

**AUTOMAKER-SUPPLIER RELATIONSHIPS AND NEW PRODUCT  
DEVELOPMENT IN THE TRUCK INDUSTRY: THE CASE OF *VOLVO DO BRASIL***

**Jon Charterina (University of the Basque Country UPV/EHU)  
Imanol Basterretxea (University of the Basque Country UPV/EHU)  
Jon Landeta (University of the Basque Country UPV/EHU)**

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**“Automaker-supplier relationships and new product development in the truck industry:  
The case of *Volvo do Brasil*”<sup>1</sup>**

**Jackson Dal Ponte\***

Lean Xchange Consulting Services,  
Paraná, Brazil

Email: jackson\_dal\_ponte@hotmail.com

\*Corresponding author

**Jon Charterina and Imanol Basterretxea**

University of the Basque Country (UPV/EHU),  
Faculty of Economics and Business,  
Bilbao, Spain

Email: jon.charterina@ehu.eus

Email: imanol.basterretxea@ehu.eus

**Key Words:** buyer-supplier relationship, supply chain, new product development, automotive industry, inter-firm collaboration, Volvo Trucks, Volvo Production System.

**Abstract**

Previous studies have focused on differences between western and Japanese approaches to supply chain network management techniques as regards NPD and relationship-specific ties. Based on in-depth interviews with senior managers at Volvo Trucks Brazil and two Spanish first tier suppliers, the aim of this research is to learn about the types of NPD collaboration ties used between Volvo and suppliers and to examine the supply chain network management techniques and routines used to intensify inter-firm collaboration and promote value-chain optimization.

One main finding of this research is that there is not one best buyer-supplier relationship style for NPD, but that relationships differ significantly depending on the degree to which the buyer relies on the capacity and technology possessed by each provider. Lower NPD frequency than in the car industry and the introduction of the Volvo Production System in 2007 also make buyer-supplier relationships focused on NPD stronger in Volvo Trucks than in previously researched big car firms.

**Introduction.**

As complexity in its multiple sources increases (Kim & Wilemon 2003) and product life cycles tend to shorten (Griffin 1997), efficient supply chain management is becoming increasingly critical for large manufacturers in technology intensive industries such as the auto industry. A typical passenger vehicle can contain more than 30,000 parts, most of which are produced by many levels

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of supplier tiers. A company like Toyota can purchase more than 70 percent of the total value of its parts from its suppliers (Dyer & Hatch, 2006). In the case of the company analyzed in the present study, 90% of the components of a typical Volvo Truck are produced by external suppliers, making supply chain network management a key factor for innovation, survival and success.

The big players in the automobile industry are far from adopting standardized supply chain network strategies, and the literature indicates wide discrepancies between western and Japanese companies (Dyer & Hatch, 2006; Kotabe et al., 2003; Takeishi, 2001). Big western companies like Ford and GM tend to exercise their bargaining power to secure better terms, normally selecting suppliers via competitive bid and making price the main priority. However, these companies tend to neglect suppliers' contribution to new product development (NPD) and suppliers are constantly threatened by competition as these automakers usually shift to new suppliers when they propose better offers (Zirpoli & Caputo, 2002). In contrast, Japanese companies like Toyota and Nissan have leaned towards the development of long-term relationships with fewer suppliers. The Japanese supply chain management style promotes more stable integration between suppliers and automakers. These companies tend to build strong collaborative ties, engaging supplier networks not only in NPD, but securing an efficient communication and knowledge-sharing flow capable of detecting and eliminating inefficiencies as they arise. In the Japanese context, prices are usually negotiated on a technical basis and both buyer and suppliers are constantly looking to optimize the whole value chain, on a win-win approach (Dyer & Hatch, 2006; Kotabe et al., 2003; Takeishi, 2001; Zirpoli & Caputo, 2002).

While the literature focuses on comparisons between western and Japanese strategies, few studies have researched European automakers. Zirpoli and Caputo (2002) have analyzed Fiat's supply chain management strategy and were able to identify mixed elements from the Japanese and western supply chain management techniques. However, very little research has been conducted on other big players. Whereas supply chain management and NPD in the passenger car segment have been extensively examined in previous empirical research, the truck industry has been analyzed to a much lesser extent. Said industry has some relevant differences of its own if compared with the car segment: a professionally oriented customer base, a longer period for product development, and a product range with a longer lifespan.

Volvo Trucks' supply chain has been previously analyzed from different perspectives: supply chain management ethics (Svensson and Baath, 2008); overlapping supply chains in Volvo Group (Hertz, 2006); product remanufacturing (Östlin, Sundin, Björkman, 2008) or globalization (Vahlne, et al. 2011). Particularly interesting for our analysis are the works of Ivarsson and Alvstam (2005), which study the technology transfer from Volvo Trucks to local suppliers in Brazil and other three

countries; and that of Wallace (2004), which examines the introduction of lean production at Volvo do Brazil.

The aim of this research is to learn about the types of collaboration ties used between Volvo Trucks and suppliers concerning NPD. We also seek to examine the supply chain network management-specific techniques and routines utilized to intensify inter-firm collaboration and promote value-chain optimization. Our intention is to shed light on the determinants of inter-firm collaboration, as well as to understand the mechanisms adopted by both sides to regulate and facilitate inter-firm interaction.

The article is organized as follows. In the next section, we review the literature on buyer-supplier relationships and their effect on NPD. We then present a brief profile of the Volvo Group. This is followed by an outline of the research methods used in the project discussed herein and the presentation of results. The final section is devoted to discussion and conclusions.

## **Literature background**

### ***Strong buyer-supplier ties versus arm's length ties in NPD. Are the differences philosophical or just contextual?***

With the ultimate goal of reducing production and procurement costs, over the last decades business-to-business markets have evolved, putting high pressure on agents to outsource tasks, improve quality, reduce inventory costs and time to market, and gain from scale and scope economies. Few industries have been as affected by these tendencies as the automotive industry. It is arguably the manufacturing sub-sector most frequently referenced in the studies that analyze and review relationship models in supply chains. Two main types of relationship governance are used to achieve these aims, namely, an adversarial model, by means of which buyers “pit suppliers to achieve a cost reduction”, and a collaborative one, based on working together to lower both the suppliers’ and the buyer’s costs (Wilson 1995, p. 3).

During the second half of the 90s this differentiation became particularly clear and was one of the reasons for Japanese automakers’ success in penetrating the US market, showing marked contrasts to the situation that established US car makers were bearing (Dyer & Hatch 2006). Analysis of supplier-client relationships in the Business-to-Business area also revealed the arm’s length type of agreements and that a network of idiosyncratic inter-firm linkages had been set up as a source of relational rents for the firm (Dyer & Singh 1998). These linkages were supposed to make it possible to share best practices, knowledge management, and ultimately, the achievement of “abnormal gains” that are a reflection of market rewards (Kale, Dyer & Singh 2002).

Notwithstanding these differences in terms of managerial vision, some recent works point to more prosaic causes as the main reasons behind the contrast with arm’s length type of agreements.

Firstly, over the last thirty years the closed *keiretsu* system of vertically integrated supplier networks characteristic of the Japanese automotive industry has been ‘westernized’ due to market pressures seeking competition and cost reduction (MacDuffie & Helper, 2005). Assembly firms in general are promoting purchasing and production systems of their own. In this sense, Mejza et al (2013) found that whereas Thai suppliers to Japanese OEMs distinguish in terms of delivery and flexibility, supplier firms from this same country selling to American assemblers give higher priority to cost and quality. Secondly, Netland’s (2012) analysis of 30 of the so-called company-specific production systems (XPS) from the same number of brands, as opposed to the best-known *Toyota Production System*, showed that these XPSs are not exact copies of each other. Thirdly, compared to the situation of the incumbent ‘Big Three’ automakers, the newly established Japanese and European rival plants in the US did not have to bear the burden of an older and more-unionized workforce during the eighties. Only as of 2008 and 2009, after GM and Chrysler had been through bankruptcy, did this situation change for the better thanks to bailout funds from the U.S. federal government, and some concessions from the United Auto Workers (UAW) such as the transfer of health care liabilities to union-managed funds, and lower-tier wages for new hires (Katz, MacDuffie & Pil, 2013). Fourthly, one of the main reasons that pushed the established American automaker firms to apply harsh contract terms to their suppliers and no flexibility was their limited margin to renegotiate terms with their creditors. By passing this pressure on to their suppliers, these OEM firms sought to alleviate their cash-flow problems (Ben-Shahar & White, 2006).

Finally, there is ample evidence of the recurrent use of a relatively small and fixed set of norms that the ‘Big Three’ firms from Detroit historically maintained almost unchanged over time and from one supplier to another across tens of thousands of agreements. There are several underlying reasons for this practice: the assurance of no margin of negotiability for mid-level purchasing managers within the OEM’s organization chart, a clear message of equal treatment to all of the suppliers, or more simplicity and economies derived from not drafting and overseeing different legal terms with so many supplier firms, among other reasons (Ben-Shahar & White, 2006)

In summary, despite the fact that some management differences have existed among networks of automakers and their respective suppliers in the contract terms established for their relationships, these differences should not be explained by a philosophical stance but rather by economic and technical factors. Some of these factors have been recognized in the strategic supply chain management and the new product development (NPD) literature, namely: the assessment and reduction of risks within the supply chain (Christopher & Peck 2004, Tang 2006; Thun & Hoenig 2011; Tang & Musa 2011), product complexity (Novak & Eppinger 2001, Griffin 2007), other types of complexity (Kim and Wilemon 2003), uncertainty (Hobday, 1998; Miyazaki & Kijima 2000; Vachon & Klassen 2002), agency and transactions costs (Monteverde & Teece 1982, Novak

& Eppinger 2001), or knowledge and absorptive capacity (Cohen & Levinthal 1990, MacDuffie & Helper 1997, Speckman, Spear & Kamauff 2002).

Kim and Wilemon (2003) assess multiple sources of complexity: technological, market, development, marketing, organizational and intraorganizational. The last one, the configuration of a buyer-supplier relationship in a supply chain is an especially clear example of intraorganizational complexity phenomena, which occur “between functional groups or organizations” when they must “work together to solve a development problem” (p.22). These types of complexity are usually highly correlated and manifest in a combined manner. If product complexity is high, the buyer firm is expected to opt for configuring its supply channel towards reducing it along with other manifestations of complexity, and thus, reducing the overall complexity of the network. Assuming product complexity as a function of transactions costs (Williamson 1985), Novak and Eppinger (2001) found that a greater level of product complexity leads OEMs to opt for vertical integration in order to avoid higher complexity derived from outsourcing its production to suppliers. According to transactions cost theory, vertical integration brings the advantages of more efficient coordination and reduced opportunism from supplier firms when there is risk of opportunism and the product or part entails highly specific knowledge, making it difficult to switch its production to other suppliers when necessary (Monteverde & Teece 1982).

However, other forms of close coordination in the supply chain which do not involve the internalization of tasks are also possible (Williamson 1991). Thus, the most important issues in a long term agreement (supply contract) such as the termination rights, warranties and remedies, ownership of tooling elements, servicing parts and intellectual property, evidence a high degree of asymmetric power in favor of the OEM. Finally, there is the concern for one’s reputation in an oligopolistic market, which deters these suppliers from acting opportunistically or terminating the relationship unilaterally (Ben-Shankar and White 2006).

Countering this situation, the supplier’s possession of knowledge, higher level of absorptive capacity (Spekman, Spier & Kamauff 2002) and its capacity to be commissioned to produce subassemblies or a larger number of parts are qualities contributing to make this supplier more eligible. Finally, suppliers with more knowledge and absorptive capacity invest more in R&D, possess more expertise and tend to communicate better with their customers (Mascarenhas, Baveja & Jamil 1998). However, these same suppliers tend to have the upper hand in the negotiation process for the production parts or subsets they are commissioned, resulting in the need to depart from the above mentioned pre-specified (‘boilerplate’) contracts (Vanalle, Dias & Salles 2010).

Thus, our research proposition is:

RP1: When there is a high level of product complexity, automakers try to minimize their share of it by opting for suppliers with higher capacity to absorb knowledge, invest in R&D or perform more complex tasks.

### *The use of contracts in NPD*

Although mutual buyer-supplier cooperation seems to be necessary for value creation, it does not appear at random, nor is it easily fostered. For a buyer-supplier relation to endure, each partner must remain satisfied with the other's performance and outlook (Stigler & Becker 1977, Kotabe, Martin & Domoto 2003). Moreover, a critical barrier to such collaboration is the risk of exploitation by an opportunistic partner (Williamson, 1985). Thus, firms tend to rely on governance mechanisms to mitigate their risks when promoting inter-firm cooperation (Ring and Van de Ven, 1992; Lusch and Brown, 1996, Lumineau and Malhotra, 2011), and use contracts as a means of control (Williamson 1985).

Both the marketing and purchasing research streams have shown the same recurring research themes with respect to buyer-supplier relationships, namely: (1) the identification of characteristics and benefits of buyer-supplier relationships; (2) the establishment and development of buyer-supplier relationships; and (3) managing buyer-supplier relationships (Olsen & Ellram 1997). The discussion on governance mechanisms within this third area has particularly been a source of great concern.

Regarding the costs associated to the governance of relationships and the role of contracts, several studies in the past stressed the need to overcome the theoretical limitations of the transaction cost theory (TCT) (Williamson 1985, 1991) to understand the governance of some alliances in an effort to extend the original TCT market-versus-vertical-integration solution, and include other intermediary situations (Achrol & Gundlach 1999; Anderson, Håkansson & Johanson 1994; Anderson & Weitz 1992; Dyer 1997; Gulati 1995; Heide & John 1990, 1992; Heide & Stump 1995; Joshi & Stump 1999; Macneil 1980; Nevin 1995; Nielson 1996).

In the field of supply chain management, contracts regulating automaker-supplier relationships are normally characterized as being relatively similar with respect to a number of general purchasing conditions that usually remain unchanged across supplier firms (Ben-Shahar & White 2006, Gurcaylilar-Yenidogan 2014). In general terms, despite the asymmetrical power conditions mainly benefiting the OEM, relationships differ depending on the technological complexity of the components sold, the supplier's institutional characteristics, its production capacity and the specific history of the relationship (Vanalle, Dias & Salles 2010). Suppliers producing more technically complex parts and holding the intellectual property rights tend to have the upper hand in

negotiations with automakers and not to share knowledge. This has been evidenced, for example, in the case of braking system producers among Turkish suppliers (Gurcaylilar-Yenidogan 2014), or IT software solutions in the case of suppliers for American automakers (Ben-Shahar & White 2006). Prior research argues that the contract configuration of a buyer-supplier relationship affects the negotiation and enforcement of agreements and facilitates the OEM firm's strategy towards value creation (Luo 2002, Lui & Ngo 2004, Arruñada & Vazquez 2006, Argyres, Bercovitz & Mayer 2007, Lumineau & Malhotra 2011). This contract configuration process concerns the decision on what parts or tasks are to be outsourced or produced within the firm, and what sort of alliances are to be created with suppliers of a varying level of technical advancement. Supplier involvement in NPD may range from 'none', meaning no implication in its design or improvement, to a 'black – box' type of relationship in which design is totally supplier-driven, based on the OEM's requirements for the specific component (Clark & Fujimoto 1991, Zhao, Cavusgil & Cavusgil 2014). It is precisely contracts that play a central role in contingency planning to facilitate adaptation and change, in the face of environmental variability (Dekker, Sakaguchi & Kawai 2013). More specifically, with respect to supplier discrimination based on the complexity of the part sold, Zhao et al (2014) found that the more complex the part produced by the supplier is, the more involved the supplier will be in NPD, albeit these types of relationships tend to be less frequent. They also found a positive relation between this 'black-box' type of integration and speed to launch the product on the market. Finally, and contrary to what was expected, they found no relation with respect to product innovativeness.

As for the case of anticipating contingencies, Lumineau and Malhotra (2011) differentiate two common approaches for resolving inter-firm disputes: the rights-based approach and the interest-based approach. Whereas the former approach is "distributive, adversarial, and competitive", and more aimed at controlling the relationship, the latter approach is "integrative, consensual, and problem-solving", and thus more aimed at achieving coordination (Lumineau & Malhotra 2011, p. 535). It is worth noting that contractual disputes in the automotive sector tend to be scarce, mainly due to the negative effects that these may have on the supplier firm's reputation and survival in the industry (Gurcaylilar-Yenidogan 2014, Ben-Shahar & White 2006). However, it was found that contracts which are more aimed at coordination than control are more likely to foster an interest-approach in case a dispute arises, leading to lower resolution costs. This positive cost-reduction effect exists even when, due to power asymmetries, the disputant parties are least likely to engage in cooperative interaction (Lumineau & Malhotra 2011).

The risks from the supplier side in terms of the competence trust that the automaker perceives clearly influence the selection of the right supplier and reach well beyond the contract. In particular, these risks affect "both the practices firms use to manage cooperation and their selection of trusted



partners, which in turn facilitates supply chain management” (Dekker, Sakaguchi & Kawai 2013, p. 123). Bearing these ideas from prior literature in mind, our research propositions are:

RP2: Relationships with suppliers providing parts with higher product complexity also entail more intraorganizational complexity in the supply agreement, namely, a longer and more complex selection among alternative suppliers, and a more complex negotiation and settlement of a contract with the selected supplier.

RP3: Relationships with suppliers providing parts with less product complexity will also imply less intraorganizational complexity, making it easier for the automaker to switch from one to another. This situation involves an easier supplier selection and contract settlement process.

### **The Volvo Group and *Volvo do Brasil*. Summary profile**

The Volvo Group is one of the world’s leading manufacturers of trucks, buses, construction equipment and marine and industrial engines. At the end of 2015, the Volvo Group had 88,464 regular employees and 11,037 temporary employees and consultants. The Volvo Group has 66 factories in 18 countries around the world and sells its products in more than 190 markets.

Volvo has operated in Brazil since the 1930s, and has run a local production facility in the city of Curitiba since 1977. Like many other automotive producers, Volvo was motivated in the beginning, by fulfilling Local Capacity Requirements (LCR) and high tariffs on completely-built-up (CBU) vehicles, Knock-Down Kits (CKD) and components (Ivarsson and Alvstam, 2005, 1329). It currently produces trucks (medium and heavy duty), buses, powertrain and some construction equipment models, all carrying the Volvo brand. Volvo do Brazil represents a “main factory” compared to the “kit factories” of Volvo Trucks in other developing countries (Ivarsson and Alvstam, 2005, 1335), and even if most of its production is sold in Brazil, there are also some exports of complete truck and buses to several American countries, as well as engines and cabins to other Volvo factories in Belgium and Sweden.

Volvo do Brazil is not a passive importer of technologies and innovations from Volvo Group’s headquarters in Sweden, but an active player whose innovation is driven by a series of collaborative inter-organizational processes of interactive learning with other Volvo Group firms, but also with suppliers, other automotive manufacturers, or institutions such as the Lean Institute of Brazil (Wallace, 2004, 803). One good example of this inter-organizational learning process is the Volvo Production System (VPS). VPS background in Brazil dates back to the 90s, when local management learnt from Mercedes Benz’s Lean implementation at a Lean Summit organized by the Lean Institute of Brazil. Volvo do Brazil managers started a value-stream mapping (VSM) for the

Curitiba production plant. As a result of this, *Volvo do Brasil* was able to install an additional truck assembly line without increasing factory space due to more efficient use of the space they had freed as a result of optimization of the older production line. In April 2005, *Volvo do Brasil* launched the SIV, or Sistema Industrial Volvo. The information about this accomplishment spread to the entire organization across the globe. In the meantime, other sites in France, Sweden and the United States also had similar experiences, applying continuous improvement methodologies. In the beginning there were only one-off initiatives to fulfill different needs at different locations. However, when headquarters realized the benefits they decided to start a global process. By 2006 Volvo Group had decided to create its Volvo Production System, as a common system inspired by the Toyota Production System (Liker and Meier, 2005). The whole model was first tested in *Volvo do Brasil*.

The VPS provides principles, tools and guidelines indicating how all the units in Volvo's global production network should work to reach operational excellence. The overall aim of implementing and sustaining the VPS is to reach world-class performance in six defined competitive priorities: safety, quality, delivery, cost, environment and people (abbreviated to SQDCEP) (Netland and Sanchez, 2014). Two *Volvo do Brasil* production plants are currently listed among the 5 best-rated VPS results in the Group. The Powertrain plant is ranked number one and the Trucks plant fifth. Volvo do Brazil was soon considered a Group role model (Vahlne et al. 2010, 10) and currently remains as such for VPS deployment.

There is a very high level of knowledge exchange among Volvo units. The evaluation model is the so-called VPS Assessment, managed by a global team of lean experts. Assessments are standardized and applied to every Volvo facility worldwide. Good examples are promoted by the global VPS team and shared on a monthly basis via Knowledge Management Events attended remotely by as many as 200-300 Volvo people across the globe. The global team also maintains the Knowledge Sharing Library to publish examples of good practices. Volvo Group promotes global forums between units with similar functions across the globe. Thus, best-practices are constantly shared among all units, securing lateral knowledge sharing.

## **Methodology**

The case we studied follows Stake's guidance (1994), that is, it offers significant opportunities to learn about the issues being examined. One of the co-authors of the paper had 6 years' experience (between 2008 and 2014) as "VPS Coordinator". Having occupied said position, he facilitated access to knowledgeable informants, rich longitudinal data and offered the possibility to gain insights.

In the most recent phase of our work with *Volvo do Brasil*, interviews took place in May 2015. They were conducted with the managers of New Product Development from Volvo Trucks and

Volvo Bus. In the Purchase Department, we interviewed the two Purchase Managers. At the Volvo Production System Department, interviews were conducted with the Global VPS Concept Development Director and the VPS Manager for Global Trucks Operations Brazil. Later interviews and clarifications were held with respondents and an additional interview was performed with a former Renault Trucks Plant Manager for Lyon Stamping Plant. A total of seven Volvo managers were interviewed. All interviews were recorded and transcribed. Based on the literature review, three different questionnaires were designed for each of the departments in which the interviews took place, in order to obtain a wide perspective of the buyer-supplier collaboration ties. As the aim of the research is to find out which types of habitual collaboration ties exist between buyer-supplier within new product development and performance efficiency, it is important to include both sides in the field research.

With respect to the supplier's sampling frame, we were provided with a list of over 8,751 Spanish suppliers, 4,059 of which were active. Of these, 210 were Basque suppliers providing parts to the Volvo Group. From this supplier group, 26 were re-selected as potential respondents. The filtering was facilitated by eliminating one-time suppliers and suppliers devoted to other types of products or services, leaving as potential interviewees only those identified as major Tier 1 Basque providers, locally recognized as knowledge-intensive firms. Among those firms, two providers were known by the authors as very long-term providers for *Volvo do Brasil* and other Volvo Group firms. They had also closely collaborated in NPD experiences with *Volvo do Brasil* and with other firms in the group such as Renault Trucks. These two providers were Fagor Ederlan, - a firm specialized in chassis and powertrain applications employing 3,546 people in 2015, with a turnover of 624M euro -, and Batz, - a stamping dies and automotive systems supplier employing 1,500 people, with a turnover of 230M € As in the case of Volvo, our access to knowledgeable informants at both providers also offered possibilities to gain rich insights.

On the supplier side we built a questionnaire designed to assess the supplier's standpoint and also to confront buyer-supplier's perceptions of key elements of inter-firm collaboration on NPD in the light of the literature review. Tooling plant managers at both firms were interviewed in May 2015.

In order to increase the reliability of our analysis of the interviews, as recommended in the literature (Gibbert et al. 2008), two peers who were not co-authors independently analyzed the transcripts of the interviews and discussed and reviewed the draft of the paper. With the same purpose in mind, the drafts were also reviewed by key informants at *Volvo do Brasil* and by the two suppliers interviewed in May-June 2016.

## **Results**

### ***NPD frequency differences between the passenger car and truck businesses***

Although buyer-supplier collaboration on NPD is very frequent across the automotive industry, the supplier's access to an automaker's NPD process tends to be moderated by the automaker's own internal NPD capabilities. Volvo Trucks usually launches a new model every 4-5 years. Meanwhile, GM, Toyota or Volkswagen launch several new models every year. Consequently, the level of internalization of NPD capabilities for Volvo Trucks tends to be lower, as it is cheaper and more cost-efficient for Volvo to take advantage of specialized external sources than to try to internalize those capabilities. As one of the interviewed suppliers states:

*“We have customers that are huge and they have specific areas for product development that are very skilled in giving the suppliers only very breathily information, the minimum required. And there are other smaller customers like Volvo trucks and Jaguar Land Rover that have lower internal capacity for development and they are more open to dialogue and cooperate on NPD. Large automakers, such as Volkswagen for example, will hardly allow us to get into the development of their vehicles because they have really closed internalized procedures” (Manager provider 1)*

The truck business not only differs from the passenger car by having less frequent NPD cycles. It also means that the lifespan of production contracts with suppliers tends to be longer than for those pertaining to the passenger car segment. Another key point concerns the considerably lower production volumes in the truck business compared to the passenger car segment.

As Volvo volumes in units are not high compared to other automaker companies, the firm has opted for a single source global supplier policy. As a consequence of this, they can gain volumes and increase attractiveness to keep a profitable supplier base. Volvo's low NPD frequency and single source global supplier policy seems to increase the company's willingness to engage suppliers in the development process, which implies securing the firm's capability to create organizational mechanisms to coordinate intra and inter-firm relationships.

### ***Types of inter-firm collaboration in NPD***

The Volvo Group has a long history of developing pioneering products and services for the transport and the construction industries. Its research has resulted in cutting-edge technologies in the areas of safety, energy efficiency and emission reductions. Those improvements often require the collaboration of suppliers, mainly in those businesses as Volvo Trucks that outsource the vast majority of the components used in their assemblage. Approximately 90% of the components are produced by external suppliers.

*“In fact we only assemble things, we're only putting the parts together. We use the suppliers, we develop parts but these parts are produced outside based on a production plan and we bring them in” (Volvo manager 2)*

When it comes to new product development, a higher rate of components is developed in-house. About half of the truck components are developed internally for later quotation with suppliers. The

other half are related to components developed in collaboration with suppliers upon Volvo's request.

The types of collaboration may vary according to the component complexity and amount of technology involved and according to the buyer's dependence on the supplier's technology or production capacity. It can range from *null* or *none* to complete outsourcing as noted in the revision of the theory (Clark & Fujimoto 1991; Zhao, Cavusgil & Cavusgil 2014). Supplier collaboration is said to be *null* whenever Volvo is fully responsible for the component's concept and design. Suppliers will only be contacted at the moment of quotation. These suppliers' R&D and internal innovation capability does not play a relevant role within the NPD cycle and they often compete on price, resulting in lower profit margins.

From the evidence collected during the field research at Volvo, we observed that suppliers are mainly segregated according to two main criteria: (1) "dependence for capacity" and (2) "dependence for knowledge". Within the first group (ie, dependence for capacity) we may find all the suppliers that provide components which the automaker itself could produce internally, but due to reasons such as cost, efficiency, space or management attention they have decided to outsource to external production. However, in this group the company normally develops the basic concept of the component internally, so as to identify and describe the need, and later quotes with suppliers. Negotiations are carried out in two steps: first to agree on which supplier will work on the tooling, then in a second round of negotiation the buyer will evaluate and decide which supplier will take the industrialization contract. Firstly, they quote and develop the tooling, and later the production *per se*. There is no rule stipulating that the supplier working on the tooling development also receives the production contract. However, being selected to work on the tooling already indicates a pre-disposition from the automaker to do business with this specific supplier.

With respect to the second group (dependence for knowledge) the automaker will search for suppliers which possess the specific required technologies to complement their internal capabilities. In this group, the automaker can face at least two distinct scenarios: (a) *non-core business* items and (b) *core-business* items. By non-core business items we mean components for which the automaker does not control the technology or the *know-how*, as they rely on specialized suppliers to provide these kinds of parts, for example air conditioning, tires, air compressors, steering pumps, turbo chargers, etc. In the second sub-group (dependence for "core business") the company will look for suppliers capable of filling what would be internal competence gaps. We identify certain suppliers which focus on developing solutions to enable automakers to comply with legal requirements, in terms of green-house emissions, for example. For this sub-group we could mention, for instance, suppliers devoted to producing SCR (Selective Catalytic Reduction), starter motors, etc.

The level of buyer-supplier interactions in NPD and the supplier's bargaining power vary according to the level of dependence the buyer has on the supplier's capabilities. In the first group (dependence for capacity), suppliers seem to have lower negotiation power and tend to compete on price, consequently having lower margins and less bargaining power. It does not mean they do not interact on product development. On the contrary, they can interact, as suppliers are expected to provide improvement suggestions capable of lowering prices and securing the right quality level. These suggestions usually consist in proposing adaptation to the tooling design so as to facilitate the industrialization process, consequently reducing price, or even proposing new materials or standard parts.

In the second group (dependence for technology) the automaker usually concentrates its efforts on providing specifications and securing components adaptability to its own products. Normally the buyer is interacting with specialized and knowledge-intensive suppliers which are not likely to be the owners of the tooling or drawings. This kind of supplier tends to have bigger margins, which the buyers consider logical, since they devote a considerable amount of resources to R&D.

In order to increase the involvement of these knowledge-intensive suppliers in problem-solving and promote end-to-end optimization projects across the value-chain, Volvo do Brazil has launched the S.C.O.R.E. (*Supply Chain Optimization Road for Excellence*) program. The program includes providing *Lean Thinking* training and consulting to suppliers on specific tools and methods according to the need. Furthermore, Volvo holds regular meetings and workshops with key suppliers, called "The Supplier Day" initiative. At these meetings, Volvo shares strategic goals with key suppliers, aimed to align them with the company goals.

*"We are involving the suppliers and the other areas in the early phases of the projects more and more. And when we have components under suppliers' responsibility, we involve them in other areas like manufacturing, after-market in the same way; they are part of the discussions from the beginning of the projects" (Volvo Manager 2)*

Kotabe et al. (2003) have also drawn a line between "simple technical exchanges" and a "higher-level of whole technological capabilities". Kotabe et al. (2003) are very aligned with Takeishi (2001) as both identify the amount of technology involved in the transaction as determinant for the type of buyer-supplier interaction. We can draw a parallel between "simple technical exchanges" with "dependence for capacity" and "higher-level of whole technological capabilities" with "dependence for technology".

Takeishi (2001) has also indicated that the level of competence varies among automakers, as some have bigger NPD capabilities than others. This leads us to conclude that the type of relationship between buyer-supplier is greatly determined by the buyer level of dependency on the supplier's technological skills, and that suppliers with higher technological capabilities ultimately have stronger chances to achieve better results when cooperating with automobile manufacturers. These

characteristics evidenced from the interviews and the knowledge gained by analyzing Volvo give support to the plausibility of RP1, namely, that said automaker selects suppliers with a higher capacity to absorb knowledge, invest in R&D or perform more complex tasks when there is a higher level of product complexity.

### ***Contracts as a way to safeguard NPD***

A big player like Volvo, with a long market background and tradition, keeps a wide variety of formal control mechanisms like *General Price Conditions*, *Price Agreements* and *Warranty Agreements*, among others, which seem to be very effective in restraining suppliers from eventually misleading behavior.

Any kind of buyer-supplier relationship developed by Volvo starts with performing the *Supplier Evaluation Model* assessment. It is a standard questionnaire composed of multiple modules to assess and evaluate a supplier's situation as per finance, quality, health & safety, production capabilities, etc. Before starting any joint development or sharing any kind of information, they must first sign the *Confidentiality Agreement*.

For its part, the *Long Term Agreement* (LTA) is a contract applied to all active suppliers, contemplating a wide range of clauses to secure aspects like the supplier's *competitiveness*, *delivery precision*, as well as general guidelines concerning *productivity*.

*"I would say each area has a control mechanism. For example, in Purchasing we have the Long Term Agreement; it is a commercial agreement. In Quality, we have the Supplier Evaluation Model and another regarding PPM (Parts per million). Logistics also has a specific agreement, because we have to control delivery precision, for example. In the Logistics area we have a specific person to work on this relationship, the so called SRM (Supplier Relationship Manager), whose role is to work with the supplier in order to follow up delivery precision, logistics costs, things like that. So for each specific area we have different kinds of specific agreements to control QDCF (Quality, Delivery, Cost and Features)." (Volvo manager 3).*

The *Confidentiality Agreement* prevents suppliers from sharing Volvo information with others, as well as protecting the suppliers themselves from having their own drawings inadvertently appropriated by the buyer and quoted with other suppliers (unless the buyer purchases the *tooling*). This is the basic contractual requirement to safeguard the company's sensitive information from opportunistic behavior. Opportunistic behavior from the supplier side has not been highlighted as a real threat to the business, as no significant episodes have been observed by the interviewees, at least in recent times. As matter of fact, trust has not been highlighted as an issue by the *Purchase Department*; not even the risk of opportunistic behavior seems to be an issue, possibly due to the wide range of contracts and legal ties enforced between the agents.

*"We don't know exactly if they are able to keep 100% of the information, but we have never had this problem. Sometimes we have some small deviations, then we bring in the management for a meeting to explain it again, but we have never gone to court" (Volvo manager 3)*

Another interesting aspect enforced by the Volvo Group's Supplier Development is the so-called single sourcing per component policy, unlike some other competitors that work with dual or even multiple sourcing. Even if a new supplier which is not listed in Volvo's accredited database presents better commercial conditions, this *Long Term Agreement* already signed with a current supplier prevents Volvo from shifting to the new one. Rather, Volvo will facilitate this new supplier's full assessment, to invite it to sign the *Confidentiality Agreement*, and offer the new and the incumbent suppliers the opportunity to compete.

Nevertheless, if Volvo recognizes that the new supplier is indeed offering better conditions, Volvo has to notify its current provider about the new offer and the detected gap with respect to the new proposal prior to termination of the previous contract with the current provider. Finally, Volvo must offer this active provider the possibility to adjust the commercial conditions to win over the new offer in order to keep the contract in effect. If a current supplier could not provide with improved commercial conditions up to the point of covering or equalizing a new proposal, then Volvo has, per contract, the prerogative to anticipate contract termination within a certain period of time. In such case, Volvo will be able to start a new contract with the new supplier which has offered better conditions.

Although our informants conceded more importance to contracts than to trust as a way to safeguard NPD, the single source policy and the Long Term Agreements of Volvo do Brazil with its suppliers can be interpreted as signs of high trust. Previous researchers have also highlighted those long term relationships, giving the Brazilian plant 15-20 years to establish new supplier relations, compared to only 4-8 years in Volvo Truck's plants in China, India or Mexico (Ivarsson and Alvstam, 2005, 1335). Those long term relationships and Volvo do Brazil's single source policy are similar to Volvo Trucks Europe's relationships with its providers (Vahlne et al. 2010) and help to establish close, inter-firm learning and collaboration with providers.

Volvo seems to manage its supply chain by adopting a mix of both strong buyer-supplier ties and arm's length ties, but making variations in accordance with the level of dependence on a supplier's NPD capabilities. The firm will tend to adopt competitive bid whenever dealing with suppliers under the "dependence for capacity" conditions. Correspondingly, it will promote and develop stronger ties with those in the "dependence for technology" category.

Under the "dependence for capacity" scheme, involvement in specific investments to support suppliers' R&D is normally restricted to the purchase of *tooling* developments, which includes full property rights of drawings, prototypes and technical information related to the given component developed. The act of purchasing the *tooling* developments can be seen as an investment in product development. It is the way the company has found to take advantage of its suppliers' R&D



capabilities and reduce NPD costs. In these cases, the NPD can be seen as a buyer-supplier business transaction in itself.

In line with previous research (Chung and Kim, 2003), one of Volvo’s objectives when finding and selecting suppliers for new components development is to take advantage of their expertise.

*“The company relies on very innovative suppliers to secure access to new technologies capable of ensuring compliance with the right level of greenhouse emission as regulated by governments. Normally, these suppliers are the same, or belong to a small group of suppliers that dominate these specific technologies, and it would be very costly for any automaker to individually devote internal resources to this kind of research and development on their own” (Volvo Manager 1)*

However, there is another type of collaboration that usually takes place when Volvo wants to develop an innovative product that does not exist in the market and searches for one or more suppliers that work with a similar technology and propose the joint development of this new product.

Although Volvo is not reportedly interested in capturing supplier’s *know-how* by itself, it is key to the company’s securing well-developed internal competences to monitor component quality, functionality, performance, safety and durability, as well as a strong focus on delivery precision, in order to minimize any production downtime risk.

Zirpoli and Caputo (2002) analyzed Fiat’s supply chain management strategy and have compared it with that of other big players in the automotive industry such as Ford, Toyota, Nissan, Daimler-Chrysler and GM. This comparison revealed mixed elements from Japanese and western supply chain management techniques. This study has been used to assess the Volvo Group’s behavior towards these competitors (See Table1 ).

**Table 1.- A comparison between alternative supply chain management models including Volvo Trucks**

<b>Model</b>	<b>Adversarial</b>	<b>Keiretsu</b>	<b>Fiat</b>	<b>Volvo Trucks</b>
<i>Characteristics of supply relationship</i>				
Reasons for supplier developing a new component	Request for supply	Long range development plans	Request for supply	Request for development and/or supply
Timing of involvement	Style freezing	Concept or before	Concept or before	Concept or before
Influence of suppliers on NPD	None	High	High	High
Number of suppliers per model	High	One or two	One or two	One
Selection of suppliers	Competitive bid	Belonging to Keiretsu	Competitive bid and existence of previous relation	Competitive bid and existence of previous relation
Selection criterion (perceived as prevalent by suppliers)	Price	Trust and technical	Price	Price and technical
Specific investments in tools and equipment by	Minimum	Often equally shared	Mostly made by suppliers	Restricted to tooling

the OEM				
Duration of the relationship	Until better offer	Long period	Life of the model	Long period
Level of technology control by OEM of component outsourced	Very high	High	Often low	High
Supplier R&D	Not relevant	High	High	High
Overall transparency of the relationship	Low	High	Low	High
<i>Organizational solutions</i>				
Price setting	Absent	Common practice	Absent	Target cost
Target costing	Cost cuts based on market power	Negotiated on technical basis	Fixed cost cuts not based on a technical evaluation	Fixed cost cuts based on expected productivity gains
Profit sharing	Absent	Fairly applied	Not formalized, judged not fair by suppliers	Fairly applied, only for incremental cost-reductions
Vertical information sharing	Minimum	Intense (use of resident engineer)	Intense (use of resident engineer)	From minimum to intense, according to complexity and dependence on suppliers' R&D
Horizontal information sharing	None	Low	None	Variable, depending on complementary needs

Source: Adapted from Zipoli and Caputo, 2002, 1403, with the inclusion of Volvo Trucks data.

In summary, from the opinions collected, we can confirm that Volvo decides partially in accordance with RP2 and RP3: There is a set of core providers that lean towards supply agreements of greater product complexity, entailing a longer and more effortful interaction in product development and evaluation. Also, the automaker agrees upon sharing the property of the know-how developed from collaborative NPD with suppliers. However, process innovations are not the automaker's particular concern. Rather, it is delivery precision, quality and costs:

*For me it is more important delivery precision, quality and costs, maybe costs is the first one, because I have to be competitive, but also we have quality [...] When we have co-design, of course we work with them, and we try to be as innovative as possible, but I don't know if we have this kind of selection, or if we consider this capability from the supplier as a differential to select them (Volvo Manager 2).*

### **Concluding remarks and Discussion**

Automakers today tend to outsource the vast majority of component production to external suppliers. Volvo outsources about 90% of the total parts used in its assembly process. Therefore, collaboration with suppliers on NPD is a reality. However, the types of collaboration on NPD between Volvo and its providers vary according to component complexity, its relation to the “core

*business*”, the buyer’s dependence on the supplier’s technology or dependence on the supplier’s production capacity.

The Volvo case shares many similarities with that from Toyota (Dyer and Hatch, 2006). Not only by implementing the *Volvo Production System*, but also by recognizing suppliers as an important source of innovative ideas and making the collaborative relationship with suppliers a corner-stone of its strategy. Volvo also works with a single-source supplier policy, which enables longer and closer cooperation with dedicated suppliers, often attached to *Long Term Agreements*. Volvo, like Toyota, promotes its own specific production system and both use it as a common-language for leveraging internal and external integrated efficiency. Dyer (1997), Takeishi (2001) and Dyer and Hatch (2006) have highlighted Toyota’s cooperation willingness, common-language and integrated problem-solving between buyer and suppliers on NPD and also on process improvements as the source of the company’s competitive advantages. As Volvo moves forward with its *Volvo Production System*, the Swedish automaker paves its way to building efficient end-to-end value-chain performance. Considering the single source supplier policy, long term relationships, the adoption of the *Volvo Production System* and an extended value-chain optimization mindset, we could place Volvo closer to Japanese practices (Toyota and Nissan) than to American ones (GM, Ford, Chrysler).

The field research has not confirmed trust as a primary feature of the buyer-supplier embedded ties as suggested by Uzzi (1997) or Gulati (1995). As Volvo relies on contracts as the main governance mechanism, no type of interaction without formal contracts exists; trust never replaces contracts for this automaker. As matter of fact, trust has not been highlighted as an issue in interviews, nor does the risk of opportunistic behavior seem to be an issue, possibly due to the wide range of contracts and legal ties established between the agents. We could not find evidence to support Yang et al. (2011) or Reuer and Arino (2007) as we did not see different contractual ties arriving from a higher or a lower level of trust. All the dyadic relationship ties are regulated by the same control mechanisms, applied according to the type and level of interaction, but never replaced by informal ties such as trust.

It is also possible that trust is more important than the interviewed managers supposed, since trust can be taken for granted with a high percentage of current providers. A significant reduction in the supplier base in Brazil, from 400 in 1999 to 153 in 2003 (Ivarsson and Alvstam, 2005), probably helped to make a selection of those more trustworthy suppliers. Long Term Agreements and the single source policy applied with key providers can also be interpreted as signs of high trust that help collaboration on NPD.

According to the interviewed suppliers, collaboration on NPD is more difficult with the big western automotive players with stronger internal NPD capabilities. In comparison to Volvo, these

companies tend to be very restrictive when including suppliers in the NPD process, and often build very exclusive contracts preventing changes. A new study would be required to examine in greater depth the relationship between internal NPD capabilities, the level of rigidity on deliverables arranged by contract and overall supply chain added value to determine the extent to which the supplier's participation is excluded or restricted.

While the bulk of the data for this research consists of interviews carried out at Volvo do Brazil, we consider that most of its findings are generalizable to Volvo Trucks. Following the concept of the global manager, Volvo Trucks places and replaces an elite cadre of senior managers across its companies, and some of the managers we have interviewed in Brazil have global responsibilities and also previous experience managing other plants in the group. In fact, some of the interviewed managers have also led similar supply chain policies in European plants and many of those experiences were also mentioned in the interviews. Supply chain policy is embedded in the VPS, and Volvo do Brazil is a Group role model for VPS deployment, thus making generalization feasible.

### **Limitations**

While the number of interviews held at Volvo do Brazil, the interviewees' positions and the 6 year experience of one of the authors of the paper as former VPS Coordinator give us a detailed understanding of Volvo's point of view; the number of interviews held with providers is low and have been conducted with a more exploratory aim. Further research should include a higher number of suppliers of the different types analyzed in the research (namely, "dependence for capacity" and "dependence for knowledge").

Interviewed managers on both sides often made comparisons between the truck industry and the passenger car industry, and thus the paper highlights how buyer-supplier collaboration on NPD differs between the two sectors. The comparisons and findings were brought to our attention due to the fact they enjoy similar supplier bases. Future studies should place greater emphasis on comparing competing companies in the same category (truck industry) and analyzing how different governance mechanisms in the supply chain affect NPD.

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