

Several studies analyse the innovation generated in CNPD, by classifying created products as brand-new products or improved/modified products, based on their novelty (Garcia and Calantone, 2002; Parida et al., 2012; Chaochotechuang and Mariano, 2016; Tafti et al., 2019). In this regard, the studies carried out by Stadler (2011) on LFs show that innovation is more radical in product design, when compared to processes. However, Faems et al. (2005) and Soosay et al. (2008) claim that inter-firm collaboration also leads to the development of new processes.

Other studies state that CNPD occurs between LFs due to their technological and production capacity to create highly complex products. However, other studies state that specialised and flexible SMEs are also involved in CNPD (Van de Vrande et al., 2009; Lee et al., 2010; Nicholas et al., 2011). Another standpoint states that collaboration between LFs and their service suppliers creates new products, while collaboration between SMEs creates improved products (Faems et al., 2005). Nevertheless, industrial firms also involve service suppliers in CNPD in order to develop new manufacturing processes (Sáez et al., 2002; Faems et al., 2005; Un and Azakawa, 2015).

2.2 Inter-firm alignment

Several studies define alignment as inter-firm sharing, combination and integration of activities (Luftman, 2000; Lawson et al., 2009; Acur et al., 2012; Khan et al., 2012; Chen and Huang, 2014; Hofman et al., 2017). Alignment also relies on the industry's technological intensity, firm size and product complexity (Olson et al., 2005; Lawson et al., 2009; Chen and Huang, 2014). Other research analyses alignment according to the following aspects: market, technological and product alignment (Voss and Voss, 2000; Zhou et al., 2005; Acur et al., 2012; Chaochotechuang and Mariano, 2016; Tafti et al., 2019).

Market alignment analyses the collaborative relationship according to trust and commitment, the sharing of strategic information and inter-firm involvement (Becker and Homburg, 1999). High-intensity market alignment occurs when firms develop new products (Ketchen et al., 2007; Brettel et al., 2012). Technological alignment is the interaction between firms when sharing and internalising new technologies (Gatignon and Xuereb, 1997; Voss and Voss, 2000; Zhou et al., 2005). Frequent communication and a high degree of sharing and integrating technical information lead to technological alignment (Luftman, 2000; Papp, 2001; Morita et al., 2015). Product alignment addresses how firms share and adapt resources (Gatignon and Xuereb, 1997; Acur et al., 2012; Morita et al., 2015). Product complexity, flexibility and large adaptation investments

contribute to a greater intensity of product alignment (Joshi et al., 2003; Lawson et al., 2009).

Both market alignment and technological alignment are important strands on defining strategy, while product alignment analyses activities associated with product development (Acur et al., 2012). According to Joshi et al. (2003) and Lee (2004), simultaneous alignment in strategic and operational terms leads to a higher intensity of alignment, due to higher combination between objectives and activities performed.

2.2.1 Market alignment

Trust and commitment: Trust leads to information sharing between suppliers and clients (Handfield and Bechtel, 2002; Wognum et al., 2002; Petersen et al., 2003; Gonzalez-Zapatero et al., 2017), and to a higher intensity of alignment (Spekman et al., 1998; Handfield and Bechtel, 2002). According to Hakansson (1990), trust among SMEs tends to grow throughout the relationship. Other studies analysing LFs state that the highest degree of trust occurs in inter-firm relationships at the stage of development of new ideas (Spekman et al., 1998; Wognum et al., 2002; Sjoerdsma and Weele, 2015). Hence, it is expected that new product design leads to a higher degree of trust between firms. In contrast, Powers and Reagan (2007) argue that a higher degree of trust is created in the final stages of the supplier-client relationship due to the growing commitment. Therefore, market alignment, which is determined by trust, can be influenced by relational factors and by the innovation generated in CNPD. However, this topic is rarely analysed in the reality of SMEs.

Trust favours commitment (Morgan and Hunt, 1994; Powers and Reagan, 2007), which, in turn, leads to inter-firm alignment and relationship (Humphries and Wilding, 2004; Stanko et al., 2007; Tallon and Pinsonneault, 2011; Sjoerdsma and Weele, 2015). Commitment is based on the flexibility between firms to align processes promoting information sharing and the combination of activities and objectives (Rothaermel, 2001; Lavie and Rosenkopf, 2006; Powers and Reagan, 2007; Tallon and Pinsonneault, 2011). From another standpoint, studies analysing LFs claim that the highest intensity of commitment occurs during the designing of new products as a result of frequent information sharing (Stanko et al., 2007; Sjoerdsma and Weele, 2015). Lavie and Rosenkopf (2006) state that the highest degree of commitment occurs in high-tech industries; however, they do not relate the topic to firm size. According to Powers and Reagan (2007), commitment arises throughout the collaborative relationship.

Sharing of strategic information: Information sharing relies on the trust created in the supplier-client relationship (Simatupang and Sridharan, 2002; Zhao and Lavin, 2012; Brun et al., 2013; Melander et al., 2014). According to Morgan and Hunt (1994) and Wipple and Russell (2007), the sharing of strategic information relies on the commitment between firms. Petersen et al. (2003), Yeung et al. (2009) and Melander et al. (2014) also argue that the sharing of strategic information takes place in the early phases of inter-firm collaboration. Other studies applied to LFs state that the sharing of strategic information occurs in high-tech industries due to the high degree of product complexity, and that it is based on product strategy coordination (van Echtelt et al., 2008; Yeung et al., 2009; Zhao and Lavin, 2012; Melander et al., 2014). Therefore, the various interactions between suppliers and clients create differences in alignment as to the sharing of strategic information (Wipple and Russell, 2007; Yeung et al., 2009; Zhao and Lavin, 2012). However, the studies do not analyse the influence of firm size on the sharing of strategic information in the relationship.

Type of inter-firm involvement: The type of supplier involvement has an influence on inter-firm collaboration (Handfield et al., 1999; Petersen et al., 2003; Noke and Hughes, 2010) and alignment in CNPD (van Echtelt et al., 2008; Khan et al., 2012). Early supplier

involvement in CNPD increases the combination of activities due to the quick perception regarding product design (Petersen et al., 2003; Khan et al., 2012; Brun et al., 2013), and leads to a higher intensity of alignment due to a better understanding of its objectives (Lee, 2004; Blackhurst et al., 2005). However, LFs or firms operating in high-tech industries are those promoting early supplier involvement in CNPD (Petersen et al., 2003; Pero et al., 2010). Moreover, there is a higher intensity of alignment in the early stages in CNPD, when differentiated products are created, because they require greater information sharing (Pero et al., 2010; Khan et al., 2012; Tafti et al., 2019).

2.2.2 Technological alignment

Type of communication: Inter-firm relationships promote the adjustment of communication throughout information sharing (Luftman, 2000; Papp, 2001; Wogum et al., 2002; Bstieler, 2006; Handfield et al., 2015). In this regard, the sharing of information on product design promotes frequent communication between firms, both SMEs and LFs (Wognum et al., 2002; Bstieler, 2006), resulting in the highest intensity of alignment from the early stage of CNPD (Campbell and Avison, 2005; Brun et al., 2013). Other research on LFs states that frequent communication leads to technological alignment in high-tech industries (Luftman, 2000; Reich and Benbasat, 2000). According to Wognum et al. (2002), the lowest intensity of alignment with SMEs as suppliers is due to a less frequent communication. However, Handfield et al. (2015) proved that high-tech SMEs also share information frequently. Thus, one can claim that the intensity of technological alignment depends on the industry's technological intensity.

Sharing of technical information: The sharing of technical information promotes alignment (Simatupang and Sridharan, 2002; Petersen et al., 2003; Zhao and Lavin, 2012), in accordance with the involvement and commitment created between firms (Spekman et al., 1998; van Echtelt et al., 2008; Rezaei et al., 2015). According to Lee (2004), alignment starts by defining the activities in CNPD, which intensifies in the subsequent stages. Another standpoint states that the sharing of technical information among LFs operating in high-tech industries occurs in product conceptual design (Spekman et al, 1998; Zhao and Lavin, 2012; Melander et al., 2014). According to van Echtelt et al. (2008), it is product differentiation that leads to the sharing of technical information in CNPD, at the time of design conception. Moreover, the literature states that the lowest intensity of alignment occurs when firms occasionally share technical information to monitor the activities undertaken jointly (Spekman et al., 1998; Simatupang and Sridharan, 2002).

Integration of technologies: Integration of technologies occurs when firms have a single view on the objectives of collaboration (Petersen et al., 2003; Simatupang and Sridharan, 2005; Zhao and Lavin, 2012; Brun et al., 2013). The integration of technologies in CNPD occurs in the design stage, when firms are differentiating the product (Kim, 2006; Khan and Creazza, 2009; Brun et al., 2013). Moreover, the development of new products and the industry's high technological intensity foster the integration of technologies in the early stages of CNPD (Handfield et al., 1999; Petersen et al., 2003; Brun et al., 2013) and a high intensity of alignment. Another view states that the integration of technologies occurs upon the collaboration between LFs due to the high degree of specialisation (Holweg and Pil, 2008; Khan et al., 2012). Other studies carried out in LFs show that the integration of technologies occurs in the early stages of CNPD due to the sharing of information about new business models and product design (Droge et al., 2004; Holweg and Pil, 2008; Wong et al., 2013). This phenomenon promotes high intensity of technological alignment (Pero et al., 2010; Wong et al., 2013) between LFs. However, generally speaking, the reality of SMEs is poorly analysed.

2.2.3 Product alignment

Complexity: Complexity is determined by product structure (Hendersen and Clark, 1990; Pero et al., 2010; Khan et al 2012; Martins et al., 2012). In turn, product alignment relies on the coordination of activities in CNPD (Handfield et al., 1999; Petersen et al., 2003; Martins et al., 2012). In this regard, studies on LFs show that a higher degree of product complexity promotes alignment at the time of design conception (Khan et al., 2012; Martins et al., 2012; Melander et al., 2014). Other studies state that the high degree of complexity of new products, mainly developed by high-tech LFs, promotes a higher intensity of alignment (Spekman et al., 1998; Wynstra and Ten Pierick, 2000; Martins et al., 2012; Melander et al., 2014). Thus, the high degree of complexity of differentiated products promotes alignment from the early stage of CNPD (Martins et al., 2012; Brun et al., 2013). Conversely, the low degree of complexity leads to alignment in the final stage of CNPD (Moreira, 2005). Nevertheless, further research on complexity is required in order to assess how SMEs undertake alignment in CNPD.

Flexibility: Flexibility, which is determined by the firms' adaptability (Van der Vaart and Van Donk, 2006; Tallon and Pinsonneault, 2011; Sjoerdsma and Weele, 2015), has an influence on alignment in CNPD (Tallon and Pinsonneault, 2011; Khan et al., 2012; Sjoerdsma and Weele, 2015). According to Handfield and Bechtel (2002) and Homburg et al. (2005), supplier involvement in CNPD makes the manufacturing process of its clients more flexible – higher degree of adaptability to the product to be developed. Entrialgo et al. (2000) and Van der Vaart and Van Donk (2006) corroborate such principles, by emphasising the significance of flexibility for collaboration and alignment in SMEs. From another standpoint, Davidson et al. (1999) argue that a higher degree of flexibility and adaptability required in CNPD stems from the need for specialisation in the design stage. Zhou and Wu (2010) and Nicholas et al. (2011) complement this view, by stating that this phenomenon occurs in high-tech industries.

Adaptation investments: Inter-firm collaboration promotes adaptation investments (Morgan and Hunt, 1994; Zhao and Lavin, 2012; Sjoerdsma and Weele, 2015), in line with the need of adjustment to new manufacturing technologies (Heide and John, 1988; Song and Thieme, 2009; Zhao and Lavin, 2012). Suppliers generally make investments related to product technical design (hardware, forming, moulds, samples), while clients invest in processes configuring prototypes (project, software, forming) (Handfield and Bechtel, 2002; Zhao and Lavin, 2012; Brun et al., 2013). Song and Thieme (2009) specify that designing new products requires investment in new equipment. Thus, adaptation investments, mainly made by suppliers, contribute to alignment due to the dependency created between firms (Heide and John, 1988; Handfield and Bechtel, 2002). Although the literature refers the adaptation investments made in CNPD, it overlooks the reality of SMEs regarding the innovation generated.

Tables 1, 2 and 3 provide a compilation of the literature review about alignment, indicating the main authors, aspects and implications in CNPD, as well as the focus of analysis regarding firm size.

The framework presented in Figure 1 was developed to study the dynamic of alignment in CNPD through two linked steps – collaboration and alignment steps. The collaboration step describes how firms interact in CNPD taking into account the internalisation of technologies (Van de Vrande et al., 2009; Noke and Hughes, 2010; Hilletofth and Eriksson, 2011), the type of actors (Faems et al., 2005; Lee et al., 2010; Un and Azakawa, 2015) and the generated innovation (Parida et al., 2012; Hossain, 2015). There are three types of alignment: market, technological, and product alignment (Gatignon and Xuereb, 1997; Voss and Voss, 2000; Zhou et al., 2005; Acur, et al., 2012; Wong et al., 2013).

3 Methodology

This research analyses how SMEs and LFs carry out alignment in upstream CNPD, in a comparative perspective.

The unit of analysis is firms in their upstream collaboration, in order to measure alignment intensity, from the perspective of the client firm.

This research is based on a qualitative research (Baxter and Jack, 2008) and relies on single and multiple case studies to portray reality and evaluate the relevant variables. Studying multiple cases allows us to analyse the reality of each firm (Yin, 2003; Baxter and Jack, 2008) and compare different realities (Voss et al., 2002).

Theoretical sampling was used to select all six industrial firms known for involving suppliers in CNPD – also known as focal firms – corresponding to three SMEs (FF1, FF2 and FF3) and three LFs (FF4, FF5 and FF6). The firms were classified as SMEs and LFs according to the European Commission's criterion (2003) regarding the number of employees, therefore making it possible to analyse and compare alignment in accordance with firm size. This sample comprises firms operating in several industries, allowing us to assess the heterogeneity of their behaviour. Table 4 presents the profile of focal firms.

Two-round semi-structured interviews were carried out with the managers of the firms about alignment with suppliers in CNPD, the characteristics of their actors, type of involvement and type of innovation generated. Interviews were carried out with an interviewing script with semi-open questions, to guide the research (Malhotra, 2007; Baxter and Jack, 2008). These interviews were taped and later transcribed into paper. The interviews lasted between 1 hour and 10 minutes and 1 hour and 35 minutes. The anonymity of the surveyed firms' identity ensured the confidentiality of the collected information, thereby promoting in-depth content. The interviews were carried out in the facilities of the firms, which made it possible to gain some additional information on their innovative projects and activity, undertaken in collaboration with suppliers, as well as the range of available products, main markets, existing technology, developed manufacturing processes, and systems used to manage information flows. The data was gathered through two rounds of interviews, analysis of written documents, and a feedback report on the results, which helped to triangulate all information.

The analysis regarding the type of supplier involvement, in order to assess alignment with the market, is based on the CNPD stages in which they operate – idea/design stage (initial stage), engineering/manufacturing process stage, and prototype development stage. The definition of the stages was adapted from Handfield et al. (1999) and Eisto et al. (2010).

The data collection process was organised into two cycles. An analysis of the response and information gathered took place after each cycle. In the first cycle, the objective was to obtain a clear overview of involvement in the different CNPD phases, the objectives of the CNPD process and the type of suppliers involved taking into account market, technological and product alignment. In particular, we were looking for information regarding trust and commitment, sharing of information, type of supplier involvement, type of communication, integration of technologies, product complexity, adjustment investments and flexibility of the adaptation process. The second cycle was prepared based on the preliminary conclusions from the first cycle. The second round of interviews was prepared with greater detail, based on the same open-ended questions as in the first cycle although seeking for enhancements of emerging ideas or reviews of the concepts that were not completely clear after the first round of questions. Clearly, in this second phase the major efforts were in understanding the whole process.

Table 1 Overview of market alignment

Authors	Alignment aspects	Implications in CNPD	Firm size
Hakansson, 1990; Petersen et al., 2003; Humphries and Wilding, 2004; Lavie and Rosenkopf, 2006; Powers and Reagan, 2007; Gonzalez-Zapatero et al., 2017;	Trust and commitment	Improve the relationship between firms, from the first stage of CNPD – promote early CNPD; Improve flexibility in managing the relationship, with implication in the great combination of activities developed by firms in CNPD.	Not specified
Morgan and Hunt, 1994; Handfield and Bechtel, 2002			LF and SMEs
Spekman et al., 1998; Rothaermel, 2001; Wognum et al., 2002; Stanko et al., 2007; Sjoerdsma and Weele, 2015			LF
Tallon and Pinsonneault, 2011			SMEs
Morgan and Hunt, 1994; Brun et al., 2013	Sharing of strategic information	Improve the supplier-client relationship and commitment between firms in CNPD; Improve trust between firms involved in the early stages of CNPD	LF and SMEs
Simatupang and Sridharan, 2002; Petersen et al., 2003; Wipple and Russell, 2007; van Echtelt et al., 2008; Yeung et al., 2009; Gonzalez-Zapatero et al., 2017; Hofman et al., 2017;			Not specified
Zhao and Lavin, 2012; Melander et al., 2014			LF
Handfield et al., 1999; Petersen et al., 2003; Lee, 2004; van Echtelt et al., 2008; de Matos et al., 2017; Gonzalez-Zapatero et al., 2017; Hofman et al., 2017;	Type of inter-firm involvement	Early supplier involvement improves the combination of activities and the high intensity of alignment from the first stages of CNPD.	Not specified
Blackhurst et al., 2005; Pero et al., 2010; Khan et al., 2012			LF
Noke and Hughes, 2010; Chaochotechuang and Mariano, 2016			SMEs
Brun et al., 2013			LF and SMEs

Table 2 Overview of technological alignment

Authors	Alignment aspects	Implications in CNPD	Firm size
Mohr and Spekman, 1994; Chaochotechuang and Mariano, 2016;	Type of communication	Communication between companies in the early stages of CNPD improves the knowledge about the product and increases the technological fit of CNPD.	SMEs
Papp, 2001			Not specified
Luftman, 2000; Reich and Benbasat, 2000; Wognum et al., 2002; Campbell and Avison, 2005			LF
Bstieler, 2006; Brun et al., 2013; Handfield et al., 2015			LF and SMEs
Rezaei et al., 2015; Chaochotechuang and Mariano, 2016;	Sharing of technical information	Increase commitment between suppliers and customers, especially when it occurs in the initial phase of CNPD.	SMEs
Simatupang and Sridharan, 2002; Petersen et al., 2003; Lee, 2004; van Echtelt et al., 2008; Gonzalez-Zapatero et al., 2017; Hofman et al., 2017;			Not specified
Spekman et al., 1998; Zhao and Lavin, 2012; Melander et al., 2014			LF
Handfield et al., 1999; Petersen et al., 2003; Simatupang and Sridharan, 2005	Integration of technologies	Increase the specialisation level of the firms involved in CNPD and alignment about the manufacture processes.	Not specified
Droge et al., 2004; Kim, 2006; Holweg and Pil, 2008; Pero et al., 2010; Khan et al., 2012; Zhao and Lavin, 2012; Wong et al., 2013			LF
Khan and Creazza, 2009; Brun et al., 2013			LF and SMEs
Chaochotechuang and Mariano, 2016;			SMEs

Table 3 Overview of product alignment

Authors	Alignment aspects	Implications in CNPD	Firm size
Hendersen and Clark, 1990; Handfield et al., 1999; Petersen et al., 2003; Moreira, 2005; de Matos et al., 2017;	Complexity	The product's high complexity could increase the coordination and adjustment of activities in CNPD; The product's high complexity can lead to premature involvement of suppliers in CNPD and, consequently, to early alignment.	Not specified
Spekman et al., 1998; Wynstra and Ten Pierick, 2000; Pero et al., 2010; Khan et al 2012; Martins et al., 2012; Melander et al., 2014			LF
Brun et al., 2013			LF and SMEs
Gerwin, 1993; Davidson et al., 1999; Homburg et al., 2005	Flexibility	The greater adaptation and flexibility of the supplier turns the CNPD more agile, with implication, also, to the customers activity; In general, great flexibility of suppliers promotes their early involvement in CNPD.	Not specified
Entrialgo et al., 2000; Van der Vaart and Van Donk, 2006			SMEs
Handfield and Bechtel, 2002; Zhou and Wu, 2010; Nicholas et al., 2011			LF and SMEs
Tallon and Pinsonneault, 2011; Chaochotechuang and Mariano, 2016;			SMEs
Khan et al., 2012; Sjoerdsma and Weele, 2015			LF
Heide and John, 1988; Chaochotechuang and Mariano, 2016;	Adaptation investments	Promotes greater adjustment of resources needed for CNPD, in relation to the manufacturing processes.	SMEs
Morgan and Hunt, 1994; Handfield and Bechtel, 2002; Brun et al., 2013			LF and SMEs
Song and Thieme, 2009			Not specified
Zhao and Lavin, 2012; Sjoerdsma and Weele, 2015			LF

Figure 1 Framework of analysis

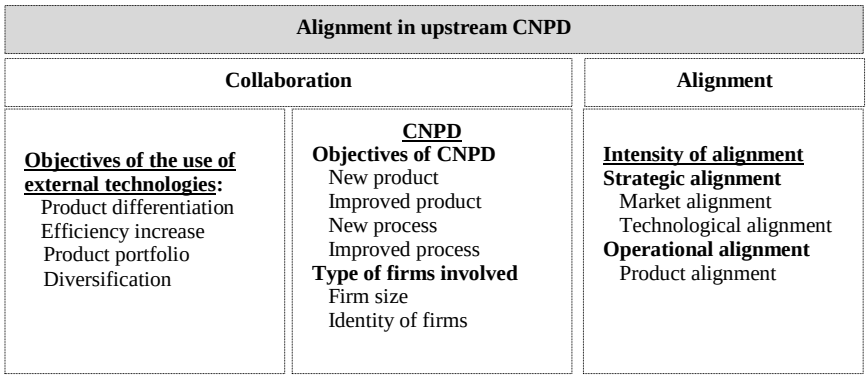

Table 4 Profile of focal firms

Description	FF1	FF2	FF3	FF4	FF5	FF6
Main activity	Electronic products	Wood accessories for bathrooms	Surface treatments	Fixing systems	Hardware and metal components	Ceramics
Technological intensity	High	Low	Moderate	High	Moderate	Moderate
Principal products	Electronic plates and circuits, Other electronic equipment	Toilet seat covers and wood bases for shower trays	Surface treatments, Heat treatments	Fixing systems, Fixing components, Shafts	Decorative hardware, Hinges, Other metal products	Ceramic tiles, Decorative ceramics, Hand-painted tiles
Number of employees	200	10	31	253	252	317
Firm size	SME	SME	SME	LF	LF	LF
Interviewee	CEO	General manager	Industrial director	Production director	Industrial director, Commercial director	R&D manager

After the first cycle of the data collection process, the data was coded and analysed. The researchers coded the transcripts and compared the coding. During the data analysis phase the researchers aimed at identifying relevant issues, questions, and common factors, according to the three alignment topics under study, as recommend by Miles and Huberman (1994). The data was subsequently coded and organised in tables as presented in the following sections. The data from this phase was subsequently used to improve the construct validity and was subsequently confirmed in the second round of interviews.

In order to strengthen the validity of the findings the emphasis was on discovering and discussing the types of alignments within and between types of firms. This was further validated by the interviewees. The secondary data obtained from the interviews was compared to build the multiple case study approach, which helped to mitigate the negative effects of observer bias (Eisenhardt and Graebner, 2007).

4 Empirical findings

4.1 Case studies and collaboration in Upstream CNPD

This section describes the contexts found in accordance with the analysis variables used in the study of CNPD, as shown in Table 5.

FF1 is an SME that manufactures electronic products. FF1 seeks to increase efficiency with CNPD regarding design, technical advice and cost of components. Trust, technical capacity, and flexibility of suppliers promote collaboration. Suppliers participate in the initial stages of CNPD – the idea/design stage and the engineering stage – to conceive product design and develop manufacturing processes. FF1 involves industrial suppliers to generate brand new and improved products/components, and service suppliers to develop new and improved processes. The suppliers are large industrial firms and service SMEs.

FF2 is an SME that manufactures wooden bathroom accessories. CNPD involves suppliers that are skilled in terms of quality, product price and delivery deadlines. Trust and flexibility regarding specifications and quantities are key factors in collaboration. FF2 involves suppliers in the final stage of CNPD – prototype development – to increase efficiency, through technical advice on new materials and the manufacturing process. CNPD generates improved products, thereby increasing their mechanical resistance and improving their finishing. FF2 collaborates with small and medium-sized industrial and commercial suppliers.

Table 5 CNPD between focal firms and suppliers

Variables/Case studies	FF1	FF2	FF3	FF4	FF5	FF6
CNPD - Phases:						
Idea/Design	Yes	-	-	Yes	-	-
Engineering/Manufacture process	Yes	-	-	Yes	Yes	Yes
Prototype development	-	Yes	Yes	-	Yes	Yes
Objective of the use of external technologies						
Product differentiation	-	-	-	Yes	-	-
Efficiency increase	Yes	Yes	Yes	-	-	-
Product portfolio diversification	-	-	-	-	Yes	Yes
Objectives of CNPD:						
Brand new product development	Yes	-	-	Yes	Yes	-
New improved product	Yes	Yes	-	Yes	Yes	Yes
Brand new process development	Yes	-	-	Yes	Yes	Yes
New improved process	Yes	Yes	Yes	-	Yes	Yes
Type of suppliers:						
Size of suppliers (SME/LF)	SME/LF	SME	SME/LF	LF	SME/LF	SME/LF

FF3 is an SME that operates in the metal surface treatment industry. FF3 develops improved treatment methods in collaboration with suppliers with technical skills and competitiveness in terms of price and quality, as well as flexibility to produce variable lot sizes. Suppliers participate in the final stage of CNPD to render their advice on new components and handling methods. Hence, CNPD increases efficiency of the FF3 case – resistance improvement and metal finishing. Industrial suppliers are multinational companies that develop chemical components, while service suppliers are SMEs that develop treatment methods.

FF4 is a large firm that specialises in the manufacturing of fastening systems for vehicles. Product complexity leads to the involvement of suppliers in the initial stages of CNPD – the idea/design stage and engineering stage. Innovation influences CNPD, as product differentiation requires the incorporation of external technologies in order to create new products and manufacturing processes. Industrial suppliers are involved in product conceptual design and new manufacturing processes. Service suppliers collaborate in the engineering stage in order to develop new manufacturing processes. FF4 involves large suppliers in CNPD that are able to generate high scales of production. FF4 interacts with industrial suppliers in a functional way during the initial stage of CNPD.

FF5 is a large firm that manufactures hardware and metal components. Suppliers are involved in CNPD during the engineering stage and the prototype development stage. Contribution from suppliers during the engineering stage is the proposal of new product sizes, materials and tools, whilst during the prototype development stage it involves the development of components and manufacturing tests. Industrial suppliers are involved in FF5 to develop engineering processes and the prototype. Service suppliers are involved in the engineering stage to conceive manufacturing processes, which are incorporated at a later stage of CNPD. CNPD generates new and modified products. Suppliers are both SMEs and large firms.

FF6 is a large firm. Suppliers collaborate with FF6 to conceive improved products, with a view to diversify product portfolio. Industrial suppliers are involved in the engineering stage and the prototype development stage, in order to conceive new components and product design, while service suppliers are involved in the engineering stage to develop new and improved manufacturing processes. FF6 collaborates with suppliers of large industrial equipment and SMEs supplying ceramic components, as well as service SMEs.

4.2 Alignment in upstream CNPD

This section describes alignment in upstream CNPD. Tables 6 and 7 describe market, technological and product alignment. The case studies allow us to analyse and compare how SMEs and LFs share, combine and integrate their activities with suppliers.

4.2.1 Alignment between SMEs and suppliers

The high levels of trust and commitment foster the sharing of strategic information between suppliers and SMEs, as shown in the FF1 case. In this regard, FF1 reveals that sharing strategic information works as a catalyst for the alignment of product concept and innovation strategy. Thus, the combination of activities in the initial stages of CNPD – the idea/design stage and the engineering stage – fosters early upstream alignment. Likewise, it can be concluded that the high levels of trust and commitment obtained in the initial stages of CNPD are the result of the combination of business objectives. Therefore, the FF1 case shows that supplier involvement in the initial stages of CNPD leads to early alignment. From another perspective, high-tech SMEs developing new products (as illustrated by case FF1) promote stronger alignment with suppliers, since they widen the combination of activities through the various stages of CNPD. The cross-case comparison reveals that market alignment between suppliers and SMEs is stronger when there is early collaboration, leveraged by trust and commitment, as illustrated by FF1 (see Table 6). By contrast, FF2 and FF3 reveal that lower trust and commitment influence strategic activity alignment.

Technological alignment is influenced by the way in which SMEs share information and incorporate technologies. The frequency and amount of communication carried out by FF1 is higher than FF2 and FF3. On the other hand, FF2 and FF3 show that the ongoing communication between SMEs and service and commercial suppliers is due to their involvement in the final stage of CNPD (see Table 6). Therefore, the higher intensity of technological alignment in CNPD is the result of frequent communication between suppliers and SMEs. On the other hand, sharing the project portfolio is a way of allowing the information shared within CNPD to encompass the innovation strategy – type of innovation and product concept – and manufacturing processes, rather than being limited to prototyping activities. In this regard, FF1 shows that the extended sharing of information, partnered with frequent communication, promotes a comprehensive transfer of information in CNPD. In contrast, FF2 and FF3 show that sharing the product portfolio does not enable an extended sharing of information. From another perspective,

technological alignment between SMEs and suppliers is stronger in high-tech industries (as in case FF1), as there is increased sharing of information. Comparing FF1 with FF2 and FF3 shows that technological alignment, determined by the incorporation of technologies, is higher due to the increased sharing of information in the initial stages of CNPD, in the development of radical innovation-based products.

Product complexity influences the way in which SMEs and suppliers carry out collaborative product alignment. Thus, inter-firm alignment is stronger when SMEs involve suppliers in the initial stages of highly complex CNPD, as illustrated by FF1. In contrast, improved/modified products developed by FF2 and FF3 in the final stage of CNPD result in a weaker inter-firm alignment with suppliers. Furthermore, the more flexible and adaptable firms are in the product design stage the more aligned they are with their suppliers (see Table 7). In comparison with FF1, the flexibility and adaptability of FF2 and FF3 with suppliers is lower, since they develop low-complex improved products. Thus, the earlier the collaboration and higher the complexity of products, the stronger becomes product alignment in CNPD. Adaptation investments carried out by SMEs and suppliers within CNPD depend on the generated innovation. It should be noted that the development of products based on radical innovation fosters the undertaking of structural investments, and not just those undertaken with working procedures for the development of improved/modified products.

4.2.2 Alignment between LFs and suppliers

As to market alignment, FF4 and FF5 show that the high levels of trust and commitment arising from CNPD carried out by LFs lead to an increased sharing of information. In addition, the long-term relationship promotes commitment – as illustrated by the FF4 case – resulting in increased market alignment. This interaction fosters the joint definition of objectives.

The sharing of strategic information within CNPD is fostered by the high level of trust and radical innovation generated. The FF4 case shows that the sharing of strategic information, fostered by the long-term relationship with suppliers, promotes joint activities in CNPD. The FF5 and FF6 cases show that the diversification of the product portfolio promotes the sharing of technical information but does not lead to the sharing of strategic information. Nonetheless, differentiation leads to higher alignment (FF4), as the development of products that are highly complex and based on radical innovation promotes the sharing of strategic information. As regards the supplier involvement, FF4 shows that earlier interactions within CNPD lead to greater sharing of strategic information in the initial stages of CNPD. FF4 also reveals that involvement of industrial suppliers in the idea/design stage generates joint product design knowledge and joint definition of objectives (see Table 8). From another perspective, FF4 reveals that market alignment is higher in CNPD carried out by high-tech industries that create highly complex and innovation intensive products. The comparison between the FF4 case and FF5 and FF6 cases shows that the high levels of trust and commitment work as catalysts for market alignment since they promote the sharing of strategic information between firms in the initial stages of CNPD.

Technological alignment occurs in accordance with the type of involvement of suppliers in CNPD and product complexity. In this regard, FF4 reveals that frequent communication with suppliers promotes a higher technological alignment, when it is carried out during the initial stages of CNPD. This interaction is due to the increased information flow, resulting from the complexity of the undertaken activities. From another point of view, FF5 and FF6 cases reveal that the ongoing communication between firms and service suppliers only occurs in the final stage of CNPD. One can

conclude that this increased technological alignment is due to frequent communication between focal firms and industrial suppliers in the initial stages of CNPD (see Table 8).

FF4 shows that sharing information on product concept, innovation strategy, and manufacturing technologies between the CNPD actors strengthens technological alignment. In contrast, FF5 and FF6 reveal that sharing information and combining activities in the prototype development stage lead to lower intensities of technological alignment, since this does not foster complete sharing of information within CNPD. On the other hand, FF4 shows that the high technological intensity of the industry and the co-development of differentiated products with suppliers boost the intensity of technological alignment, due to the extended sharing of information. Another perspective on alignment reveals that the main incorporation of technologies occurs in the initial stages of CNPD. It should be noted that, while in the FF4 case there is incorporation of technologies for the engineering process and working procedures in the initial stages of CNPD, in the FF5 and FF6 cases this incorporation only happens in the final stage of CNPD. This dichotomy shows that the incorporation of technologies occurs unevenly, and it is influenced by the early involvement of suppliers in CNPD and by product differentiation, as illustrated by FF4.

Although case studies reveal some similarities regarding the combination of activities within CNPD, product alignment is higher when suppliers are involved in the initial stages of CNPD, as illustrated by FF4 and FF5 cases. In particular, FF4 shows that new product differentiation and complexity strengthen alignment during the initial stage of CNPD. In contrast, FF6 shows that the low complexity of improved/modified products limits alignment to prototyping activities (see Table 9). From another perspective, the increased complexity and product differentiation promote product alignment intensity, supported by the high degree of flexibility among firms. In contrast, FF6 reveals that flexibility between firms is lower when CNPD generates improved products. Therefore, the higher the product differentiation and flexibility of the firms, the stronger product alignment becomes. Innovation and technological intensity of the industry determine the type of investment to be undertaken within CNPD. Thus, product differentiation demands the undertaking of structural investments, as illustrated by FF4. In fact, while the adaptation investments made by FF5 and FF6 concern prototyping activities, FF4 undertakes structural investments to enhance CNPD activities. Overall, case studies show that there is a lower degree of product alignment when LFs develop improved/modified products.

The largest incorporation of technologies in CNPD is carried out by the studied LFs, comparatively to most SMEs. This difference is due to early supplier involvement to create new products, encouraging better know-how incorporation from the initial stage of CNPD. In contrast, FF2 and FF3 reveal that the development of improved/modified products by SMEs leads to lower technological alignment, due to reduced sharing of technical information, which then results in a reduced incorporation of technologies. Nonetheless, FF1 shows that the incorporation of technologies is due to the increased sharing of technical information during the initial stage of CNPD, instead of firm size.

Table 6 Market and technological alignment between SMEs and suppliers

Variables/Case studies	FF1	FF2	FF3
Strategic variables			
Market alignment			
Trust and commitment	Trust between firms is a critical factor to the relationship. Commitment derives from the continuous interaction between firms in collaborative projects.	Trust exists for certain suppliers. The lower degree of trust in certain suppliers results from a possible leak of information. Commitment results from continuous collaboration and mutual strategic interest.	The existing trust in the suppliers of chemicals results from the long-term relationship. The lower degree of trust in service suppliers results from a possible leak of information. Long-term relationships lead to commitment.
Sharing of strategic information	There is sharing of strategic information through project specification about: innovation strategy, product application, commercial objectives and costs	There is no sharing of strategic information in CNPD.	There is no sharing of strategic information in CNPD.
Type of supplier involvement (early involvement)	Idea/design stage: involvement of industrial suppliers to adjust the concept and functionality of the new product. Engineering stage: involvement of service suppliers to develop manufacturing processes, analysis of product performance, costs and finishing.	Prototype development stage: involvement of industrial suppliers to adjust finishing and costs. Prototype development stage: involvement of commercial suppliers to adjust manufacturing specifications and raw materials.	Final stage of industrial process: involvement of industrial suppliers to adjust the composition of chemical components. Final stage of industrial process: involvement of service suppliers to adapt the process to diverse chemical treatments.
Technological alignment			
Type of communication (frequency)	Frequent communication in CNPD when developing tasks with suppliers.	Regular communication in CNPD with industrial suppliers to verify material conformity and manufacturing efficiency.	Regular communication in CNPD with industrial suppliers to verify conformity (reaction) of the components.
Sharing of technical information	Sharing of project specification about: innovation objectives, specifications, applicability, engineering process, product performance, components, finishing, working methods. Results in the global combination of the innovation process.	Sharing of the product file with information about: manufacturing specifications, specifications, format, finishing, product functionality. Results in the combination of the product's resources.	Sharing of the technical file of industrial process with information about: industrial process objectives, finishing specifications, components, equipment installed. Results in the combination of resources of the productive process.
Integration of technologies	Integration by focal firm: new materials and production process. Integration by the suppliers: application of materials, standards, product design.	Integration by focal firm: application of new materials. Integration by the supplier: application of materials.	Integration by focal firm: application of components. Integration by the supplier: application of new components.

Table 7 Product alignment between SMEs and suppliers

Variables/Cases	FF1	FF2	FF3
Operational variables			
Influence of product complexity	High complexity of new products requires proposals of: new components, formats and finishing from industrial suppliers; production process fine-tuning from service suppliers. The complexity of modified products requires proposals of: components adjusted to the product, functionality and cost from industrial suppliers.	Complexity of modified products requires proposals of: raw materials adapted to the type of product from commercial suppliers; components and finishing from industrial suppliers.	Complexity of modified processes requires proposals of: components adjusted to the type of treatment from industrial (chemical) suppliers. Service suppliers reconfigure production processes which operate with different temperatures.
Flexibility and adaptation	Flexibility and adaptation of suppliers – as to product design, standards, components and performance, finishing, costs, production process fine-tuning, delivery time, resource flows. Flexibility and adaptation of focal firm – as to cost of components, management of resources and working methods.	Flexibility and adaptation of suppliers – as to raw materials, quantities, costs, finishing. Flexibility and adaptation of focal firm – as to costs and finishing.	Flexibility and adaptation of suppliers – as to components, costs, speed of response, quantities, production process fine-tuning. Flexibility and adaptation of focal firm – as to costs and working methods.
Adjustment investments	Focal firm: invests in processes, equipment and training of the teams. Suppliers: invest in equipment, production processes and procurement.	Focal firm: invests in tools and production processes. Suppliers: invest in tools to develop components.	Focal firm: invests in production processes and training of the teams. Suppliers: invest in new components and production processes.

Table 8 Market and technological alignment between large firms and suppliers

Variables/Case studies	FF1	FF2	FF3
Strategic variables			
Market alignment			
Trust and commitment	Trust between companies results from the continued relationship. Commitment derives from the continued relationship to develop innovative projects and results achieved, which leads to the joint definition of business objectives.	Trust in suppliers of tools and of production process is due to confidentiality, formalisation and continued relationship. Commitment results from the continuous participation of companies in innovative projects.	Trust in suppliers of moulds and services is based on continued relationship and commitment. The low degree of trust in the suppliers of components is due to a possible leak of information. Commitment results from the continuous relationship in CNPD.
Sharing of strategic information	There is sharing of strategic information in the project specifications file about: CNPD objectives, product strategy, cost of resources, product application.	There is no sharing of strategic information in CNPD *(only informal sharing of information about the objective of CNPD).*	There is no sharing of strategic information in CNPD *(only informal sharing of information about product application).*
Type of supplier involvement (early involvement)	Idea/design stage: involvement of industrial suppliers to adjust the concept of the product, formats, application, finishing, tests and tasks management. Engineering stage: involvement of industrial and service suppliers to develop manufacturing specifications, tools and production process.	Engineering stage: involvement of industrial and service suppliers to adjust finishing, formats, manufacturing specifications, product functionality, tools. Prototype development stage: involvement of industrial and service suppliers to perform adjustment on components, tools and tests.	Engineering stage: involvement of industrial and service suppliers to adjust the components that form the design, moulds and process fine-tuning. Prototype development stage: involvement of industrial and service suppliers to adjust and test components and finishing.
Technological alignment			
Type of communication (frequency)	Frequent communication in CNPD with industrial suppliers to design tools, and with service suppliers for process fine-tuning.	Regular communication in CNPD with industrial suppliers and occasional communication with service suppliers to verify the conformity of materials and manufacturing effectiveness.	Regular communication in CNPD with industrial suppliers and occasional communication with service suppliers to verify the effectiveness of the manufacturing process.
Sharing of technical information	Sharing of project information (about materials specifications, finishing, product application, task coordination, standards, size, control metrics and equipment) results in the combination of the innovation process and working methods.	Sharing of project specifications (about design, specifications, materials, size, finishing, engineering process, product performance, standards, control metrics) results in the combination of resources and working methods.	Sharing of project specifications (about product design and format, specifications, finishing, standards, mechanical strength, manufacturing process (moulds), control metrics) results in the combination of features of the product.
Integration of technologies	Integration by focal firm: new materials, finishing and process fine-tuning. Integration by the suppliers: tools, application of materials and standards.	Integration by focal firm: new materials and their application. Integration by the suppliers: application of materials and tools.	Integration by focal firm: application of materials. Integration by the suppliers: application of components and product design.

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Table 9 Product alignment between large firms and suppliers

Variables/Cases	FF4	FF5	FF6
Operational variables			
Product alignment			
Influence of product complexity	The high complexity and differentiation of the new product requires proposals of: new materials adjusted to the degree of product innovation, formats, standards and tools by the industrial suppliers; new tools and production process fine-tuning by service suppliers. The complexity of the modified products requires: proposals by the industrial suppliers of materials adjusted to the product range, functionality and cost.	The complexity inherent to the new product portfolio diversification requires proposals of: materials adjusted to the product, and finishing by industrial suppliers; tools and working methods by service suppliers. The complexity of the modified products requires proposals of: materials adapted to the product and cost by industrial suppliers; and adapted tools by service suppliers.	The complexity inherent to the new product portfolio diversification requires proposals of: high-strength components with innovative design that fit the product design and finishing by industrial suppliers. Service suppliers develop moulds and production process fine-tuning according to the complexity of the components and product design.
Flexibility and adaptation	Flexibility and adaptation of suppliers – as to specifications, standards, delivery time, finishing, cost, formats and project management. Flexibility and adaptation of focal firm – as to new working methods, project management, cost and specifications.	Flexibility and adaptation of suppliers – as to new materials, design, formats, costs, finishing, standards, delivery time. Flexibility and adaptation of focal firm – as to costs, project management, equipment.	Flexibility and adaptation of suppliers – as to design, specifications, components, standards, speed of process, cost of resources, quantities delivered. Flexibility and adaptation of focal firm – as to costs and equipment.
Adjustment investments	Focal firm: invests in equipment and training. Suppliers: invest in equipment, working processes and production process fine-tuning.	Focal firm: invests in tools, production process fine-tuning and some equipment. Suppliers: invest in components and tools.	Focal firm: invests in light equipment, tools and production process fine-tuning. Suppliers: invest in components and tools.

5 Discussion about Alignment

Although the studied firms deal with alignment in different ways, there are similarities between SMEs and LFs regarding CNPD activities with their suppliers.

The case studies show that LFs involve suppliers in order to differentiate products or diversify their portfolio, while SMEs involve suppliers to increase efficiency. This difference is due to the radical innovation generated by LFs in CNPD compared with the analysed SMEs. On the other hand, the LFs analysed involve suppliers to conceive the product design – idea stage – and develop new manufacturing processes – engineering stage. However, the FF1 case, regarding an SME, shows that early involvement in CNPD is not limited by firm size. Additionally, supplier size does not limit their intervention in CNPD, as in cases FF5 and FF6. However, there are exceptions to the influence of firm size in the supplier-client relationship, as exemplified by cases FF2 and FF4. In the first case, this exception is because the firms operating in the industries are SMEs. In the second case, it is due to the high specialisation and production scale required in CNPD. From another perspective, the case studies reveal the importance of the collaboration of service suppliers in CNPD.

As to market alignment, the case studies reveal that there is a higher degree of trust and commitment in CNPD carried out by LFs than for most SMEs. However, the FF1 case, regarding an SME, reveals that trust and commitment do not depend on firm size, but rather on supplier-client long-term relationship, based on the sharing of information. On the other hand, regardless of firm size, market alignment is higher in high-tech industries (as illustrated by FF1 and FF4), when the sharing of strategic information in the initial stage of CNPD is strong. Nonetheless, alignment determined by the sharing of strategic information is not influenced by firm size, as illustrated by FF1, but rather by: the high degree of trust and commitment arising from the supplier-client relationship, early involvement of suppliers in CNPD, and radical innovation.

Overall, market alignment is higher when both SMEs and LFs are involved in CNPD with suppliers as a result of activities in the initial stages of product development.

The FF1 and FF4 cases show that market alignment is higher during the design concept design and engineering processes, in order to improve efficiency of SMEs or differentiate products from LFs, through radical innovation generated in CNPD. Comparatively, the intensity of alignment between SMEs and suppliers is lower when they collaborate in the final stage of CNPD to develop modified products (illustrated by FF2 and FF3).

Overall, technological alignment, measured by type of communication, is higher in CNPD led by LFs than SMEs. However, FF1 reveals that (frequent) communication in CNPD is not influenced by firm size, but rather by radical innovation. In contrast, development of improved/modified products leads to lower communication intensities (as in FF2 and FF3). Thus, radical innovation and technological intensity of the industry promote a higher intensity of alignment in upstream CNPD, arising from frequent communication.

As to the sharing of technical information, technological alignment between LFs and suppliers is higher than for most SMEs. However, FF1 shows that there is a higher degree of sharing of technical information during the initial stage of CNPD. Moreover, the higher degree of sharing of technical information is due to the increased information flow resulting from new product conceptual design, as illustrated by FF1 and FF4. In contrast, FF2 and FF3 show that the development of modified products generates lower communication flows between SMEs and suppliers, due to the reduced sharing of technical information. In particular, F1 reveals that technological alignment intensity in CNPD does not rely on firm size, but rather on radical innovation and early supplier involvement.

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The higher intensity of product alignment is the result of the increased complexity of products created in CNPD, to improve firm efficiency or differentiate the product, and promotes the intensity of alignment between high-tech firms and suppliers involved in the initial stage of CNPD, as illustrated by FF1 and FF4. In contrast, the lower complexity of modified products developed by SMEs fosters the interaction with suppliers during the final stage of CNPD (illustrated by FF2 and FF3), which results in a lower intensity of alignment. Thus, the intensity of product alignment is not influenced by firm size, but rather by high complexity and radical innovation.

The higher intensity of product alignment is also the result of high flexibility generated in CNPD carried out by LFs. However, the FF1, FF5 and FF6 cases show that SMEs also collaborate with LFs, when they have flexibility to develop new products. Another standpoint reveals that the adaptability of both LFs and SMEs to the requirements of product design leads to greater flexibility, as illustrated by FF1 and FF4. Hence, this increased flexibility is the result of the need for the specialisation of firms in the initial stages of CNPD.

Overall, the higher intensity of product alignment, measured by adaptation investments, occurs in CNPD carried out by the studied LFs. Nonetheless, FF1 and FF4 reveal that adaptation investments depend on radical innovation, both for SMEs and LFs. In these cases, the development of brand new products requires structural investments in equipment and training. In contrast, the development of improved/modified products by SMEs (illustrated by FF2 and FF3) requires less adaptation investments, due to the lower degree of complexity of the activities undertaken in the final stage of CNPD.

6 Conclusions and implications

Alignment is an important topic in inter-firm collaboration. It can be measured taking into account market, technological and product alignment. As noted in the introduction, the main purpose of this article was to analyse and compare how LFs and SMEs influence the intensity of alignment. For that CNPD activities in upstream activities were analysed.

Regarding market alignment, one can conclude that the degree of trust and commitment in CNPD activities fosters the strategic sharing of information between partners. Moreover, it is possible to conclude that the earlier the involvement of the suppliers in CNPD activities, the more frequent the communication between the partners is and the more flexible they are. This outcome leads to an increased share of strategic information, which fosters more trust and commitment between partners. This occurs for both types of firms, SMEs and LFs.

One can also conclude that the more frequently firms communicate with their suppliers the more intense the share of information is, which is mandatory for integrating technologies regarding product idea/design concept. As such, one can conclude that technological alignment, regardless the size of the firm, is dependent on frequent communication, which is more intense in the initial stages of CNPD activities. Moreover, the more frequently partners share information, the more capable they are integrating technologies. This occurs for both LFs and SMEs.

Product alignment depends on the three main variables: product complexity; flexibility and adaptation; and the structural investment undertaken. It was clear that the more complex a product is in CNPD activities the more intense the relation tends to be between the partners as the relationship depends on the continuous adaptation and flexibility when co-developing and co-designing new products/solutions. Moreover, the higher the complexity of the products, the more important the relational aspects are for both parties to deal with structural investments to be undertaken. As such, one can

conclude that there is higher product alignment when developing and designing new and highly complex products.

It is possible to conclude that there are differences within the cases of SMEs analysed as well as within the cases of LFs. Clearly, the asymmetry found in inter-firm alignment does not depend on the size of the firm but rather on the product complexity and on the type of upstream involvement. Clearly, alignment is higher when firms are involved in new product design activities aiming at increasing the efficiency of firms or fostering product differentiation. The intensity of alignment depends on the share, combination, and adjustment of activities, which is larger when inter-firm activities involve highly complex products in the initial stage of CNPD phase. Evidently, both the incorporation of disruptive technologies and the technological intensity of the industry also influence the intensity of inter-firm alignment and the early involvement in CNPD.

The results of this study also show that the higher intensity of alignment is caused by the increased sharing of information during the initial stages of CNPD. Nonetheless, regardless firm's size, inter-firm alignment is stronger in CNPD activities that involve the share of simultaneously strategic and technical information to create highly complex products.

The main contribution of the paper is clear: size does not matter and the technological intensities of the product and industry do. Although LFs might have plentiful of resources *vis-à-vis* SMEs, it is clear that alignment can take place among SMEs as well as LFs. Moreover, alignment depends on firms' capabilities to engage in trust-based relationships that lead to tighter commitment between partners, which foster the sharing of both strategic and technical information. Early supplier involvement also plays an important role in getting firms communicating frequently in order to integrate their technologies and adjust their investments. Finally, product complexity plays an important role in making partners working together to embrace structural investments. As such, in differently endowed industries inter-firm collaboration may differ.

The main managerial implications are the following ones: First, firms need to embrace in long-term relationships in order to reach trust-based relationships to foster inter-firm commitment. Second, early supplier involvement, during the idea/design phase of CNPD is important so that relationships are closer. After the prototyping phase, firms are closer to discrete, market-based transactions. Third, highly complex products are very important for the development of long-lasting relationships as they enable CNPD activities, more share of information and a strategic relational positioning. Clearly, managers must understand that alignment in CNPD has implications on the way firms share, combine and integrate upstream activities.

7 Limitations and future research

Case studies are important tools for theory testing and theory building. The case studies analysed in this paper supported the conclusion that SMEs have similar constraints as LFs. As such, although alignment takes place among SMEs and LFs, the main limitation of this research method is that the results cannot be generalised to the population. Thus, other studies need to analyse SMEs and LFs in several types of industries through quantitative studies. Additionally, this research analyses only CNPD alignment in upstream activities. As such, future research could analyse the downstream perspective and compare it to upstream alignment. Another option for future research is to consider the comparative study of alignment between high-tech and low-tech industries. Future studies could also analyse alignment in accordance with the type of products developed. Lastly, future research could analyse alignment considering the relationship with other partners – competitors, public firms.

Author

References

Acur, N., Kandemir, D. and Boer, H. (2012) 'Strategic alignment and new product development: drivers and performance effects', *Journal of Production Innovation Management*, Vol. 29, No. 2, pp.304–318.

Baxter, P and Jack, S. (2008) 'Qualitative case study methodology: study design and implementation for novice researchers". *The Qualitative Report*, Vol. 13, No. 4, pp.544–559.

Becker, J. and Homburg, C. (1999) 'Market-oriented management: a systems-based perspective', *Journal of Marketing Focused Management*, Vol. 4, No. 1, pp.17–41.

Bianchi, M., Cavaliere, A., Chiaroni, D, Frattini, F. and Chiesa, V. (2011) 'Organizational modes for open innovation in bio-pharmaceutical industry: an exploratory analysis', *Technovation*, Vol. 31, No. 1, pp.22–33.

Billington, C. and Davidson, R. (2013) 'Leveraging open innovation using intermediary networks', *Production and Operations Management*, Vol. 22, No. 6, pp.1464–1477.

Blackhurst, J., Craighead, C.W., Elkins, D. and Handfield, R.B. (2005) 'An empirically derived agenda of critical research issues for managing supply-chain disruptions', *International Journal of Production Research*, Vol. 43, No. 19, pp.4067–4081.

Brettel, M., Mauer, R., Engelen, A. and Kupper, D. (2012) 'Corporate effectuation: entrepreneurial action and its impact on R&D project performance', *Journal of Business Venturing*, Vol. 27, No. 2, pp.167–184.

Brun, A. Bolton, S. and Chinneck, C. (2013) 'Benefits of aligning design and supply chain management', *International Journal of Engineering Science and Technology*, Vol. 5, No. 2, pp. 49–64.

Bstieler, L. (2006) 'Trust formation in collaborative new product development', *Journal of Production and Innovation Management*, Vol. 23, No. 1, pp.56–72.

Campbell, B., Kay, R. and Avison, D. (2005) 'Strategic alignment: a practitioner´s perspective', *International Journal of Enterprise Management*, Vol. 18, No. 5/6, pp.653–661.

Chaochotechuang, P. and Mariano, S. (2016) 'Alignment of new product development and product innovation strategies: a case study of Thai food and beverage SMEs', *International Journal of Globalisation and Small Business*, Vol. 8, No. 2, pp.179–206.

Chen, Y-Y. and Huang, H-L. (2014) 'Conceptualizing and developing alignment model between business strategy and knowledge management strategy', *10th International Academic Conference, Vienna*, pp.184–197.

Davidson, J.M., Clamen, A. and Karol, R.A. (1999) 'Learning from the best new product developers', *Research-Technology Management*, Vol. 42, No. 4, pp.12–18.

de Matos, A.L., Pires, S.R. and Vivaldini, M. (2017) 'Product development: the supply chain management perspective', *International Journal of Business Innovation and Research*, Vol. 13, No. 1, pp.52–67.

de Medeiros, J., Vidor, G. and Korzenowski, A. (2018) 'Review of experimental methods to optimise the collaboration between organisations in the new product development process', *International Journal of Business Innovation and Research*, Vol. 15, No. 4, pp.467–482.

Droge, C., Jayaram, J. and Vickery, S.K. (2004) 'The effects of internal versus external integration practices on time-based performance and overall firm performance', *Journal of Operations Management*, Vol. 22, No. 6, pp.557–573.

Eisenhardt, K. and Graebner, M. (2007) 'Theory building from cases: opportunities and challenges', *Academy of Management Journal*, Vol. 50, No. 1, pp.25–32.

Eisto, T., Holtta, V., Mahlamaki, K., Kollanus, J. and Nieminen, M. (2010), "Early supplier involvement in new product development: a casting-network collaboration model, *International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering*, Vol. 4, No. 2, pp.138–148.

Entrialgo, M., Fernandez, E. and Vazquez, C.J. (2000) 'Linking entrepreneurship and strategic management: evidence from Spanish SMEs', *Technovation*, Vol. 20, No. 8, pp. 427–436.

Ettlie, J.E. and Reza, E.M. (1992) 'Organizational integration and process innovation', *Academy of Management Journal*, Vol. 35, No. 4, pp.795–827.

European Commission (2003) 'Commission recommendation of 6th May 2003 concerning definition of micro, small and medium-sized enterprises', *Official Journal of the European Union*, Vol. L124, pp.36–41.

Faems, D., Van Looy, B. and Debackere, K. (2005) 'Interorganizational collaboration and innovation: toward a portfolio approach', *Journal of Product Innovation Management*, Vol. 22, No. 3, pp.238–250.

Fawcett, S. E., Magnan, G. M. and McCarter, M. W. (2008) 'Benefits, barriers and bridges to effective supply chain management', *Supply Chain Management: An International Journal*, Vol. 3, No. 1, pp. 35–48.

Garcia, R. and Calantone, R. (2002) 'A critical look at technology innovation typology and innovativeness terminology: a literature review', *Journal of Product Innovation Management*, Vol. 19, No. 2, pp.110–132.

Gatignon, H. and Xuereb, J-M. (1997) 'Strategic orientation of the firm and new product performance', *Journal of Marketing Research*, Vol. 34, No. 1, pp.77–90.

Gonzalez-Zapatero, C., Gonzalez-Benito, J. and Lannelongue, G. (2017) 'Understanding how the functional integration of purchasing and marketing accelerates new product development, *International Journal of Production Economics*, Vol. 193, pp. 770–780

Hakansson, H. (1990) 'Technological collaboration in industrial networks', *European Management Journal*, Vol. 8, No. 3, pp.371–379.

Handfield, R.B., Ragatz, G.L., Petersen, K.J. and Monczka, R.M. (1999) 'Involving suppliers in new product development', *California Management Review*, Vol. 42, No. 1, pp.59–82.

Handfield, R.B. and Bechtel, C. (2002) 'The role of trust and relationship structure in improving supply chain responsiveness', *Industrial Marketing Management*, Vol. 31, No. 4, pp.367–382.

Handfield, R.B., Cousins, P.D., Lawson, B. and Petersen, K.J. (2015) 'How can supply management really improve performance? A knowledge-based model of alignment capabilities*', Journal of Supply Chain Management*, Vol. 51, No. 3, pp.3–17

Heide, J.B. and John, G. (1988) 'The role of dependence balancing in safeguarding transaction-specific assets in conventional channels', *Journal of Marketing*, Vol. 52, No. 1, pp.20–35.

Hendersen, R.M. and Clark, K.B. (1990) 'Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms', *Administrative Science Quarterly*, Vol. 35, No. 1, pp.9–30.

Hilletofth, P. and Eriksson, M. (2011) 'Coordinating new product development with supply chain management', *Industrial Management Data Systems*, Vol. 111, No. 2, pp.264–281.

Hofman, E., Faems, D. and Schleimer, S. (2017) 'Governing collaborative new product development: Toward a configurational perspective on the role of contracts', *Journal of Product Innovation Management*, Vol. 34, No. 6, pp. 739–756.

Holweg, M. and Pil, F.K. (2008) 'Theoretical perspectives of the coordination of supply chains', *Journal of Operations Management*, Vol. 26, No. 3, pp,389–406.

Homburg, C., Kuester, S., Beutin, N. and Menon, A. (2005) 'Determinants of customer benefits in business-to-business markets: a cross-cultural comparison', *Journal of International Marketing*, Vol. 13, No. 3, pp.1–31.

Hossain, M. (2015) 'A review of literature on open innovation in small and medium-size enterprises', *Journal of Global Entrepreneurship Research*, Vol. 5, No. 6. (doi.org/10.1186/s40497-015-0022-y).

Humphries, A.S. and Wilding, R. (2004) 'Long term collaborative relationships: the impact of trust and C3 behavior', *Journal of Marketing Management*, Vol. 20, No. 9-10, pp.1107–1122.

Joshi, M.P., Kathuria, R. and Porth, S.J. (2003) 'Alignment of strategic priorities and performance: an integration of operations and strategic management perspectives', *Journal of Operations Management*, Vol. 21, No. 3, pp.353–369.

Ketchen, D.J., Hult, G.T. and Slater, S.F. (2007) 'Towards greater understanding of market orientation and the resource-based view', *Strategic Management Journal*, Vol. 29, No. 9, pp.961–964.

Khan, O., Christopher, M. and Creazza, A. (2012) 'Aligning product design with the supply chain: a case study', *Supply Chain Management: An International Journal*, Vol. 17, No. 3, pp.323–336.

Khan, O. and Creazza, A. (2009) 'Managing the product design-supply chain interface: towards a roadmap to the design centric business', *International Journal of Physical Distribution and Logistics Management*, Vol. 39, No. 4, pp.301–319.

Kim, S.W. (2006) 'The effect of supply chain integration on the alignment between corporate competitive capability and supply chain operational capability', *International Journal of Operations and Production Management*, Vol. 26, No. 10, pp.1084–1107.

Koberg, C.S., Detienne, D.R. and Heppard, K.A. (2003) 'An empirical test of environmental, organizational and process factors affecting radical innovation', *Journal of High Technology Management Research*, Vol. 14. No. 1, pp.21–45.

Lamberti, E., Caputo, M., Michelino, F. and Cammarano, A. (2017) 'How to measure collaboration in an open innovation context', *International Journal of Business Innovation and Research*, Vol. 14, No. 3, pp.301–326.

Lavie, D. and Rosenkopf, L. (2006) 'Balancing exploration and exploitation in alliance formation', *Academy of Management Journal*, Vol. 49, No. 4, pp.797–818.

Lawson, B., Petersen, K.J., Cousins, P.D. and Handfield, R.B. (2009) 'Knowledge sharing in interorganizational product development teams: the effect of formal and informal socialization mechanisms', *Journal of Product Innovation Management*, Vol. 26, No. 2, pp.156–172.

Lee, H.L. (2002) 'Aligning supply chain strategies with product uncertainties', *California Management Review*, Vol. 44, No. 3, pp.105–119.

Lee, H.L. (2004) 'The triple-a supply chain', *Harvard Business Review*, Vol. 82, No. 10, pp.102–112.

Lee, S., Park, G., Yoon, B. and Park, J. (2010) 'Open innovation in SMEs: an intermediated network model', *Research Policy*, Vol. 39, No. 2, pp.290–300.

Luftman, J. (2000) 'Acessing it-business alignment', *Information Systems Management*, Vol. 20, No. 4, pp.9–15.

Malhotra, N. (2007) *Marketing Research – An Applied Orientation*, Person Education, New Jersey.

Martins, R.S., Filho, O.V.S., Pereira, S.C.F. and Di Serio, L.C. (2012) 'Strategic alignment in the Brazilian automotive chain', *Journal of Operations and Supply Chain Management*, Vol. 5, No. 1, pp.16–30.

Melander, L., Rosell, D. and Lakemond, N. (2014) 'In pursuit of control: involving suppliers of critical technologies in new product development', *Supply Chain Management*, Vol. 19, No. 5/6, pp.722–732.

Moreira, A. C. (2005) 'O problema da co-especialização no desenvolvimento colaborativo de novos produtos', *Revista Produção*, Vol. 15, No. 1, pp.23–33.

Morita, M., Machuca, J.A., Flynn, E.J. and De los Rios, J.L.P. (2015) 'Aligning product characteristics and the supply chain process – a normative perspective', *International Journal of Production Economics*, Vol. 161, pp.228–241.

Morgan, R.M. and Hunt, S.D. (1994) 'The commitment-trust theory of relationship marketing', *Journal of Marketing*, Vol. 58, No. 3, pp.20–38.

Nicholas, J., Ledwith, A. and Perks, H. (2011) 'New product development best practice in SME and large organizations: theory vs practice', *European Journal of Innovation Management*, Vol. 14, No. 2: pp.227–251.

Noke, H. and Hughes, M. (2010) 'Climbing the value chain: strategies to create a new product development capability in mature SMEs', *International Journal of Operations and Product Management*, Vol. 30, No. 2, pp.132–154.

Olson, E.M., Slater, S.F. and Hult, G.T.M. (2005) 'The Performance implications of fit among business strategy, marketing organization structure, and strategy behavior', *Journal of Marketing*, Vol. 69, No. 3, pp.49–65.

Pae, J.H. (2017) 'Mutual benefits for buying and supplying firms: the role of technology routinisation', *International Journal of Business Innovation and Research*, Vol. 14, No. 3, pp.327–344.

Papp, R.M. (2001) *Strategic Information Technology: Opportunities for Competitive Advantage*, Idea Group Publishing, Hershey, PA.

Parida, V., Westerberg, M. and Frishammar, J. (2012): 'Inbound open innovation activities in high-tech SMEs: the impact on innovation performance', *Journal of Small Business Management*, Vol. 50, No. 2, pp.283–309.

Pero, M., Abdelkafi, N., Sianesi, A. and Blecker, T. (2010) 'A framework for the alignment of new product development and supply chains', *Supply Chain Management – An International Journal*, Vol. 15, No. 2, pp.115–128.

Petersen, K.J., Handfield, R.B. and Ragatz, G.L. (2003) 'A model of supplier integration into new product development', *Journal of Product Innovation Management*, Vol. 20, No. 4, pp.284–299.

Powers, T.L. and Reagan, W.R. (2007) 'Factors Influencing successful buyer-seller relationships', *Journal of Business Research*, Vol. 60, No. 12, pp.1234–1242.

Reich, B.H. and Benbasat, I. (2000) 'Factors that influence the social dimension of alignment between business and information technology objectives', *MIS Quarterly*, Vol. 24, No. 1, pp.81–113.

Rezaei, J., Ortt, R. and Trott, P. (2015) 'How SMEs can benefit from supply partnerships', *International Journal of Production Research*, Vol. 53, No. 5, pp.1527–1543.

Rothaermel, F.T. (2001) 'Incumbent's advantage through exploiting complementary assets via interfirm cooperation', *Strategic Management Journal*, Vol. 22, No. 6-7, pp.687–699.

Sáez, C.B., Marco, T.G. and Arribas, E.H. (2002) 'Collaboration in R&D with universities and research centres: an empirical study of Spanish firms', *R&D Management*, Vol. 32, No. 4, pp.321–341.

Saragih, H.S. and Tan, J.D. (2018) 'Co-innovation: a review and conceptual framework', *International Journal of Business Innovation and Research*, Vol. 17, No. 3, pp.361–377.

Silva, L.F. and Moreira, A.C. (2017) 'Collaborative new product development and the supplier/client relationship. Cases from the furniture industry', in Garcia-Alcaraz, J.L., Alor-Hernández, G., Maldonado-Macias, A.A. and Sánchez-Ramírez, C. (Eds.) *New Perspectives on Applied Industrial Tools and Techniques* (pp. 175-195), Springer International Publishing: Heidelberg.

Silva, L.F. and Moreira, A. C. (2018) 'Collaborative New Product Development in SMEs and Large Industrial Firms. Relationships upstream and Downstream in the Supply Chain', in Moreira, A.C., Ferreira, L., & Zimmermann, R. (Eds.), *Innovation and Supply Chain Management. Relationship, Collaboration and Strategies* (pp. 101-121), Springer International Publishing.

Simatupang, M.T. and Sridharan, R. (2002) 'The collaborative supply chain', *International Journal of Logistics Management*, Vol. 13, No. 1, pp.15–30.

Simatupang, T.M. and Sridharan, R. (2005) 'An Integrative framework for supply chain collaboration', *International Journal of Logistics Management*, Vol. 16, No. 2, pp.257–274.

Sjoerdsma, M. and van Weele, A.J. (2015) 'Managing supplier relationships in new product development context', *Journal of Purchasing and Supply Management*, Vol. 21, No. 3, pp.192–203.

Song, M. and Thieme, J. (2009) 'The role of suppliers in market intelligence gathering for radical and incremental innovation', *Journal of Product Innovation Managem*ent, Vol. 26, No. 1, pp.43–57.

Soosay, C.A., Hyland, P.W. and Ferrer, M. (2008) 'Supply chain collaboration: capacities for continuous innovation', *Supply Chain Management: An International Journal*, Vol. 13, No. 2, pp.160–169.

Spekman, R.E., Kamauff Jr, J.W. and Myhr, N. (1998) 'An empirical investigation into supply chain management', *International Journal of Physical Distribution and Logistics Management*, Vol. 28, No.8, pp.630–650.

Stadler, C. (2011) 'Process innovation and integration in process-oriented settings: the case of the oil industry', *Product Innoavtion Management*, Vol. 28, No. 1, pp.44–62.

Stanko, M.A., Bonner, J.M. and Calantone, R.J. (2007) 'Building commitment in buyer-seller relatiosnhips: a tie strenght perspective', *Industrial Marketing Management*, Vol. 36, No. 8, pp.1094–1103.

Tafti, F., Abdolvand, N. and Harandi, S. (2019) 'A strategic alignment model for collaborative open innovation networks', *International Journal of Business Innovation and Research*, Vol.19, No.1, pp.1–28.

Tallon, P.P. and Pinsonneault, A. (2011) 'Competing perspectives on the link between strategic information technology alignment and organizational agility: insights from a mediation model, *MIS Quarterly*, Vol. 35, No. 2, pp.463–486.

Un, A.C. and Asakawa, K. (2015) 'Types of R&D collaborations and process innovation: the benefit of collaborating upstream in the knowledge chain', *Journal of Product Innovation Management*, Vol. 32, No. 1, pp.138–153.

Van de Vrande, V., de Jong, J.P., Vanhaverbeke, W. and de Rochement, M. (2009) 'Open innovation SMEs: trends, motives and management challenges', *Technovation*, Vol. 29, No. 6/7, pp.423–437.

Van der Vaart, T. and Van Donk, D.P. (2006) 'Buyer-focused operations as a supply chain strategy: identification the influence of business characteristics', *International Journal of Operations 6 Production Management*, Vol. 26, No. 1, pp.8–23.

Van Echtelt, F.E., Wynstra, F., Van Weele, A.J. and Duysters, G. (2008) 'Managing supplier involvement in new product development: a multiple-case study', *Journal of Innovation Management*, Vol. 25, No. 2, pp.180–201.

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002) 'Case research: case research in operations management', *International Journal of Operations and Production Management*, Vol. 22, No. 2, pp.195–219.

Voss, G.B. and Voss, Z.G. (2000) 'Strategic orientation and firm performance in an artistic environment', *Journal of Marketing*, Vol. 64, No. 1, pp.67–83.

Wipple, J.M. and Russell, D. (2007) 'Building supply chain collaboration: a typology of collaborative approaches', *The International Journal of Logistics Management*, Vol. 18, No. 2, pp.174–196.

Wognum, N., Fisscher, O.A. and Weenink, S.A. (2002) 'Balanced relationships: management of client-supplier relationships in product development', *Technovation*, Vol. 22, No. 6, pp.341–351.

Wong, C.W.Y., Wong, C.Y. and Boon-itt, S. (2013) 'The combined effects of internal and external supply chain integration on product innovation', *International Journal of Production Economics*, Vol. 146, No. 2, pp.566–574.

Wynstra, F. and Pierick, E. (2000) 'Managing supplier involvement in new product development: a portfolio approach', *European Journal of Purchasing and Supply Management*, Vol. 6, No. 1, pp.49–57.

Yeung, J.H., Selen, W., Zhang, M. and Huo, B. (2009) 'The effects of trust and coercive power on supplier integration', *International Journal of Production Economics*, Vol. 120, No. 1, pp.66–78.

Yin, R.K. (2003) *Case Study Research: Design and Methods*, Sage, Thousand Oaks, CA.

Zhao, Y. and Lavin, M. (2012) 'An empirical study of knowledge transfer in working relationships with suppliers in NPD', *International Journal of Innovation Management*, Vol. 16, No. 2, pp.1–26.

Zhou, K.Z., Yim, C.K. and Tse, D.K. (2005) 'The effects of strategic orientations on technology and market-based breakthrough innovations', *Journal of Marketing*, Vol. 69, No. 2, pp.42–60.

Zhou, K.Z. and Wu, F. (2010) 'Technological capability, strategy flexibility, and product innovation', *Strategic Management Journal*, Vol. 31, No. 5, pp.547–561.