The paradox of supplier development in technology-based luxury supply chains

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International Journal of Operations and Prod Manag

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| Journal: | *International Journal of Operations and Production Management* |
| Manuscript ID | IJOPM-11-2022-0703.R3 |
| Manuscript Type: | Research Paper |
| Keywords: | supplier development, paradox, Case study, Capabilities, luxury product, process model |
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**Response Letter**

**IJOPM-11-2022-0703**

**"The Paradox of Supplier Development in Technology-Based Luxury Supply Chains"**

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Dear Prof. Kocabasoglu-Hillmer:

We are delighted that our contribution was accepted for publication on the Special Issue you managed. We are really grateful for the appreciation you and the other Guest Editors showed for our work.

More importantly, we really would like to thank you for the exceptional guidance you and the other Guest Editors so kindly provided along the entire review process. Your advice was indeed fundamental not only to strengthen the conceptual value and overall clarity of the manuscript, but also to align it properly with the topic of the Call for Paper.

As for the last points you asked us to address in the final revision – that we report them below for convenience's sake:

*1.) Can we ask you to proofread one last time. We found some grammatical mistakes (e.g. "Specifically, we illustrates...", pg. 14) that the word processor does not seem to catch. We found the following site quite helpful: https://www.deepl.com.*
*2.) Can we use developing-leveraging rather than developing::leveraging?*
*3.) Hillmer et al.... should be Kocabasoglu-Hillmer et al..*
*4.) We urge you to delete references to "new" or "radical", and just say product and process innovation.*

We addressed all of them, in line with your indications. With respect to point 4.), we would like to specify that, while we removed the general references to "new" and/or "radical" when referring to "product" and/or "process", we occasionally kept these adjectives, only for those products/processes cases that the informants themselves had qualified in such way.

Again, thank you for accepting our manuscript, and sincere congratulations for the very interesting topic you chose for the Special Issue. We truly believe this Special Issue will significantly advance the current understanding of how paradoxes can inform the Operations & Supply Chain Management literature.

With Best Regards,

The Authors

# The Paradox of Supplier Development in Technology-Based Luxury Supply Chains

**Purpose** – This paper aims to examine how collaborative supplier development (SD) activities, supplier capabilities, and buyer-supplier relationship interrelate in technology-based, luxury product business contexts characterized by small volumes, difficult targets, and resource constraints relative to those targets.

**Design/methodology/approach** – Using inductive case research method, we investigate multiple embedded cases involving six dyadic buyer-supplier relationships of two luxury product manufacturers in the motorcycle and automotive industries. Each dyad represents an important sub-system for which the buying firm committed significant SD efforts to help the supplier successfully achieve difficult targets.

**Findings** – The analysis reveals how paradoxical tensions might emerge as the firms engage in successful SD activities, which could lead to decreasing relationship commitment ultimately resulting in the termination of the relationship. We utilize the "*value co-creation and value capture*" paradox framework to understand the SD and relationship dynamic, and characterize it as *developing-leveraging* paradox to explain its dualities, i.e., commitment-based SD efforts (increasing value co-creation), and unilateral leveraging of the newly acquired capabilities (increasing value capture) by both the buyer and the supplier. Overemphasis on value capture by one of the exchange partners spurs a detrimental vicious cycle leading to the decline of the relationship.

**Research limitations/implications** – The study explains the paradoxical dynamics that may emerge in SD activities of innovative, technologically complex, luxury product firms. The findings contribute to the SD literature by highlighting how learnings from SD activities could contribute to the dark sides of buyer-supplier relationship. The technologically complex, luxury product contextual characteristics of the study may limit the generalizability of our findings.

**Originality/value** –The study provides novel insights into the emergence and management of paradoxes in buyer-supplier relationships, in terms of virtuous and vicious dynamics of developing-leveraging.

**Keywords** – Case study, luxury products, supplier development, capabilities, paradoxes, process model

## 1 Introduction

In recent years, original equipment manufacturers (OEMs) have increasingly turned to their supply networks as a strategic source of competitive advantage (Jaaskelainen *et al.*, 2022; Wagner, 2010). To ensure that the suppliers meet the expected capability enhancement goals, focal firms often need to engage in "supplier development" (SD) activities (Krause, 1999; Modi and Mabert, 2007). Previous research recognizes that the virtuous process of SD and capability development (Krause *et al.*, 2007; Modi and Mabert, 2007; Wagner, 2010) typically requires commitment from both parties involved. Relational commitment is specifically useful in encouraging investments in SD efforts and maintaining the continuity of the relationship (Joshi, 2009; Ghijsen *et al.*, 2010). However, there is also evidence of unsuccessful or suboptimal SD activities (Tran *et al.*, 2021; Su *et al.*, 2018). Apparently, these negative outcomes cannot solely be attributed to the supplier's inability to acquire the new skills (Kim *et al.*, 2015), but may also be attributed to factors such as supplier opportunism (Tran *et al.*, 2021), lack of sufficient motivation to engage (Kim *et al.*, 2015; Nagati and Rebolledo, 2013), inadequate relational capital (Blonska *et al.*, 2013), or imbalanced bargaining power within the exchange relationship (Tran *et al.*, 2021).

We conjecture that most of the factors mentioned above are particularly relevant when SD activities are undertaken for the product and/or process development of high-end, technologically complex, and exclusive products. Further, due to the novelty of the product or process, the gaps between the required capabilities and expected goals are likely to be wide, thus necessitating intense buyer-led SD efforts. However, setting challenging targets in this context may create ambiguity in the desired goals and present risks of knowledge spillover, among other difficulties. These factors exacerbate the already complex technical and managerial challenges of SD activities. These difficulties may impede the realization of the positive SD dynamics linking relationship commitment, SD efforts, supplier capability improvement, and performance outcomes that are noted in literature. The presence of these challenges raises questions about the evolution of SD dynamics and the outcomes they drive in these contexts.

Keeping in view these circumstances, our study analyses the SD activities of two innovative luxury product firms, each specializing in technologically complex products. We focus on three key suppliers for each firm, recognizing these suppliers' pivotal role in contributing to the firms' competitive success. The SD activities aim to develop critical resources in the presence of distinct contextual characteristics: small volume transactions; uncertainties in achieving difficult targets (e.g., engineering innovation or superb quality requirements); and time and resource constraints.

In such business contexts, SD efforts are complex and their management poses challenges, rendering the dynamics and outcomes difficult to predict. Accordingly, the aim of this inductive study is twofold: (a) to examine why and how SD activities are managed by innovative, technologically complex, luxury product firms; and (b) unravel how relationship commitment, SD efforts, and supplier capability interrelate over time in this context.

The analysis of these dynamics uncovers a surprising revelation: the successful completion of SD activities in achieving the projects' targets do not necessarily yield mutual relationship commitment. In the initial stages of SD engagement, both the focal firms and their key suppliers exhibit a willingness to commit to the SD activities. They invest in the resources essential for enhancing the suppliers' capabilities to enable the focal firms to acquire the components at the desired performance standards. However, as time progresses towards the later stages, as the focal and supplier firms acquire and develop unique capabilities through their collaborations, they tend to leverage the new competencies and reduce their mutual commitment, thus leading to a counterintuitive decline or termination of the relationship. To explain this phenomenon, we draw upon the paradox framework proposed by Lewis (2000). The persistent tension between the interrelated dualities of *value co-creation* during supplier development and *value capture* through the leveraging of the acquired capabilities characterizes a paradox within the buyer-supplier relationship, that we denote as the *developing-leveraging* paradox in order to describe the two contradictory and interrelated elements that in our settings correspond, respectively, to the value co-creation and value capture dualities.

Our research contributes to the literature on SD by unveiling and explaining the paradoxical dynamics that connect SD efforts, supplier capabilities, and relationship commitment within specific business contexts. Through an in-depth examination of these dynamics, our study enriches the SD literature by highlighting the fundamental role that the buyer's learning plays in the SD process. Specifically, we illustrate how both the supplier's learning and the buyer's learning shape the dynamics of the SD activities over time. These learnings motivate each party to leverage the capabilities acquired through the SD process to its individual advantage, deemphasizing the objective of mutually beneficial common growth and development. By building upon previous research in the supply chain literature (see also, Wilhelm and Sydow, 2018; Kocabasoglu-Hillmer *et al.*, 2023), we demonstrate how a paradox perspective can clarify and explain the simultaneous existence of conflicting dualities in buyer-supplier exchanges.

## 2 Related literature

In the context of technologically complex, luxury product firms engaging in supplier development (SD) for product and process development, several conflicting perspectives arise, leading to behavioral and operational challenges in the buyer-supplier dyads. However, there is a scarcity of theoretical frameworks that adequately explain the SD dynamics in these contexts. Eisenhardt (1989: 536) recommends adoption of an inductive case study with plausible theoretical anchors as tentative "mental frames of reference" in such situations. Accordingly, in the ensuing review, we highlight the main theoretical frameworks, the underlying constructs and relationships that we referred to while conducting the case studies. Particularly, we utilize the paradox theoretic tenets to analyze, understand, and respond to the contradictions and tensions that emerge as the buyer/supplier firms strive to benefit from product/process development (e.g., Eisenhardt, 2000).

### *2.1 SD efforts in product/process development contexts*

Buying-firm-driven, supplier-based product and/or process innovation necessitates significant SD efforts due to two primary reasons. First, there is typically a gap between the desired level of competence and the current level of competence of the supplier (Wagner, 2010; Lawson *et al.*, 2015).

Secondly, the buyer-supplier relationship is often new, lacking the necessary infrastructure for effective interactions such as information sharing mechanisms, performance evaluation systems, and contractual safeguards.

SD efforts can be direct or indirect. Direct efforts involve the buying firm making technological and capital investments in the supplier, providing in-person training and guidance. Indirect efforts may include offering financial incentives to encourage the achievement of performance goals (Lee and Li, 2018; Krause *et al.*, 2007). In the context of product/process innovation, SD efforts typically involve the supplier's product development activities, co-location at supplier's facility to enhance their product development performance, sharing of technological know-how, assisting in the design of new production processes, and offering project management support (Lawson *et al.*, 2015). However, there are risks in making significant investments in SD efforts, particularly for novel product/processes. Therefore, reciprocal commitments, including the willingness to deploy relation-specific financial, capital and human assets, and share relevant information, are crucial for successful SD (Blonska *et al.*, 2013; Lawson *et al.*, 2015; Dyer *et al.*, 2018). Both parties must make investments and establish arrangements for equitable sharing of gains, contributing to deeper commitment, higher value creation, and the mitigation of opportunistic behavior (Blonska *et al.*, 2013; Dyer *et al.*, 2018).

While research on SD has primarily focused on the buying firm's perspective, SD is an inter-organizational activity that requires significant contributions from supplier as well (Chen *et al.*, 2016). The supplier's motivations to engage in SD efforts depends on the potential to co-create value (Dyer *et al.*, 2018) and derive benefits in terms of higher profit and reputation due to the buying firm's purchases (Nagati and Rebolledo, 2013; Mortensen and Arlbjørn, 2012; Lawson *et al.*, 2015).

### *2.2 The role of product and market contexts in SD efforts*

The SD literature has primarily focused on the types, consequences and – to a lesser extent – the contextual factors that affect SD adoption (Chen *et al.*, 2016; Kim *et al.*, 2015). Although Chen *et al.* (2016) emphasize the importance of considering context for cost-effective SD, empirical studies have largely overlooked this aspect, with only a few exceptions (e.g., Nagati and Rebolledo 2013; Krause,

1999) that consider technological dynamism or market competition as key contextual factors. The knowledge gap hinders a clear understanding of the SD dynamics in situations characterized by constraints on time, knowledge, capabilities, and budgets as in cases of technologically complex product/process development (e.g., Jayaram, 2008). In such contexts, as in the aerospace industry, the need for radical innovation coupled with uncertainties in achieving difficult targets is likely to make the gap between the desired and current levels of competence of the supplier relatively high (Reed and Walsh, 2002). Similar challenges may exist in the innovative, technologically complex, luxury automobile sector, since the manufacturers operating in this context have to source small batches of very high-quality, innovative components and systems. Suppliers, and especially the smaller ones, may not possess (or be able to acquire) the appropriate skills required to meet these stringent requirements cost-effectively under time pressure. Furthermore, the low volumes of this niche sector (Mahapatra *et al.*, 2010) may reduce its business attractiveness from a supplier's perspective resulting in limited pool of potential partners. For the buyer firm, these conditions create a risk of being locked in with a smaller and lesser capable supply base, impacting the effectiveness of SD efforts (e.g., Lawson *et al.*, 2015). On the other hand, when highly capable suppliers are available, they often are large companies that are typically uninterested in low volume business and unwilling to engage and invest in collaborative joint undertakings (e.g., Lawson *et al.*, 2015; Kim *et al.*, 2015). Moreover, these large suppliers tend to exploit their bargaining power to demand relatively higher prices for their contributions (Mahapatra *et al.*, 2010).

### *2.3 Dynamics of relationship commitment in SD efforts*

Successful SD activities are mutually beneficial for both buyers and the suppliers (Krause *et al.*, 2007; Modi and Mabert, 2007; Wagner, 2010). In general, competent buyer-led SD efforts improve a supplier's capabilities and performance leading to benefits for the buying firm as well. These benefits are more pronounced when, there is high resource interdependence (Dyer *et al.,* 2018), both the buyer and supplier possess expertise and a willingness to participate and reciprocate in joint exploration of possibilities (Kim *et al.*, 2015) and invest in relation specific assets and develop knowledge sharing

routines (Dyer *et al.,* 2018), and the exchange relationship continues for a long time (Krause *et al.*, 2007, Joshi, 2009; Glavee-Geo, 2019). In effect, commitment by both buying and supplier firms is an important factor for embracing deeper SD efforts, and buyer-driven SD itself is expected to enhance the supplier's commitment (Ghijsen *et al.*, 2010) facilitating continuity in the relationship.

However, there are situations where the assumed "virtuous dynamics" in SD efforts do not hold true. Factors such as opportunistic behavior (e.g., Lawson *et al.*, 2015), low levels of resource interdependence, value creation potential and complementary resources (Dyer *et al.,* 2018) by a partner, and insufficient relational capital (Blonska *et al.*, 2013; Tran *et al.*, 2021) can hinder the benefits of SD efforts. Thus, in technology-based luxury supply-chain contexts, the interrelationships among SD efforts, supplier capabilities and relationship commitment may deviate from the conventionally assumed positive association among these factors.

### *2.4 Paradox perspective and SD product/process development contexts*

In the context of buyer-supplier dyads, supplier development and engagement for product/process innovations may present conflicting situations such as cooperation/competition and incongruent goals, values, actions, and capabilities – leading to strategic, operational and behavioral contradictions (Niesten and Stefan, 2019). While the contradictions may seem logical in isolation, they become irrational and conflicting when they occur simultaneously. Understanding and managing the dynamics of these contradictions can be challenging. The paradox perspective, referring to "persistent contradictions between interdependent elements" (Poole and Van de Ven, 1989; Lewis, 2000) offers an opportunity to make sense of these contradictory phenomena.

We review the key themes of paradox perspective that help us interpret the theoretically contradictory observations in our study of dyadic SD processes (e.g., Poole and van de Ven, 1989; Lewis, 2000; Lado *et al.*, 2006; Jay, 2013; Niesten and Stefan, 2019). Specifically, we refer to the "value co-creation" and "value capture/appropriation" themes that we find relevant to the buyer-driven supplier development contexts considered in this study.

It is important to recognize the tensions that arise due to the paradoxical contradictions in dynamic business environments. Existing literature (e.g., Poole and Van De Ven, 1989; Lewis, 2000; Lado *et al.*, 2006; Jay, 2013) suggests identifying the plausible causes of these tensions, and adopting approaches to address them effectively. Lewis (2000) discusses the application of paradox framework to understand the tensions across four contexts – the belongingness of organizational units, learning, organizational processes, and performance.

Value co-creation and value capture/appropriation represent contradictory yet interrelated actions for buyers and suppliers seeking competitive advantage (Niesten and Stefan, 2019). In buyer-supplier dyads, various alternatives exist, such as: arm's length/relational control and coordination (Brito and Miguel, 2017; Dyer *et al.,* 2018), cooperation/competition (Griffith *et al.*, 2006; Wilhem and Sydow, 2018), exploratory/exploitative innovation (Gualandris *et al.*, 2018; Kocabasoglu-Hillmer *et al.*, 2019), and investments in general/relation specific assets (Niesten and Stefan, 2019). However, emphasizing exclusively any one of these alternatives can lead to risks of dysfunctional performance outcomes. Simultaneous applying opposing alternatives may result in persistent contradictions and tensions due to their interrelatedness (Das and Teng, 2000; Smith and Lewis, 2011). Yet, balancing the contradictory alternatives while viewing them as complementary could maintain tensions constructively to create the virtuous value co-creation and value capture/appropriation dynamic, and alleviate negative outcomes of tensions (Niesten and Stefan, 2019). This virtuous cycle necessitates the dynamic capabilities to deal with tensions constructively to promote collaborative value co-creation while ensuring private as well as common gains through the necessary value appropriation mechanism (Wilhem and Sydow, 2018; Niesten and Stefan, 2019). The gains could include acquisition of skills from the partner during the joint value creation. Failure to balance the value co-creation and value capture poles could exacerbate the tension leading to a vicious cycle of opportunistic appropriation of resources, unintentional spillovers of resources by a partner, and missed opportunities for sustained value co-creation in the relationship (Lado *et al.*, 2008; Dyer *et*

*al.*, 2018; Niesten and Stefan, 2019). Ultimately this may result in termination of the relationship (Dyer *et al.,* 2018).

Niesten and Stefan (2019) identify three factors that make the tensions salient in the value co-creation and capture dynamic – plurality in partners' perspectives leading to goal, value and action incongruence (e.g., unfamiliarity of partners, attitude towards coopetition); scarcity of resources leading to capability mismatch (e.g., young/old and small/large partners, lack of knowledge/experience, tangible/intangible capabilities); and contextual changes (e.g., changes in technology, evolving strategic priorities). They also categorize factors contributing to both the vicious and virtuous cycles. Factors contributing to the virtuous cycle include: fair coordination/control mechanisms to facilitate investments in complementary assets and price (re)negotiation, mechanisms for open communication, developmental engagement, absorptive capacity creation, and mechanisms for the equitable appropriation of gains. Factors contributing to the vicious cycle include: myopic perspectives towards the potential of value co-creation through sustained learning, inadequate conflict resolution mechanisms, and opportunistic value misappropriation.

We utilized these perspectives while investigating the causes and consequences of tensions and contradictions in the SD dynamics observed in the empirical data. Our theoretical framework demonstrates how adopting a paradox lens can explain the capability development and leveraging dynamics in the context of product/process development within buyer-supplier dyads.

## 3 Methodology and Research Design

In our investigation, we sought to understand the interrelatedness of supplier development efforts, supplier capability, and relationship commitment within the context of technology-based luxury products. Specifically, we focused on understanding the dynamics that unfold in buyer-supplier interactions. In technology-based luxury product SD efforts, we noted a confluence of three contextual factors – small volumes, challenging targets (such as demanding engineering innovations or excellent quality), and time and resource constraints relative to those targets. To our knowledge, theoretical frameworks addressing these contextual factors have not been developed yet.

To address our research objectives, we employed a case research methodology (Eisenhardt and Graebner, 2007; Edmondson and McManus, 2007). Case studies offer a valuable approach for delving into the underlying reasons and processes, capturing fine-grained details, and exploring the strategic motivations and choices made by the involved actors (Gioia *et al.*, 2013; Yin, 2014; Gehman *et al.*, 2017). By adopting this methodology, we aimed to gain a comprehensive understanding of the dynamics and complexities inherent in the buyer-supplier interactions, particularly with technology-based luxury products.

### *3.1 Selection of cases*

Our research design employed a multiple case approach, utilizing a replication logic. Each case is first analyzed individually to identify emergent themes, and subsequently, these themes are compared across cases for analytic generalization (Eisenhardt, 1989; Gehman *et al.*, 2017). We had the opportunity to access two of the world's most prominent technology-based luxury automotive firms, which we refer to as *Supreme* and *Ultimate*[1]; both are headquartered in Italy. Supreme is a leading luxury brand in the motorcycle industry. Ultimate is a famous supercar company whose brand is synonymous with radical designs and performance. In both industries, these firms extensively rely on their suppliers' capabilities for complex sub-systems that contribute directly to the product performance, innovation, and quality excellence.

Both focal firms target niche segments with relatively low production volumes. At each firm, we conducted a small workshop with managers and buyers to identify and select three strategically important outsourced components. We selected embedded cases (Eisenhardt, 1989) where the focal firm had engaged in significant supplier development efforts to help their suppliers achieve challenging targets, in terms of technical performance or process quality. For the high-end motorcycle company, Supreme, we examined the cases of wheel rims, frames, and radiators. For the supercar company, Ultimate, we centered our investigation on one of its top-of-the-range car model,

[1] All company names, including those of suppliers, are anonymized for confidentiality reasons.

specifically studying the cases of gearbox, stop-start system, and suspension. In both sets of embedded cases, we adopted a dyadic research design to capture the perceptions and interpretations of the actors on both sides of the buyer-supplier relationship (Gioia and Thomas, 1996).

### *3.2 Data collection*

Our data was collected through several rounds of diachronic semi-structured interviews conducted between 2012 and 2017, involving various informants. The first phase of data collection took place from 2012 to 2014 with interviews at the focal firms and the selected suppliers. The second phase occurred in 2016 and 2017 when we conducted several follow-up interviews with the case firms to understand the evolution of the relationships. The interviews for each buyer-supplier dyad began soon after the confirmation of successful innovation and beginning of commercial production but early enough in the relationship to mitigate retrospection bias. We interviewed engineers, R&D and quality managers, buyers and the purchasing director from the focal firms. We aimed to understand what their intentions or visions for the components had been, what technical challenges they had faced, how they had found and selected the supplier, what SD activities had taken place (issues, people involved, resources mobilized, dates, duration, solutions, and outcomes), and how the relationship had evolved over the years (see Appendix 1 for the interview protocol). To ensure a comprehensive understanding, we also interviewed engineers, managers or CEOs of the selected suppliers across several countries to gather their perspectives on the same dimensions. Our approach of conducting dyadic interviews with multiple informants from both sides enabled the triangulation of evidence (Jick, 1979) and a deeper understanding of the perceptions and intentions of both firms over time.

In total, we conducted 74 face-to-face interviews with 45 informants, as shown in Table 1. For the Supreme case, we conducted 18 interviews with 8 informants from the focal firm, and 17 interviews with 13 informants from the suppliers of the selected components. For the Ultimate case, we conducted 20 interviews with 9 informants from the focal firm, and 19 interviews with 15 informants from the suppliers. On average, the interviews lasted for one hour and were audio recorded and transcribed. Additionally, we visited the factories and company offices, allowing us to complement

interview data with observational notes. We also utilized secondary data such as company reports and presentations to enrich our understanding.

*(Insert Table 1 about here)*

### *3.3 Analysis method*

To ensure accuracy, we shared the transcripts of each case with the main informants for their review and validation. All primary and secondary data was uploaded into QSR NVivo for data management. The first two authors then proceeded to open coding (Strauss and Corbin, 1998) and independently analyzed all transcripts to identify descriptive first-order codes (e.g., residency, visits, technology choice, process improvements). The first two authors conducted several abductive meetings to collaboratively interpret their respective first-order codes in relation to existing literatures (Mantere and Ketokivi, 2013; Sætre and Van de Ven, 2021). This led to the identification of second-order prior constructs (e.g., learning, capabilities) that explain the interaction dynamics in the buyer-supplier dyads (see Table 2). Importantly, instead of introducing new theoretical constructs, the focus was on capturing the relationships among preexisting theoretical constructs (Gioia *et al.*, 2013).

Following the completion of data collection and coding, the third author thoroughly read all the transcripts, verified the coding, validated the relevance of constructs, constructively challenged the emergent theory-building, and refined the analysis (Mantere and Ketokivi, 2013). We used causal loop diagrams to delineate the recursive aspects observed in the buyer-supplier interactions towards developing a process model of supplier development dynamics. This approach ensures that the proposed process model provides consistent endogenous explanations (see Repenning and Sterman, 2002; Dattée *et al.*, 2022). For instance, our analysis began with the construct of challenging targets which characterize technology-based luxury firms. The empirical data clearly demonstrate that these challenging targets, combined with very low volumes, limit the pool of capable and willing suppliers. Difficult targets, relative to the supplier's capabilities, determine the extent of the supplier's capability gap and the required developmental efforts. By exploring these relationships, we identified additional

constructs and inter-construct relationships. In the causal loop diagram, constructs are expressed with a clear intuitive direction from low to high (e.g., difficulty of targets, volumes, intensity).

Throughout the analysis, we rigorously discussed the evidence from the cases to determine the directionality and polarity (i.e., positivity/negativity) in each relationship. When the effect changes in the same direction as the cause, the relationship is positive; otherwise, it is negative. An example of a negative relationship in our data is when the supplier's capabilities increase, the gap in the supplier's capabilities decreases (all else being equal). The recursive relationships create feedback loops that either reinforce the dynamics or balance the process towards a stabilized state. The analysis continued until all three authors reached a consensus on a set of causal relationships that constituted a parsimonious and generalizable model (see Figure 3) to explain the supplier development dynamics between a focal firm and a supplier (Gioia *et al.*, 2013).

## 4 Within Case Analysis

In this section, we present the empirical evidence of the evolution of SD efforts and the dynamics of the relationships within each of the six dyads. We begin by analyzing the motorbike dyads, followed by the car dyads. To ensure consistency, we adopt a common structure for each dyad, highlighting the challenges faced by the focal firm in finding a capable and willing supplier. We then describe the SD activities undertaken to enhance value co-creation by helping the supplier to improve its capabilities and achieve the challenging targets. We provide insights into the learning process experienced by both the supplier and the buyer throughout their engagement. Subsequently, we delve into how both the supplier and the focal firm leveraged the newly acquired capabilities during their relationships to increase their value capture. Finally, we elucidate the evolution of the relationship over time (see Table 3) to provide a comprehensive understanding of the dynamics at play.

### *4.1 Case 1: Supreme – Kenni: Wheel rims*

The alloy wheel rim is a critical component for a high-end motorbike, impacting both safety and style. However, Supreme's continuous search for novel and cutting-edge wheel designs poses significant challenges (e.g., need for frequent and rigorous stress tests) to ensuring the technical feasibility.

Furthermore, Supreme sets stringent aesthetic targets that expose the supplier to high rejection and penalty risks.

Previously, Supreme sourced wheel rims from a renowned yet expensive European manufacturer (Calipro). To alleviate the economic stress, Supreme intensely scouted the Asian supply markets and could only identify Kenni as a potential alternative source for the cast alloy wheel, offering a more cost-effective solution suitable for their entry and mid-level series. Since Kenni was already supplying some Japanese motorbike OEMs, there was enough assurance regarding its technical competencies that Supreme was willing to commit to the relationship. However, Kenni was not familiar with the stylish features expected by Western clients, and none of its products had ever reached the aesthetic level expected by Supreme. Kenni's quality director expressed initial concerns but saw an opportunity for learning and improvement:

> *"When I first saw their targets on aesthetic defects, I was impressed and shared my worries with the business unit (BU) manager. Eventually, we decided it was worth trying. After all, we never had serious issues on cosmetic quality with any of our customers, and we saw also an opportunity to learn and improve."*

After helping Kenni apply the correct homologation standards, Supreme started requesting more innovative designs. However, Kenni did not have the capability for translating the vision of Supreme's designers into appropriate technical elements. The global sourcing buyer observed:

> *"The situation was critical. Kenni repeatedly rejected the technical feasibility of our proposals – thus exasperating our R&D Department. I proposed to include a young engineer in our R&D team. He had previously worked for a company that used the aluminum gravity die casting, the same process that Kenni uses. I thought he could help in rapidly identifying the main criticalities of our proposals to understand our design needs better. Meanwhile, I asked Kenni additional simulation experiments to analyze a broader range of solutions. Both teams worked like crazy for almost three months, and they finally came to a very satisfying solution."*

Nevertheless, the stringent aesthetic targets led to the rejection of half of the first shipment. To close the supplier's capability gap, a joint meeting was urgently set up at Supreme's HQ. Kenni realized it had misinterpreted some of Supreme's quality criteria. Supreme conducted four quality audits of Kenni's production and painting processes. This revealed several subtle imperfections (e.g., excessive dust concentration, insufficient surface cleaning after sandblasting, inaccurate handling

creating microfractures). The two companies conducted joint quality controls to reach a common definition of defects and Kenni submitted a recovery plan with a detailed list of corrective actions. Kenni also agreed to share the broad cost-breakup structure, while Supreme entrusted them with even more complex designs (e.g., bi-color wheel rims) that helped Kenni promote its own brand.

Despite the successful collaboration, Kenni faced increased price pressure and was not chosen for higher-margin premium products such as forged wheels, which Supreme continued to source from Calipro. Furthermore, Supreme gained the ability to precisely specify its wheel designs, reducing its willingness to commit to Kenni, and instead leveraged this capability to select a less expensive supplier from the Far East. As Supreme's global sourcing manager recalled:

> *"We could never have started with this (low-cost) supplier. Previously, we had no idea of how to conduct the wheel design process. We needed a reasonably competent partner. However, now we can tell the supplier exactly what we want, and if necessary, we can instruct them on how to improve their process."*

Currently, Kenni represents only a marginal share of Supreme's expenses on wheels rims without any new projects in the last two years. However, Kenni acknowledged that the competencies it acquired and the process improvement accomplished with Supreme's help were critical to its superior performance and expanded business opportunities with other customers in the motorbike sector.

### *4.2 Case 2: Supreme – Epik: Frames*

Supreme decided to explore the global sourcing of front and rear frames due to a declining domestic supply base, with a scarcity of reliable suppliers, and the potential to reduce manufacturing cost of this labor-intensive product in low-labor cost countries. Superior quality standards require rigorous accuracy because of the frame's impact on a motorbike's aesthetics, style, and safety. Supreme recognized the risk involved in this decision due to the complexity of this product.

The scouting activities in Eastern Europe and in Asia revealed the difficulties in finding suitable suppliers. The most competent firms showed little interests in the low business volumes of Supreme, while the smaller ones had technical and/or managerial deficiencies. Eventually, Supreme found Epik, a firm in South-East Asia that had experience supplying welded parts to Japanese motorbike OEMs.

Epik could perform all the main tasks (i.e., cutting, bending, welding and painting) in house. However, Supreme's first audit at Epik uncovered a capability gap in quality (e.g., lack of well-standardized control procedures, appearance of welded seams).

Recognizing the need for joint effort, Supreme committed to supplier development efforts to raise Epik's performance to the desired level. Supreme's quality department assisted Epik's quality assurance group, conducting four three-day audits within the first three months. A Supreme quality engineer spent three weeks at Epik's facility to ensure the correct setting-up of the assembly process, and Supreme provided test equipment to verify the quality of the welded seams. Supreme and Epik jointly investigated aesthetic issues in the painting process. They discovered that the sandblasting material used was made of iron (instead of steel) which left small scratches on the frame surface, from which painting defects originated. Epik demonstrated significant commitment towards process improvement activities. It strengthened the training program of its operators, and invested in a welding robot dedicated to Supreme's production. Overall, these intensive SD activities led to substantial supplier performance improvements. As Epik's quality director recalled:

> *"It was a sensational learning experience for us, not only for the operational aspects of the welding work, but also for the entire process management: we learned how to trace and report the process outcomes, when and how certain tests had to be performed, etc."*

Despite these joint efforts and a 3-year contract with annual planned savings, frequent requests for renegotiation arose, and it appeared that Epik's willingness to commit to the relationship with Supreme eroded. Supreme's global sourcing buyer noted:

> *"I had an impression that they felt entitled to a reward for their improvements. After all, the local markets they serve are growing fast; I can imagine they can now find other opportunities."*

When problems arose, they led to conflicts as to which party had to bear the cost of fixing them. Reciprocally, Supreme lost its willingness to commit to the relationship and felt that broadening the pool of potential suppliers was necessary to regain its bargaining power. As Supreme's supplier quality engineer observed, the SD experience with Epik enabled Supreme to restore its own competencies on the welding process, to codify documents and procedures, and to improve its ability

to develop a frame supplier. This enabled Supreme to identify and select a less expensive supplier who was awarded its most recent projects. Supreme also started an in-house frame production unit in one of its Asian plants. On their side, Epik has increased its business with several customers who recognized the impact of Supreme's supplier development activities on the improved quality capability of Epik.

### *4.3 Case 3: Supreme – Xeona: Radiators*

Supreme's engines with smaller displacement are typically air-cooled, while the larger ones require a more sophisticated, water-cooling system. Prior to its global sourcing initiative, Supreme bought both types of radiators from the European subsidiary of a Japanese manufacturer – a reliable supplier, but one unwilling to respond to Supreme's cost reduction requests. Supreme focused its global sourcing on switching to an alternative source for its air-cooled radiators but the initiative encountered challenges. The global sourcing manager recalls scouting for a supplier given the challenging targets:

> *"We thought it would be easy to find a good one. We were wrong. Many of them were supplying to the motor-scooter sector only. After seeing our drawings, they said they would not be able to make it. Others sent us samples that were simply terrible… one was even leaking oil!"*

Xeona, a manufacturer from Southeastern Asia, had experience supplying to motorbike OEMs and responded positively to Supreme's inquiry by delivering a promising but imperfect sample. An initial visit increased Supreme's confidence in Xeona's potential capability, especially because of its in-house tooling production that could expedite prototyping. Nevertheless, further improvements were necessary which Supreme was willing to support, beginning with aesthetics as noted by Supreme's supplier quality engineer:

> *"We had to instill a culture of aesthetic quality for a high-end product. This meant not only to suggest specific improvements to certain process phases (e.g., cleaning), but perhaps more importantly, to raise their attention to details. Lack of care in the product handling was causing surface scratches, which might be irrelevant for motor-scooters, but are not acceptable to us."*

Xeona's quality director described Supreme's SD activities (e.g., suggestions to eliminate the cause of rejections) as a constructive experience for their workforce. Xeona's technical director explained that the unconventional shapes of Supreme's radiators created complications in functional

design and their complex assembly required ad hoc tools. Supreme supported these improvement efforts by conducting road tests that proved useful to the radiator's vibration analysis – a study which Xeona had been carrying out only through simulations previously. The collaboration rapidly increased Supreme's knowledge about radiators. As the global sourcing manager said:

> *"Radiators were not any more the 'black box' they used to be. We grew to the point that we could include several technical specifications in the first drawing release. Then of course they were discussed with Xeona along the product development process."*

Within a few years, Xeona's substantial improvements led it to becoming the first supplier of Supreme's global sourcing project to receive the OEM's "Quality Award[2]". Surprisingly, however, some conflicts emerged soon after, reducing the willingness of both parties to continue committing to the relationship. With the gap in its capabilities reduced, Xeona sought to increase their value capture as reflected in their high-priced quotation for the next project, nearly matching that of the European competitor. Alongside differing views on the cost impacts of external economic factors (e.g., increased labor costs; currency exchange), Xeona's sales manager believed that their *"great effort and enhanced competencies should be more adequately rewarded."*

Supreme also discovered that Xeona had leveraged its Quality Award to increase its value capture outside the relationship by securing its first project with a European luxury car manufacturer. In response to Xeona's high-price quotation, Supreme initiated steps to begin a relationship with another radiator supplier. However, these steps were not fruitful. To circumvent Xeona's price quotation, Supreme proposed an additional allocation of business to Xeona for water radiators (a more complex product) and demanded a reduction in the quotation for the air radiators. Once again, the new project pushed further difficult targets that were both challenging for Xeona and narrowing the pool of suppliers. However, Xeona recognized the opportunity, offered an attractive proposal – both technically and economically – and obtained the water radiator business, whose series production has started to the satisfaction of both parties.

### *4.4 Case 4: Ultimate – Danke: Gearbox*

[2] A prize that Supreme assigns to the three top-performing suppliers of the year.

Ultimate aimed to achieve the industry's shortest gear shifting times, comparable to Formula 1 standards. Given the narrow space in the chassis, these targets required a radical architecture. Ultimate asked five suppliers who all replied that these expectations were unrealistic especially given the low volumes which were almost prototype quantities. When Danke received the difficult targets included in the request, their initial reaction was, "*Okay, it simply cannot be done. They must be mental*." Nonetheless, Danke, originally a gear producer, had just initiated a strategic move towards becoming a system integrator and was eager to collaborate with a renowned brand. Danke was the only supplier to take on the challenge and said, "*Okay, let's try*."

The weight target for the rear differential was demanding, requiring Danke to use aluminum casing for the first time. To meet the shifting time targets and accommodate the available space, Danke had to innovate by machining the hydraulics circuits directly inside the gearbox casing. This configuration of hydraulics was very innovative for the industry and definitely a first for Danke. Leveraging their recent acquisition of a firm specialized in transmission control engineering, Danke had sufficient knowledge about hydraulics and software to develop this radical gearbox with Ultimate. As a manager at Ultimate explained, SD efforts were required to help Danke achieve the difficult targets:

> "*With this project [Danke] said, 'yes, we can do it; we know that it's the first time for us, but we will do it'. This was possible because we have guided them on a lot of points*."

Ultimate invited one of Danke's engineers to reside in their parent company's R&D department to observe testing capabilities where he learned about many failure modes and their corrective actions. Moreover, Danke had to fulfill the other targets that were still outside its reach as a new system integrator. When the production started, Danke faced several issues in achieving the quality and delivery targets. Some leakage problems resulted from incorrect assembly of the gearbox, and a lack of cleanness in Danke's processes led to particles being stuck in the hydraulic channels and blocking the valves. Ultimate provided a lot of input to rectify Danke's design choices and to help them improve their washing process. An Ultimate manager explained,

> "*The first parts coming out from the new supplier aren't perfect, so you need to take into consideration several loops in order to get this high quality and performance*."

A Danke manager recognized that, as a system integrator for the first time, they had "*learning glitches, and problems in stepping into this new league.*" However, as Danke reduced their capabilities gap through SD efforts, they became able to fulfill all the difficult targets and wanted to increase their value capture by sending price-increase requests which a buyer at Ultimate perceived as unjustified and unacceptable. Such supplier's leveraging decreased Ultimate's *willingness to commit* to the relationship. Instead, Ultimate patented the gearbox architecture and used the developed specifications to broaden its sourcing by looking for other suppliers for its future projects.

Danke conducted a "lessons-learned" workshop during which its engineers and managers shared the new knowledge on actuation, software, choice of sealings, machining and modes of failure that was gained from the Ultimate project. They leveraged this experience, including their new ability to manage tier-two automotive suppliers, to increase their value capture outside the relationship by developing a product platform whose architecture derived from this Ultimate project, and which they sell to different clients across segments. The new capabilities have even allowed them to become a tier-one supplier for Ultimate's corporate parent. As a Danke manager stated:

> "*We were 'no-one' back until the late 90s and then we became a key player, a growing player; we want to become an even more dominant player in that sector*."

### *4.5 Case 5: Ultimate – Readim: Stop-start system*

To reduce CO2 emissions of their supercars, Ultimate needed a stop-start system. However, the required amount of electrical energy would necessitate an enormous battery whose size and weight would defeat all the other innovations introduced to reduce mass (e.g., carbon fiber chassis, aluminum suspensions). Ultimate engineers contacted Readim, a small company specialized in power electronics, with an innovative idea: combine a smaller battery for normal electrical functions with supercapacitors for the stop-start solution, a first in the automotive industry. Although Readim had the expertise in power electronics knowledge to specify the solution's architecture including a high-power relay normally used in railway applications, they lacked the capabilities to become an automotive supplier. Nonetheless, Ultimate was willing to help Readim achieve the challenging targets, and Readim was eager to collaborate on this radical innovation. Readim sent one of their best

engineers to reside in Ultimate's R&D center for one year. Intensive knowledge exchange occurred between Ultimate and Readim to understand how a supercapacitor must work in a car.

Since there were no existing specifications for such a supercapacitor solution, Ultimate and Readim began by referring to existing automotive norms for electrical and electronics components regarding position, safety, temperature limits, and waterproof protection. The collaboration then focused on understanding the parameters' range within which the system should operate in terms of voltage, capacitance, load balancing, maximum charge, weight, communications with the ECU, and power controls. These mutual efforts led to two sets of specifications: one set of specifications about how to integrate a supercapacitor in an automotive environment, and another about stop-and-start solutions. After extensive testing, the solution was ready for production. However, Ultimate realized that the gap in Readim's supply chain capabilities was too large to select them as tier-one supplier. As Readim's CEO clarified, the small company did not have any ISO certification to compete in the automotive world:

> "*We were hoping at that time to have at least part of the production, but at a certain point we realized that there was no way; we were not qualified.*"

Ultimate leveraged the specifications co-developed with Readim to broaden their sourcing of the stop-start system from an existing tier-one supplier (who sourced the supercapacitors from Readim). Although Ultimate did not continue the relationship with Readim in the production phase, they had absorbed significant knowledge on using supercapacitors in automotive applications from its engagement with Readim. An Ultimate engineer explained that based on this new knowledge, they pushed further the envelope of what could be achieved with this technology and engaged once again with Readim on other projects, including a solution to cold start the engine in its racing cars series:

> "*Now, we know from the technical point of view what we can expect from these supercapacitors. Now we have another project with Readim, a completely different project with a supercapacitor.*"

From the perspective of Readim's CEO, the new capabilities acquired during the project allowed them to expand their business outside the relationship. As Readim's CEO explained:

"*Readim learned how our supercapacitor must talk to the car and Ultimate learned how to talk to a supercapacitor. Our know-how in terms of how to use a supercapacitor in an automotive world has grown a lot through the interaction with Ultimate.*"

Learning from their unsuccessful bid during the sourcing stage, Readim invested in achieving an ISO 9001 certification of its production process. To increase their value capture outside the relationship, they leveraged the development project to invest in their internal test lab, to offer consulting services to other clients, and to develop under their own brand a family of energy-storage products. Now they propose their supercapacitor solutions to clients across markets, including other high-end automotive OEMs, as well as commercial vehicles and buses.

### *4.6 Case 6: Ultimate – Lishus: Suspension*

According to its powertrain R&D manager, Ultimate's goal was to achieve "*something completely over the limit of the technology, at the frontline of what was possible at the time.*" Suspension was one of the most important areas of development to offer the best vehicle dynamics ever for the brand. The radical innovation was to introduce a specific configuration, normally used solely in racing cars, for the first time in a series production model. Moreover, to fulfill its overall target of mass reduction, Ultimate wanted this suspension, including the dampers, to be completely made of aluminum – a solution not readily available in the market.

Lishus, a renowned suspension brand in the racing world and motorcycle industry, was the only potential supplier with a complete aluminum damper. However, Lishus was a relatively small company and had never realized a series production project for an automotive manufacturer. Nonetheless, Ultimate "*saw a really big potential in Lishus*" and was willing to commit to supplier development efforts to help Lishus close the gap in their capabilities. While Lishus had technically exceptional products for racing applications, they did not have the broader understanding of what performance means for a series production. After Ultimate conducted endurance and fatigue tests of Lishus' initial solution, Ultimate helped them to understand the difficult targets in terms of comfort, temperature range, safety and the meaning of reliability. Ultimate gave to Lishus "*all their knowledge in terms of processes, validation, and quality*", provided access to its corporate parent's R&D lab to

run corrosion tests, and guided Lishus in changing surface treatments and machining of parts to avoid critical issues. Ultimate provided Lishus with access to one of its suppliers' acoustic chambers to identify the source of noise defects and suggested innovative components. Lishus built a dedicated production line for Ultimate but was not ISO TS certified yet. They remained as a tier-two supplier under the system responsibility of another tier-one supplier. As an Ultimate manager explained:

> "*[employees] were sent as residents in [Lishus] factory to improve the process, keep some parameters under control, improve the way of thinking, from the design up to the manufacturing and shipping of components to avoid damage; we worked a lot to transfer that vision.*"

Lishus allocated resources for these improvement efforts by involving a project group of about 15 people for three years and had to learn extensive automotive norms. A Lishus manager commented:

> "*Because the volumes are not that high, the amount of money we had to spend to qualify this product is much more than we ever will regain*."

Ultimate retains the intellectual property of the suspension drawings and reused the suspension concepts in other projects. After achieving its ISO TS certification, Lishus obtained the tier-one status after successful audits by Ultimate and its corporate parent. Nevertheless, new active electromechanical components were becoming more prevalent and required novel competencies. For later car models, Ultimate decided to drop Lishus for another supplier with proven capabilities in active suspension – a decision which a Lishus director felt was "*a little nasty*."

Nevertheless, Lishus leveraged the improvements made during the collaboration to develop new businesses opportunities with other automotive clients. They had gained access to new components, and had learned how to comply with new standards, to conduct new types of tests, to revisit design choices, and to reinterpret their understanding of performance in terms of reliability and durability targets. Having achieved its ISO TS certification also helped Lishus increase its value capture outside the relationship by gaining new business with its clients from the motorcycle industry. Their work with Ultimate had been very visible and propelled their growth. As a Lishus manager explained,

> "*The big boom has started since then, because, suddenly when you are in the market with [Ultimate]'s experience, people will realize that and very soon others will call and say, 'hey, can we do something?'…"*

## 5 Cross-case analysis

In this section, we present a comprehensive analysis of the key relationships identified through the empirical findings across the six buyer-supplier dyads. We propose a process model that captures the paradox of supplier development dynamics in technology-based luxury product contexts.

### *5.1 Supply chain challenges of technology-based luxury firms*

Technology-based luxury firms, such as Supreme and Ultimate, differentiate themselves by pushing the technological envelope and by incorporating radical innovations within their product architecture and operational processes. These firms operate in the premium luxury segment, which imposes exceptionally high expectations of quality from their customers. As a result, these firms face three significant challenges in their supply chain.

First, they encounter difficulties in finding capable and resourceful suppliers who can co-develop innovative solutions and meet the demanding performance targets. Second, even if capable suppliers are available, they are often large firms that may not find it operationally compatible or financially viable to engage in co-development of premium products targeted at small market segments. Third, despite the focal firms' high technical competence, the unique nature of product and/or process development restricts their ability to formalize specifications, identify and qualify suppliers, and manage the undeveloped supply base. Consequently, the combination of more *difficult targets*, lower *volumes*, and lower *buyer's capability* in sourcing reduces the *size of the suppliers pool*.

Furthermore, even when the focal firm selects a reasonably competent supplier based on technical expertise, the supplier may lack several other necessary capabilities for commercial production. For example, the supplier may not know the norms or the product architecture of the focal firm or lack experience with the level of difficulty that the focal firm expects. Hence, the selected supplier will have a *capability gap*.

### *5.2 Supplier Learning Loop*

Nonetheless, the focal firm perceives potential for value co-creation with the selected supplier. The limited *size of the suppliers pool* and its need to achieve the difficult targets increase the focal firm's *willingness to commit* to the relationship to help close the *supplier's capabilities gap*. In turn, the

selected supplier is motivated to commit to the relationship due to the strategic prospect of working with the reputable focal firm. At the onset of the relationship, both parties invest resources, time, and efforts which increase the *intensity of supplier development* efforts to reduce the *supplier's capabilities gap*. They allocate people, exchange information, invest in transaction-specific assets, and share knowledge. Close collaboration, including repeated visits to the suppliers or residency at the focal firm, facilitate mutual understanding and problem-solving during the development or industrialization phases. These supplier development efforts enable value co-creation.

By committing resources, time and efforts to the relationship, the supplier progresses along a learning curve under the guidance of the focal firm and acquires new capabilities. For example, all the suppliers in our cases improved their technological performance, process quality or supply chain capabilities. Some invested in new equipment that improved their production lines; others learned new industry norms or gained knowledge about novel applications in an industry that they had never served. Such *supplier's learning*, gained through the supplier development efforts of the focal firm, increases the *suppliers' capabilities*. As the supplier's capabilities increase, the *supplier's capabilities gap* (relative to the level required for achieving the targets) reduces, less developmental efforts are required and the *intensity of supplier development* decreases. This "Supplier Learning" is illustrated as a feedback loop in Figure 1.

*(Insert Figure 1 about here)*

### *5.3 Supplier's Leveraging Loop*

However, the changes in value creation enabled through supplier development activities simultaneously create conditions for change in value capture between the supplier and the focal firm. The suppliers' newly acquired capabilities, gained through the supplier learning loop, allow them to reduce their capability gap relative to the level of difficulty of the targets. As the *supplier's capability gap* is reduced through supplier development activities, value co-creation increases within the buyer-supplier relationship. However, the SD efforts simultaneously create the conditions for changes in value capture by the supplier. Their recent improvements and higher capabilities may motivate them

to increase their value capture: either within the relationship by renegotiating their terms with the focal firms for better incentives and rents, or outside the relationship by developing business opportunities with new clients. For example, Epik, Xeona, and Danke had sufficiently closed their capabilities gap to achieve the required difficult targets and asserted that their efforts should be rewarded through price increases. Suppliers such as Kenni, Readim, and Lishus leveraged their improved processes, higher quality, new knowledge and enhanced visibility due to working with the focal firms either to improve their value propositions and gain new clients, or to develop their own product families and diversify into new market applications. They leveraged these new capabilities, acquired through value co-creation with the buyer, for the benefits of other clients and increased their value capture outside of the relationship. Thus, our empirical findings demonstrate that, as the *supplier's capability gap* decreases, the suppliers' *willingness to commit* to the relationship with the focal firm significantly decreases. A decreasing *willingness to commit* also reduces the *intensity of the supplier development efforts*, hence the opportunities to learn further from the focal firm as portrayed in the balancing loop ("Supplier Leveraging") in Figure 1.

### *5.4 Focal Firm's Leveraging Loops*

While the commitment to supplier development activities for selected suppliers close the supplier capabilities gaps, the focal firm also gains knowledge about these suppliers' fields of expertise. These newly acquired *buyer's capabilities* create three options for the focal firm: pushing further, internalizing, or broadening their sourcing with new suppliers.

First, the focal firm may choose to push further on the technological trajectory. For instance, Ultimate gained significant competencies in supercapacitors through its relationship with Readim and was then able to imagine new automotive applications, which they continued to pursue with Readim. Similarly, Supreme engineers learned with Kenni about a domain (feasibility of wheel designs) for which they had so far been dependent on their previous supplier, and were then able to develop even more complex designs with Kenni. By pushing the technological boundaries further with even more difficult targets, the pool of potential suppliers remains small, and the supplier faces a new capability

gap; both of which create an incentive for the buyer and supplier firms to pursue their commitment to the existing relationship. Figure 2 illustrates this reinforcing loop ("Pushing") whereby the supplier development activities may lead to further willingness by both firms to commit to their engagement on a technological trajectory. However, as the Lishus case illustrates, if the focal firm does not consider the same supplier to be capable enough in a disruptive technological domain then the focal firm may have to restart its sourcing process to find a new supplier.

Second, the focal firm may have developed sufficient capabilities to internalize the innovation and manufacturing activities. If the focal firm can achieve the difficult targets by itself, this reduces its dependency on the selected supplier and its commitment to the relationship. For example, after several projects with Readim, Ultimate had gained sufficient competencies in automotive applications of supercapacitors to develop a radically novel powertrain architecture on its own. Similarly, Supreme internalized part of the frame production in one of its factories. These interactions create a balancing feedback loop ("Internalizing"), as shown in Figure 2, whereby the *buyer's learning* increases its capabilities which reduces its *willingness to commit* over time and the fading away of its supplier development efforts.

Third, the knowledge acquired by the focal firm from the relationship may enhance its sourcing capability. For instance, Supreme, having restored its competencies in welding, was able to clarify its sourcing specifications and could better evaluate and develop other frame suppliers. They eventually changed the supplier. Similarly, Ultimate used the specifications co-developed with Readim to source the radical innovation from another supplier. The improved sourcing capability may also extend to a better understanding of foreign markets and more effective global sourcing to identify new potential suppliers, as the Supreme cases illustrate. The confidence gained from its supplier development activities allowed Supreme to source from new countries that they could not have successfully accessed previously. The improvements in the buyer's capabilities, both in terms of specifications and sourcing, increases the *size of the suppliers pool*. The availability of new suppliers in turn reduces

the focal firm's *willingness to commit* resources and the *intensity of supplier development* efforts with the previous supplier. This balancing feedback loop ("Broadening") is indicated in Figure 2.

Thus, the focal firm can leverage the acquired capabilities either to pursue further value co-creation by "Pushing" the technological boundaries with the supplier; or to pursue further value capture by "Internalizing" or by "Broadening" the size of its suppliers pool. Interestingly, these are not mutually exclusive when considered from a longitudinal perspective. For instance, Ultimate started by using the specifications co-developed with Readim to source from another supplier, but then pursued further projects with Readim for innovative applications. Over time, Ultimate has acquired sufficient capabilities to internalize its development of supercapacitor applications.

*(Insert Figure 2 about here)*

## 6 Discussion

Our research provides a nuanced understanding of the interplay among relationship commitment, SD efforts, and capability improvement in the context of innovative, technology-based luxury firms. Existing literature has predominantly portrayed SD as a buyer-driven, long-term endeavor aimed at enhancing suppliers' technical capabilities and performance (Krause *et al.*, 2007). It is commonly assumed that improvements in supplier capability will yield favorable results for the buyer (Wagner, 2010; Mahapatra *et al.*, 2012). Relationship commitment is typically assumed to be a precursor to supplier development efforts, as it protects the relation-specific investments made by the partners (Li *et al.*, 2012; Humphreys *et al.*, 2004), and decreases supplier management costs over time due to the improved understanding and interfirm coordination (Krause *et al.*, 2007).

Past studies explain the discontinuation of SD activities as a result of the supplier's inability or unwillingness to develop the new skills or implement improvements (Blonska *et al.*, 2013; Nagati and Rebolledo, 2013). In contrast, our study using the paradox of inter-organizational value co-creation/value capture (Niesten and Stefan, 2019), suggests that relationship commitment and SD efforts can decline even in successful initiatives. When an exchange partner leverages the newly

acquired capabilities solely for its own benefit, the focus on the value capture element of the paradox triggers a vicious cycle (Smith and Lewis, 2011).

In this section, we highlight and discuss our two main theoretical contributions. First, we elaborate on how the proposed process model captures a developing-leveraging paradox inherent in SD activities. Partners engaged in SD activities face a persistent tension between the opposing poles of jointly developing new capabilities and leveraging these newly acquired capabilities for their individual benefits. The value co-creation/value capture aspect of this paradox provides a cogent explanation for the counterintuitive outcome, whereby the buyer-supplier relationship may decline, or even terminate, despite the success of the SD activities in the technology-based luxury contexts. This outcome cannot be explained by extant SD literature, however, a paradox lens provides a useful explanation of such SD dynamics. As suggested by Poole and Van de Ven (1989, p. 565), when anomalies are identified in an object of study, adopting a paradox perspective enables us to locate tensions that could account for these anomalies. Second, our findings refine the SD literature by clarifying how the buyer's learning, which has so far remained unaddressed in this literature, can also influence the SD dynamics and potentially contribute to negative outcomes, often referred to as the "dark side" of collaborative buyer-supplier relationships in the literature (Villena *et al.*, 2011).

### *6.1 The paradox of supplier development*

The empirical evidence from our six cases points to an interesting paradox in buyer-led SD activities, which we describe as a developing-leveraging paradox. This paradox seems particularly salient in technology-based luxury supply chains where specific challenges arise due to low-volume business and technological and engineering complexity. Faced with a small supply base, as well as significant time and resource constraints, the focal firm must assist in enhancing the supplier-based capabilities to meet the difficult targets that its strategic positioning requires. However, SD activities face the inherent value co-creation/value capture tension that occurs in many interorganizational relationships (Niesten and Stefan, 2019; Lavie, 2006).

The two contradictory, but interrelated, processes exert persistent influences with one pole of the paradox creating the necessary conditions for the existence of the other (Poole and Van de Ven, 1989). By helping the supplier close its capabilities gap, the buyer-led SD activities increase the value co-creation generated by the relationship. The buyer firm, lacking alternatives (i.e., due to the small *size of the supplier pool*), allocates resources, may invest in co-specialized assets, and transfers knowledge and competencies to the supplier; thus ensuring an adequate sourcing of the required components or subsystems. Yet, these activities which enable value co-creation simultaneously create the necessary conditions for the existence of the other pole of the paradox (Poole and Van de Ven, 1989) whereby the supplier can then attempt to increase its value capture: either by leveraging their bargaining power within the relationship or by leveraging the newly acquired capabilities, if fungible, for business opportunities outside the relationship. Reciprocally, the supplier may also invest in co-specialized assets and allocate significant resources to the SD activities in order to achieve improvements under the guidance of the buyer. Yet, this engagement simultaneously creates the necessary conditions for the existence of the other pole of the paradox (Poole and Van de Ven, 1989) whereby the buyer can then leverage the capabilities newly acquired through knowledge spillovers to increase its value capture outside the relationship (sourcing from another supplier or internalizing).

This tension inherent in the developing-leveraging paradox identified in SD activities rests on contradictory, but interrelated mechanisms (Niesten and Stefan, 2019). Value co-creation occurs at the interorganizational level and is based on joint value creation mechanisms which call for knowledge-sharing and joint resource deployment. Value capture requires value appropriation mechanisms which generate benefits at the organizational level. Recent studies in the supply chain literature (Kocabasoglu-Hillmer *et al.*, 2023; Zhang *et al.*, 2021) highlight the importance of adopting a paradox lens to reflect the tension between contradictory forces in these interorganizational settings. Consistent with Smith and Lewis (2011), the paradox stems from the divergence in the buyer's and the supplier's strategic perspectives who seek to allocate their efforts and resources differently over time (Maalouf and Gammelgaard, 2016). Our analysis shows that the leveraging (increasing value

capture) by one of the parties cannot occur without prior developing (increasing value co-creation) during the SD activities. At the same time, knowledge spillovers and absorptive learning, upon which SD activities depend by their very nature, create a persistent risk, akin to the paradox of disclosure (Laursen and Salter, 2014), so that the other party may shift its emphasis on value capture.

On one hand, our findings suggest that when the partners choose to continue pushing on a technological trajectory, a virtuous cycle emerges, sustaining this developing:leveraging paradox as the firms pursue their interorganizational arrangements. However, as both firms approach the limits of what is achievable in a particular technological trajectory, the potential for further improvements decreases and diminishing returns may result and lead to a decrease in the willingness to commit, as the Kenni case illustrates. A technological discontinuity (McCutcheon and Stuart, 2000) is another mechanism which may dissipate the virtuous cycle as illustrated by Lishus which did not have the required capabilities in active suspensions. Both factors are consistent with the "value co-creation-value capture" framework proposed by Niesten and Stefan (2019).

On the other hand, focusing on one of the paradox poles leads to vicious cycles (Smith and Lewis, 2011; Lewis and Smith, 2022). In all our empirical cases where either the supplier or the buyer started to leverage the capabilities acquired during the developmental activities, the temporal shift in perspectives (Schad *et al.,* 2016) and the emphasis on increasing value capture led to a detrimental vicious cycle and the decline or termination of the relationship. Indeed, the supplier may leverage the acquired capabilities in an attempt to increase its value capture within the relationship (asking for higher rewards from the buyer) or outside the relationship by switching to more rewarding business alternatives. Moreover, the focal firm can also leverage the new capabilities acquired through absorptive learning (e.g., detailed specifications, sourcing competencies) to either internalize the components or to broaden the pool of potential suppliers. Such leveraging on both sides, reduces the mutual commitment of resources to the relationship and leads to the fading of the engagement despite the success of the SD activities. In effect, a paradox lens explains why commitment to the relationship may decrease over time, despite the realization of SD benefits.

Figure 3 presents the overall process model, grounded in our analysis of empirical data, which reflects this paradox of supplier development.

*(Insert Figure 3 about here)*

### *6.2 Addressing the paradox of supplier development*

Extant paradox literature highlights the importance (and the challenge) of explaining the transitions and shifts between temporal periods during which either side of a paradox may dominate (Poole and Van de Ven, 1989; Lewis and Smith, 2022), and the transition from virtuous to vicious cycles over time (Smith and Lewis, 2011; Niesten and Stefan, 2019). The decline in commitment due to unilateral leveraging of new capabilities after initial commitment to engage in SD activities and building the desired capability is an outcome driven by the developing-leveraging paradox in a buyer-supplier relationship. Consistent with Poole and Van de Ven (1989), we infer two key ways a partner could address this paradoxical tension in the exchange. First, recognize and accept the tension as inevitable and unsolvable: use it constructively. In the SD context, this may imply emphasizing and realizing the benefits of continuously creating higher level, tacit capability through mutual engagement by "pushing" the innovation frontier. Second, distinguish the contexts in which contradictions occur and introduce new approaches to resolve or alleviate the tension. This may imply exploring opportunities to utilize the newly acquired capabilities by switching to alternative customers or suppliers.

Our investigation provides a nuanced understanding of how commitment and SD might play out in different, and possibly counterintuitive, ways. We clarify that SD is unlikely to remain beneficial idefinitely and unconditionally. The conflicting duality in the strategic perspectives of exchange partners influences the value co-creation potential of SD. Our theorization of the relevance of SD efforts in accomplishing cost-effective innovation compares well with Mahapatra *et al.* (2012)'s findings on the usefulness of SD in enhancing supplier capability across different stages of the product life cycle. Their study observed that direct SD activities alone could offer improved supplier capability-based benefits only in the earlier phases of the product life cycle; for SD efforts to provide sustained benefits, mutual (relational) commitment must precede and continue along with the SD

activities for developing increasingly distinctive capabilities. Similar to their finding, we notice (see Figure 3) that commitment to the relationship is likely to continue when both the buyer and supplier find strategic opportunities in continuous advancement of innovation so that a definite, but manageable, capability gap is reintroduced between the two firms.

### *6.3 Accounting for buyer's learning in SD initiatives*

Our investigation reveals that even successful SD activities resulting in improved supplier's technical and quality capabilities can lead to reduced attractiveness and importance of the buyer-supplier relationship, or even to its termination. The paradox lens provides insight into this outcome by considering the role of the *buyer's learning*, an aspect that has been largely neglected in past SD studies. Particularly, the knowledge that the buying firm acquires in this experience is fundamental to efficiently engaging later in another SD initiative with a different vendor – undertaken to reduce the dependence on the previous supplier.

While interacting with their suppliers in the SD activities, the buying companies experience numerous learning opportunities with respect to the suppliers' technologies and processes, their technical issues and deficiencies, and how they can be resolved. Su *et al.* (2018) found that supplier information sharing enhances a buyer's SD efficiency. Our research supports and extends this finding, suggesting that SD can be viewed as a learning process for the buying firm as well, facilitated by supplier information sharing. Therefore, the benefits a buying firm can gain from its SD efforts do not stem only from the increased supplier's performance, but also from the acquisition of new capabilities as well as its ability to learn and engage in new initiatives with other suppliers.

### *6.4 Deeper understanding the dark sides of SD activities*

Our unexpected findings also provide two novel insights on the possible dysfunctional outcomes of collaborative interorganizational efforts such as SD. Past SD studies (Blonska *et al.*, 2013; Kim *et al.*, 2015) reported negative impacts of these activities on buyer's and supplier's performance, which were interpreted as the detrimental effects of "being too close to relationship partners", i.e., as instances of the "dark side" of collaborative buyer-supplier relationships (Villena *et al.*, 2011). The

negative outcomes could stem from supplier's reduced motivation to learn and improve once it feels its business is secured, or from supplier's malfeasance favoured by the lower buyer monitoring in the relationship.

First, differently from these previous studies, our findings suggest that, even in successful SD experiences, another dark side of these activities may lie in the supplier's decision to leverage its improvements, outside the relationship, to do business with other customers, and to reduce its commitment to the relationship with the buyer. Second, while past research exclusively considered the detrimental effects for the buyer, we argue that there is a dark side for the supplier as well. In fact, as shown in our longitudinal analysis, the buyer may also leverage the newly absorbed capabilities to either internalize or broaden its sourcing from another supplier.

## 7 Conclusion, Limitation and Future Research

This study demonstrates how a paradoxical tension between developing (value co-creation) and leveraging (value capture) may emerge in a buyer-supplier relationship for technologically complex luxury products, wherein successful supplier development activities may counterintuitively lead to the decline of the relationship. We recognize that the context of technologically complex luxury goods may have specific characteristics which may limit the generalizability of our findings. Moreover, the complex system architecture of motorbike and automotive products did not allow us to investigate the impact of design modularity on the emergence and management of this paradox.

Our findings point directly to two exciting opportunities for future research. First, to investigate the relative influence of the specific contextual factors, such as low volumes, radical innovation and strong resource constraints to achieve difficult targets, on the supplier development paradox. Second, there are exemplar firms (e.g., Toyota or Honda) that emphasize trust and commitment in their supplier development approach. However, our study suggests that if a focal firm repeatedly reduces its commitment to prolonged supplier development with one supplier in favor of another supplier, then it may appear as a less trustworthy partner with whom to engage. This could potentially lead to another paradox whereby the reputational costs may be offset by the indirect supplier development

benefits in the whole supplier base. Investigating the implications of these issues offers interesting research opportunities.

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## Figures

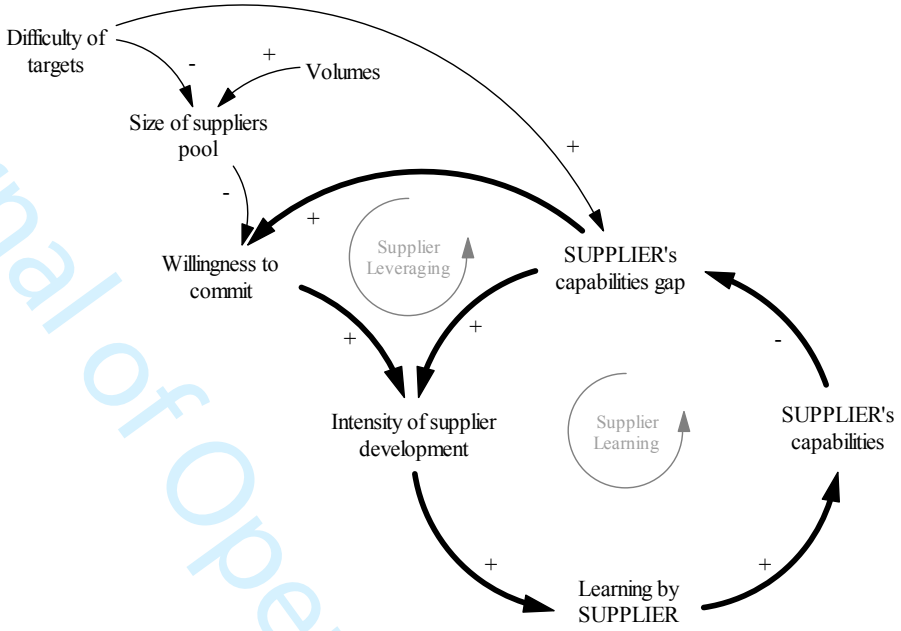


***Figure 1: Supplier's learning and leveraging***

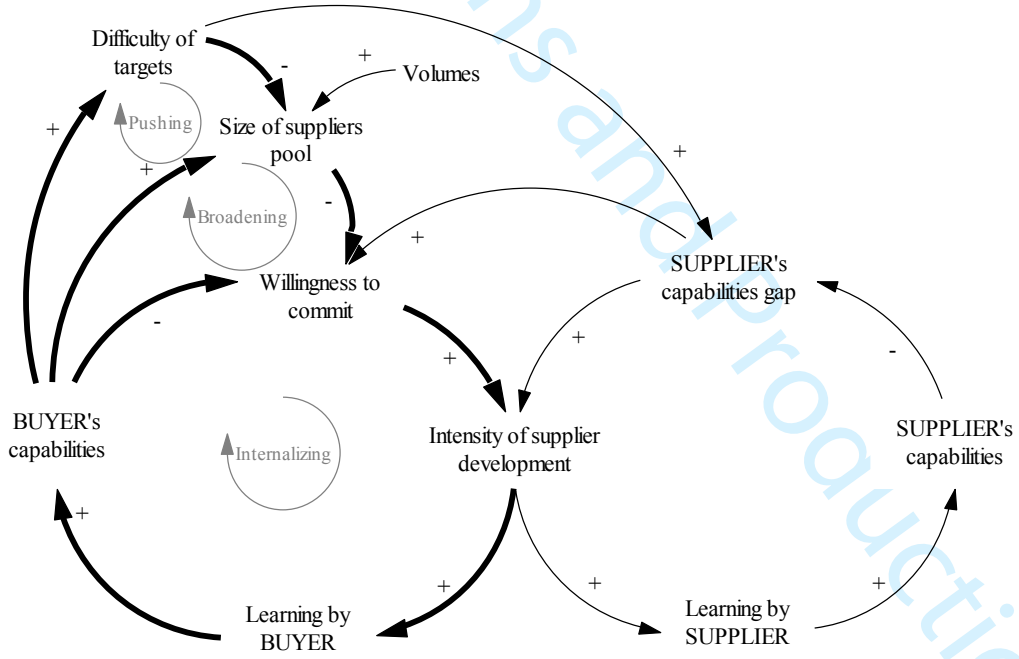


***Figure 2: Focal firm's learning and leveraging***

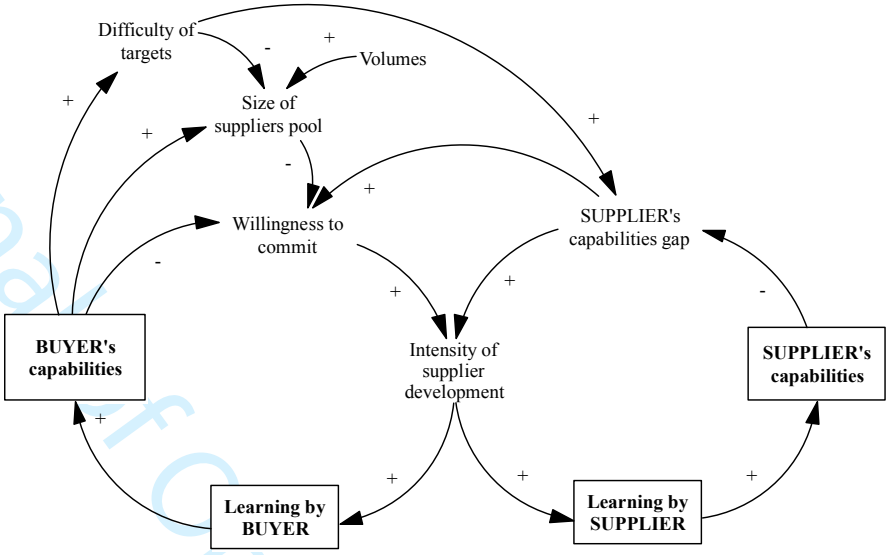


***Figure 3: The paradox of supplier development***

## Table 1: Overview of interviews

| Informant # | Position | SUPREME Functions | | # of interviews 18 |
|---|---|---|---|---|
| 1 | Director | Purchasing | | 2 |
| 2 | Manager | Global Sourcing | | 4 |
| 3 | Buyer | Purchasing | | 2 |
| 4 | Buyer | Purchasing | | 2 |
| 5 | Buyer | Purchasing | | 2 |
| 6 | Engineer | Research and Development, Quality | | 2 |
| 7 | Engineer | Research and Development, Quality | | 2 |
| 8 | Engineer | Research and Development, Quality | | 2 |
| | **Position** | **SUPPLIERS Functions** | **Embedded Cases** | **17** |
| 9 | Director | BU Manager | Kenni - Wheel rims | 1 |
| 10 | Director | Research and Development | Kenni - Wheel rims | 2 |
| 11 | Director | Quality | Kenni - Wheel rims | 1 |
| 12 | Manager | Sales | Kenni - Wheel rims | 2 |
| 13 | Engineer | Research and Development | Kenni - Wheel rims | 1 |
| 14 | Director | BU Manager | Epik - Frames | 1 |
| 15 | Director | Quality | Epik - Frames | 1 |
| 16 | Manager | Sales | Epik - Frames | 2 |
| 17 | Engineer | Research and Development | Epik - Frames | 1 |
| 18 | Director | CEO | Xeona - Radiators | 1 |
| 19 | Director | Research and Development | Xeona - Radiators | 1 |
| 20 | Director | Quality | Xeona - Radiators | 1 |
| 21 | Manager | Sales | Xeona - Radiators | 2 |
| | **Position** | **ULTIMATE Functions** | | **20** |
| 22 | Director | Quality | | 1 |
| 23 | Director | Research and Development | | 2 |
| 24 | Manager | Purchasing | | 3 |
| 25 | Manager | Research and Development | | 1 |
| 26 | Manager | Research and Development | | 2 |
| 27 | Buyer | Purchasing | | 6 |
| 28 | Buyer | Purchasing | | 3 |
| 29 | Engineer | Research and Development | | 1 |
| 30 | Engineer | Research and Development | | 1 |
| | **Position** | **SUPPLIERS Functions** | **Embedded Cases** | **19** |
| 31 | Director | Sales | Readim- Stop-start system | 2 |
| 32 | Manager | Research and Development | Readim- Stop-start system | 1 |
| 33 | Engineer | Research and Development | Readim- Stop-start system | 1 |
| 34 | Director | Research and Development | Readim- Stop-start system | 1 |
| 35 | CEO | CEO | Readim- Stop-start system | 1 |
| 36 | Manager | Sales | Danke - Gearbox | 1 |
| 37 | Director | Vice President | Danke - Gearbox | 1 |
| 38 | Director | Head of BU | Danke - Gearbox | 1 |
| 39 | Engineer | Research and Development | Danke - Gearbox | 1 |
| 40 | Manager | Sales | Lishus - Suspension | 1 |
| 41 | Engineer | Research and Development | Lishus - Suspension | 2 |
| 42 | Manager | Research and Development | Lishus - Suspension | 1 |
| 43 | Manager | Sales | Lishus - Suspension | 2 |
| 44 | Director | Head of BU | Lishus - Suspension | 2 |
| 45 | Engineer | Research and Development | Lishus - Suspension | 1 |
| | | | | **74** |

## Table 2: Theoretical constructs

| CONSTRUCT | QUOTES FROM SUPREME NETWORK | QUOTES FROM ULTIMATE NETWORK |
|---|---|---|
| VOLUMES | "The high-end motorbike is a niche sector. We are one of the main players, and still our volumes are far lower than those of the big motorscooter manufacturers" (Purchasing Director, Supreme) | "The sports car sector is very visible and very, I mean, claim that you do something, that is very helpful because you are learning a lot in the high technology, which can be used across the segment, but it is very challenging for the volumes which tend to be not so many." (Head of BU, Danke) |
| DIFFICULTY of TARGETS | "Differently from most of our customers, Supreme typically chose triangular or trapezoidal shapes instead of the more common rectangular one. This led to complications in both functional design and manufacturing, since these geometries have different heat removal rates, and a more complex assembly. Their fins are not all the same as it happens in the rectangular radiator, and ad hoc tools are required for their assembly" (Tech Director, Xeona) | "The challenges were not about the capability of the supercapacitor to crank the engine, but how can you fit a supercapacitor module into the car. So, the main purpose of [Ultimate] was performance. So the challenge was to find out the fine tuning of these supercapacitors, which is the best cell we're going to use, which is the best one in terms of reliability, performance, weight, which is the configuration, which is the best connection with the battery, with the engine, with the ECU..." (Engineer, Readim) |
| SIZE OF SUPPLIERS POOL | "The frame supply market for high-end motorbike is indeed a small one, also because some major OEMs (which are our competitors) keep their frame production in house" (Purchasing Director, Supreme) | "The main problem is the quantities because for our quantities it's not so easy to find a gearbox supplier which is also in the range of our targets; from a supplier's perspective it's almost proto quantities rather than real series" (Buyer, Ultimate) |
| WILLINGNESS TO COMMIT | "After the first audit, they [i.e., Supreme] presented us a list of the main requests of improvement we had to achieve to start doing business with them. We were aware that if we accepted, it wouldn't have been an easy journey for us. But we found it valuable to try, and they also encouraged us to do so. [Supreme] is a well-renowned company, and working with them could greatly enhance our reputation." (BU Manager, Epik) | "I mean, we're an engineering company, we love [Ultimate], nice, we'll make a good system for them. We were committed at least on a technical level and we really wanted to do this and because the smart thing would have been to say no. [Laughs]. Because the volume is not that big and the amount of money we had to spend to qualify this product is much more than we ever will regain. But it's a nice project and we continued." (BU Manager, Lishus) |
| INTENSITY OF SD | "After the shipment of our first lot, they came to our plant, bringing back both an accepted radiator and some of the rejected items. They clearly illustrated to us the reasons of rejections. It was a quite constructive experience for me and our workforce." (Quality Director, Xeona) | "On the other side you have a very skilled guy which has the capacity to see the solution quickly. Their [Ultimate] knowledge of tansmission was anyway a key point for the project. I would say that the main aspect that I would stress is how quickly we grew up in our knowledge in handling this type of stuff." (Engineer, Danke) |
| SUPPLIER'S CAPABILITIES GAP | "In designing a wheel, finding the appropriate combination of stylish and technical elements is a major challenge. Calipro (i.e., the incumbent European supplier) has been working with us for decades, and it was proficient in developing technical drawings that captured the vision of our designers. Kenni did not have a similar ability." (GS Manager, Supreme) | "This was really the big job for them. They were not really well-trained to work in this way. They have really, really a great quality for the first product but, let's say, they have no experience to keep the performance over the life." (Engineer, Ultimate) |
| LEARNING BY SUPPLIER | "Supreme's range of colors is impressively broad, especially if you think that their overall volumes are not that high. We had to become much more flexible in the painting process to manage this variety. Besides, we had to develop some expedients for certain applications that were new to us, because e.g. the painting of a bi-color rim is different from that of a solid color one" (R&D Engineer, Kenni) | "Of course, the know-how of [Readim] in terms of how using a supercapacitor in an automotive world has grown a lot through my interaction with [Ultimate]". (Product Engineer, Readim) |
| SUPPLIER'S CAPABILITIES | "Probably the most important thing is the ability to handle the braze welding process, which is the apex of the entire procedure [...] The company [Xeona] proved to be quite in control of the procedure." (Buyer, Supreme) | "Sometimes, we are very engineering oriented, so, and we have many people coming up with ideas and they want to test things, we are trigger happy, we spend a lot of money on chasing loose ends sometimes, but sometimes we find something that leads somewhere. Because if you are in the frontline already, of what is possible, I mean, that's where we are." (VP, Lishus) |
| LEARNING BY BUYER | "Much of what we needed, we had learnt it while developing Epik. To give an example: when we started with Epik, we realized we did not even have the technical drawing ready in English. Many of them were also incomplete since the missing details used to be discussed verbally with the domestic supplier." (Supplier Quality Engineer, Supreme) | "I learned a lot, basically, we learned while doing with [Readim] because […] we discovered all these things and now, I'm pretty sure that this will not be the last supercapacitor in [Ultimate], and this experience is also useful. Another thing which for me is a key point: a lot of what we learned is written in software. So, it's how to handle all the safety issues in which we can have problem and how we handle that. And this has generated a lot of software strategies. This software is only in [Ultimate]." (R&D manager, Ultimate) |
| BUYER'S CAPABILITIES | "Our new Far Eastern wheel supplier is not equipped with an internal test lab comparable to that of Kenni. But now we have reached enough competence on the quality and resistance stress tests required, that we can entrust a specialized provider with their performance." (GS Manager, Supreme) | "We need the competences inside, more or less to have an overview of the system. So it's really important at the beginning to try to give the right direction to the supplier, to have management capacity to steer the supplier in the right way." (R&D manager, Ultimate) |

# Table 3: Learning and leveraging

| | Sourcing | Supplier | SUPPLIER's LEARNING | SUPPLIER's LEVERAGING | ILLUSTRATIVE QUOTES |
|---|---|---|---|---|---|
| SUPREME | **Wheels** | Kenni | Learning TUV certificate<br>Painting process quality<br>Bi-Coloured wheel rims<br>Improved handling<br>Scrap specifications<br>Destructive tests<br>Selection of components | Improved quality for other customers<br>Renegotiation of price | *"After that has been settled, they started fighting over economic problems" (Focal firm buyer)*<br><br>*"We know that we are not the cheapest supplier for wheel rims, but I think we have some features that distinguish us from many competitors. Just to cite one, I believe our test lab is among the most advanced a customer can find" (Supplier manager)* |
| | **Frames** | Epik | Improved layout and industrialization<br>Cutting and inspection of class-A welded seams<br>Quality records and procedures, including traceability and conservation of samples<br>Improved handling<br>Scrap specifications | Improved quality for other customers<br>Requests OEM to bear unforeseen costs<br>Frequent request of price increase | *"Their requests for price raises became insistent at some point. Any time they invoked new reasons for that - be it increased labor cost, raw materials, or extra cost for transportation. My impression was they wanted to increase their margin" (Focal firm buyer)* |
| | **Radiators** | Xeona | Understanding of Aesthetics<br>Use air compressor before painting<br>Unconventional shapes (trapezoidal)<br>Learning UNI standards<br>Efficiency of transportation Customized packaging<br>Quality control, leaking test | Won Quality Award<br>Started bargaining<br>They "could show the brand" | *"The only negative thing, if I must choose one, is their change in commercial orientation." (Focal firm buyer)*<br><br>*"They earned something of course in return, they could show the brand, the products and all the processes that they created." (Focal firm quality manager)* |
| ULTIMATE | **Gearbox** | Danke | System integrator role<br>Supply chain capabilities (tier-2 suppliers)<br>Test procedures<br>Failure modes<br>Choice of components<br>Process quality<br>Washing procedure | Renegotiation of price<br>Nominated supplier by Ultimate's corporate parent<br>Developed own product | *"Probably, they had some other reasons to ask us for more money; an increase of money which was not justified." (Focal firm buyer)*<br><br>*"We also want to be more responsible for the whole system and its content" (Supplier manager)* |
| | **Super-capacitor** | Readim | Automotive norms<br>Communication interfaces with ECU<br>Electrical parameters<br>Safety constraints<br>Usage conditions<br>ISO certification | Developped consultancy services<br>Invested in test lab<br>Established own supply chain (with tier-2)<br>Developed own product family<br>Nominated supplier for racing cars | *"So, now we provide both product and service and recently we have been also qualified for production: more blocks to diversify our business." (Supplier manager)*<br><br>*"We started to develop our own range of capacitor that brings all the knowledge that we have developed together with Ultimate." (Supplier CEO)* |
| | **Suspension** | Lishus | Automotive norms<br>Components selection<br>Corrosion tests<br>Accoustic tests<br>Borader understanding of "performance"<br>ISO TS certification | Nominated as tier-1 by Ultimate's corporate parent<br>Access to other automotive OEMs<br>Developed family of aftermarket products | *"We became almost like, 'okay' for making automotive products ... it certainly generated interest all over the world and if we fast forward a little, I mean, we have now in production [names of 3 automotive brands]" (Supplier manager)* |

## Table 3 *(continued)*: Learning and leveraging

| | Sourcing | Supplier | FOCAL FIRM's LEARNING | FOCAL FIRM's LEVERAGING | ILLUSTRATIVE QUOTES |
|---|---|---|---|---|---|
| SUPREME | **Wheels** | Kenni | Knowledge of wheel design<br>Global sourcing capability<br>Test machine to check grip | Increased product complexity<br>Continued price pressure<br>Global sourcing: different supplier | *"Working with them allowed us to gain the right knowledge so that we could move from them to other suppliers." (Focal firm Global Sourcing manager)* |
| SUPREME | **Frames** | Epik | Revamped competencies on welding<br>Quality records improvement and integration<br>Learning of JIS standards<br>Component cost structure<br>Improved technical drawings | Requests that OEM's assistance is considered in component's cost assessments<br>Continued price pressure<br>Global sourcing: different supplier | *"The deep analysis we conducted on the Tubik's welding process, as well as the codification of its operational stages and related documents for quality checks, made the following supplier development experience much quicker and easier" (Focal firm buyer)* |
| SUPREME | **Radiators** | Xeona | Increased knowledge on brazing<br>Address vibration<br>Competitive benchmarks Product specifications<br>Learning JIS standards | Leverage on better cost structure understanding (to object to supplier's increased quotations)<br>Global sourcing: different supplier | *"That global sourcing was instrumental to Supreme, it enabled us to compare ourselves with others and to greatly improve our quality. There weren't any given specifications and they were created ... It forced us to rethink everything a lot of things." (Focal firm Global Sourcing manager)* |
| ULTIMATE | **Gearbox** | Danke | n.a. | Patent of the gearbox architecture<br>Looking to switch supplier for next model | *"We achieved the general layout of the gear box, the hydraulic diagram, the weight estimation, the performance estimation, everything supported by data analysis. Then, there was a second part [...] We were told that there was an enquiry also to other competitors" (Project Manager, Danke)* |
| ULTIMATE | **Super-capacitor** | Readim | Supercapacitor technology<br>Communication interfaces with relay<br>Power electronics controls<br>Load balancing<br>Specifications for start-stop system | Sourcing from another supplier<br>Pursued further projects with Readim<br>Internalized the competencies<br>New powertrain architecture | *"Now, we know, from the technical point of view what we expect from these supercapacitors. Now we have another project with Readim, a completely different project with a supercapacitor" (Focal firm R&D manager)* |
| ULTIMATE | **Suspension** | Lishus | Learned the push-rod configuration<br>Specific constraints on vehicle dynamics<br>Parameters adjustements | Own the IP<br>Used the concept in other projects<br>Changed technological trajectory for active suspension<br>Switched to another supplier for next model | *"We think that Lishus could also develop an active damper according to our targets. But at the moment they are just not really at the level, not for the technology." (Focal firm R&D manager)* |

## Appendix 1 – Interview Protocol (Example – Buyer side)

SECTION 1 – SUPPLY MARKET AND SUPPLIER SELECTION

- How complex is to find a supplier for this component? What are the main aspects of complexity in finding suppliers (e.g., technical and/or managerial deficiencies; lack of production capacity; scarce interest towards your business; etc)?
- Please describe how the sourcing process for this component is typically managed.
- When and how did you start the relationship with supplier …?
- Which factor(s) drove the selection of this supplier? What did you think was particularly valuable in starting this business relationship?
- If you cannot find an adequate supplier, what are usually the reasons?

SECTION 2 – PRODUCT

- How do you decide for a given component or sub-system the extent to which you will be relying on external expertise?
- How do you decide for which components in the system (car) you are going to really push the technological envelope? i.e. how do you decide what will be the next differentiating features?
- How does this component contribute to the overall value/performance of your final product?
- Do you look for distinctive features in this component, that make it different from those used by your competitors?
- Describe the component you buy from supplier …: shape, materials, function; number of parts, and main components;
- Describe the supplier's manufacturing process: main phases, workings, equipment used, etc.
- What are the main drivers of complexity/technical challenges for the supplier's component and process?
- How do the two firms (i.e., buyer and supplier) respectively contribute to the component design and development?

SECTION 3 – SUPPLIER DEVELOPMENT

- Motivations for undertaking the supplier development actions/initiatives: Which area(s) of supplier's capabilities/performance needed to be improved?
- Were these needs for improvement immediately identified, or did they emerge at a later stage of the interaction between the two companies?
- Could you describe the development actions that were put in place? E.g., Verbal or written prescriptions of improvement (specify the type of request); audit and direct training; request of certifications; visits to supplier's plant, to jointly examine the performance issues; resident technicians/engineers; supplier's visits to your plant aimed at enhancing the supplier's awareness of your specific needs; request of supplier's investments in tools, equipments, capital equipment, inventory; others (please specify);
- How did the supplier react to these requests? Did it show an adequate level of commitment? Did it ask for higher support from your side?
- Did you perceive risks in undertaking the supplier development efforts? (e.g., uncertain outcomes of our effort, especially in case the supplier has relatively little experience in the motorbike sector; risk of information leakages; uncertainty of necessary resources; risk of insufficient payoffs)

- What were the main outcomes of these supplier development initiatives? Were the objectives (technical/quality/cost) achieved? How would you evaluate the supplier development experience?

SECTION 4 – RELATIONSHIP DEVELOPMENT AND OUTCOMES

- Please describe how the supplier relationship has evolved in time
- How did the assigned volumes/component range change in time in this relationship?
- How often did the supplier request renegotiations of price or other exchange conditions?
- Did conflicts occur in the relationship with this supplier? What were the main sources of these conflicts?
- Did you perceive any change in the supplier's interest/commitment towards the relationship? Do you think the supplier consider this relationship as an important one in which it is valuable to invest in?
- Did your interest/commitment towards the relationship change? Would you consider this relationship as an important one, in which it is valuable for you to invest in?
- What is the current status of the supplier relationship? Is the relationship with supplier … still active?
- Did you start a relationship with other suppliers for the component we are examining?