RISK SHARING IN SUPPLY CHAIN PARTNERSHIPS: AN SME PERSPECTIVE

A study of the behaviour of risk sharing in partnerships in a construction supply chain

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TU Delft Delft University of Technology

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Preface

This thesis report is the result of six months of research and the last component towards my graduation from the master programme of Construction Management and Engineering at the Delft University of Technology. My research started with a desire in learning and understanding the risks present in construction supply chains, yet, resulted in a big interest in the adversarial nature of relationships in the construction industry.

I had the opportunity to write my thesis in a company in The Netherlands. This company is full of talented and inspiring people that motivated me to put a big effort in this research. I learned that passion is what gives you the energy and motivation for doing your best and, together with your team, for being able to achieve incredible results. The company and its people were the reason I could collect so much valuable data that allowed me to complete the study. I appreciate the help of all of you at the company that accepted to have an interview with me (or two), I learned a lot from talking with each one of you. The same goes for the interviewees of the other companies, which form part of the units of study; I appreciate the time dedicated to answer my questions, as all your responses contributed significantly to this research.

I also want to thank my graduation committee: Prof. Sicco, who never kept surprising me with his knowledge on so many subjects. You always kept me motivated in pursuing my topic and made me reflect on many aspects during the research journey, which contributed significantly to the final outcome. Dr. Jafar, for being my guide towards the right direction along the process. You always showed enthusiasm in my research and inspired me to achieve an optimal result. Ir. Jelle, for being the first one who gave me the confidence to pursue the subject of my thesis. You gave me a "push" towards a productive start when I wasn't sure in which direction to go. Loes and Barbara, for all your help and assistance from the very start of the process. You supported me and trusted me even during the moments that I felt lost. I learned a lot during my whole year in the company and I gained lots of valuable knowledge from you that I will keep in mind during my entire career.

Finally, I am very grateful to my parents for their unconditional support and, also, I want to express my gratitude to CONACyT and I2T2; because of these two organisations, I got the opportunity to pursue my master studies in The Netherlands.

I wish that my thesis offers a new perspective towards small-to-medium-sized enterprises in the construction industry. Their knowledge and expertise can have very valuable contributions in projects and in long-term collaboration. I believe in a culture of cooperation and have the hope that, one day, the building sector will entirely shift towards this way of working.

M.E. Galván Granat

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Executive summary

A research gap was found when addressing the literature on small-to-medium-sized enterprises (SMEs) in the construction industry. Subcontractors and suppliers are primarily SMEs and form the largest percentage of firms in comparison to large enterprises (LEs) in the industry. Many parties are mainly concerned with maximising their profit, reason why, in many occasions, subcontractors and suppliers are selected by the main contractor on the basis of lowest price, rather than best value. Main contractors include harsh terms in contracts with subcontractors and suppliers, e.g., risk transfer. Risk transfer is a well-known risk treatment strategy in project risk management that has the purpose of allocating a risk to the party most capable of handling it. Unequitable distribution of risk is a consequence of current practices affecting commercially and financially weaker parties, such as SMEs.

Forming and maintaining relationships were principles of supply chain management (SCM) are followed could help reduce the problem for SMEs, since part of the goals of SCM is to increase coordination and integration of the processes and parties involved. A type of supply chain relationship in SCM is a partnership and it can be often found in literature that risk sharing, which can be seen as the opposite to risk transfer, is a component of this type of relationship. However, there is no literature addressing specifically the level of risk sharing or risk allocation within a supply chain partnership, which is the research gap this study intended to fill. This research focused on finding the behaviour of risk sharing within supply chain partnerships in the construction industry from the perspective of an SME, for which the following main research question was established:

> What is the behaviour of risk sharing in partnerships of construction supply chains, taking the perspective of a small-to-medium-sized enterprise?

A case study with embedded units of study was selected as research methodology, where the *main case* is the focal firm of the studied construction supply chain. Tier-1 suppliers and clients of the focal firm were selected to be part of the embedded units of study. The units of study were dyads, that is, each a relationship between the focal firm and the selected suppliers and clients. In total, the research included seven complete embedded units of analysis: five units with suppliers and two units with clients.

Giving a concrete answer to the research question is not possible, therefore, the concept of partnership was broken down to drivers, facilitators and power regimes and the concept of risk sharing was broken down into shared and allocated risks. Interviews with employees of the focal firm and representatives of the selected suppliers and clients were the main data collection method. The analysed drivers were: asset and cost efficiency, customer service, marketing advantage, and profit stability and growth. The analysed facilitators were: corporate compatibility, management philosophy and techniques, mutuality, and symmetry. The power regimes are: buyer dominance, supplier dominance, interdependence and independence. Finally, the main positive and negative supply chain risks located in the studied links of the supply chain were classified in either shared or allocated from one party to another. The risks were also classified based on the SCOR model.

With all the information obtained from the data sources, a cross-unit analysis was made, in which all the units of study were compared. The outcome of the cross-unit analysis was a direct comparison across the units of study with respect to the drivers, facilitators, power regime analysis, distribution of allocated risks, and shared risks. Similarities and contrasts along the results were used to write theory-building propositions. The following are the 12 theory-building propositions defined based on the findings of this research:

1. Collaboration among supply chain members results in mutual advantage, independent on the difference in size of the two firms, meaning SMEs and LEs can both benefit from a relationship with collaboration.
2. LEs don't ignore the possibility of forming partnerships with SMEs if the SME offers a product or service that will help the LE increase the customer service level and its marketing advantage.
3. An LE who is interested in forming or maintaining a partnership with an SME will be willing to share risks with that SME.
4. Unique projects in terms of engineering and aesthetics have an influence on developing the marketing advantage driver for suppliers for maintaining a relationship with a specialist subcontractor that is also an SME.
5. The use of delay penalties in contracts by a buyer or the acceptance of delay penalties in contracts by a seller is not related to the presence or not of a partnership nor to the size and power of the firms involved.
6. If two SMEs have similar management philosophy and techniques, there will be a presence of shared risks, both positive and negative.
7. Mutuality, specifically two-sided thinking and action in a dyad, is directly proportional to the equal distribution of allocated negative risks within the dyad.
8. The will of a buyer and a seller to build a close relationship where there is no buyer dominance can be associated to the sharing of risks of the financial category.
9. Early involvement of two firms can reduce the risk of wrong estimation of work and result in a cost-effective design and in finding technical project solutions jointly.
10. Lack of IT compatibility is a threat that can be turned into an opportunity to be exploited by the parties in a dyad.
11. Risks causing the product to differ from the client's requirements, preparation for transportation risks, and supplier's supplier risks are normally allocated to the supplier.
12. Firms that are interdependent to one another can be associated to a higher number of shared negative risks. The size of the firms is not relevant.

With the help of the 12 listed propositions, the research question could be answered. Explaining the behaviour of risk sharing in supply chain partnerships is not easy. Defining what exactly a partnership is turned out to be more complicated than expected. Some parties consider to have a partnership because they have collaborated in several projects or for a long-time, or maybe because they have a long-term vision. Risk sharing is also a complex term, since even if risks are shared, it does not mean that both parties will put an equal effort in mitigating it, or that the consequences won't be affect one more party than the other, reason why, risk sharing can also be seen as a way of risk transferring. Jointly exploring group risks, rather than individual risks, could increase collaboration resulting in win-win outcomes for the parties in a dyad.

Contents

List of figures

List of tables

List of abbreviations

CSCM	Construction supply chain management
FF	Focal firm
GL1	Glass Supplier 1
GL2	Glass Supplier 2
GS	Glazing Systems Supplier
LEs	Large enterprises
MC	Main Contractor
PRM	Project risk management
SCM	Supply chain management
SCV	Supply chain vulnerability
SCRM	Supply chain risk management
SM1	Sheet Metal Supplier 1
SM2	Sheet Metal Supplier 2
SMEs	Small-to-medium-sized enterprises
ST1	Steel Supplier 1
ST2	Steel Supplier 2
SU	Start Up
VI	Vertical integration

Chapter 1. Introduction to the research

Facing the challenge of being in a highly competitive environment, it is no longer enough for companies to only manage their own organisation; they also need to manage the supply chain. The interest on supply chain management (SCM) has increased as firms learn about the benefits of collaborative relationships beyond their organisation (Lummus and Vorkurka, 1999). The concept of SCM was created in the manufacturing industry with the goal of improving performance and increasing efficiency and efficacy of its processes (Morledge, Knight and Grada, 2009).

In contrast with the manufacturing industry, the construction industry is a project-based sector that has experienced an increase in adversarial problems and fragmentation over the years (Morledge *et al*., 2009). For this reason, the possibility of using SCM in construction has been studied and tested as a solution to the mentioned problems. Construction supply chain management (CSCM) has the objective of increasing the coordination and integration between the different processes and parties involved in construction projects to achieve optimisation, increase efficiency and to establish win-win and cooperative relationships, which can reduce the costs of construction, allow to perform the work in less time, add value and increase customer satisfaction (Xue, Wang, Shen and Yu, 2007).

The complexity of supply networks in the construction sector, the need for higher levels of specialisation, and procurement methods are reasons why the sector is more exposed to risks than ever before (Edkins, 2009). Using a SCM approach and forming partnerships with supply chain members can allow to have a better perception of the threats and opportunities involved in the supply chain. Having a good application of SCM should implicitly consider the identification and treatment of threats and opportunities (Edkins, 2009). Nonetheless, to this date, it is still often seen that there is an inappropriate allocation of risks within the construction supply chain, which, in many occasions, results in project failure.

Supply chain risk management (SCRM) is an approach for the management of disruptions in the supply chain. In construction, either the client or the main contractor is in charge of managing the supply chain and the supply chain risks (Pryke, 2009). In the traditional construction procurement, however, main contractors are mainly concerned with maximising their profit, so they select subcontractors on the basis of lowest price, instead of best value, and use harsh contract terms on them. It is also a common practice for main contractors to transfer risks to subcontractors and suppliers, who are frequently SMEs with little or no capacity to handle such risks (Akintan and Morledge, 2013).

The survival and growth of SMEs can be difficult in the current competitive business environment, due to the increasing customer demands and changes in business models (Hong and Jeong, 2006). The increasing challenges lead to the need of forming and managing relationships with other businesses. Forming partnerships with suppliers and clients can boost SCM performance and is often essential to satisfy the end-client's requirements. However, current literature on construction partnerships is addressed mainly for large companies

(LEs), such as main contractors and clients, and it is not clear whether partnerships offer the same benefits to SMEs.

In construction, most partnering is focused on developing collaboration in upstream relationships between LEs, such as clients and main contractors, with less involvement of smaller organisations, including specialist subcontractors and suppliers, which are often SMEs (Saad, Jones and James, 2002). Circumstances including limited resources, increased competition, and high customer expectations lead for companies to build partnerships, which aids in strengthening supply chain integration and provide sustainable competitive advantage. Partnerships could offer SMEs opportunities for achieving a higher performance and could offer a more equitable distribution of risks between subcontractors and main contractors is a way that trust is created between the parties, since fairness is fundamental for trust, and results in higher chances of improving project outcomes (Akintan and Morledge, 2013).

1.1 Problem statement

In the context of construction supply chains, where there is a need to eliminate adversarial relationships and to reduce fragmentation. Unequitable distribution of risk is a consequence of current practices that often involve the inappropriate transferring of risks to commercially and financially weaker parties. SMEs can be negatively affected by this risk transfer, since they are most of the time located on the second or third tier of the supply chain, who are mainly specialist subcontractors and suppliers.

SMEs constitute a large percentage of the companies in the construction industry and, as LEs, they could also be benefited from SCM and partnerships. Establishing partnerships can bring significant opportunities for SMEs, such as sharing risks with other supply chain members. Risk sharing is a component of supply chain partnerships (Lambert, Emmelhainz, and Gardner, 1996), nevertheless, there is no literature proving that if there is a partnership, there is risk sharing where an SME is benefited.

Current literature on construction partnerships is focused mainly on LEs, such as partnerships between main contractors and clients, with less involvement of companies downstream in the process, such as specialist subcontractors, which are principally SMEs. It is not clear to what extent a partnership, where an SME is involved, can offer the firm benefits in terms of risk sharing or a more equal distribution of risks.

1.2 Research objective

The objective of this research is to determine the behaviour of risk sharing in supply chain partnerships in construction supply chains from the perspective of a small-to-medium-sized enterprise (SME). As mentioned previously, risk sharing is a component of supply chain partnerships according to literature (Lambert *et al.*, 1996), however, this research will study both elements independent from one another, i.e., as separate constructs, since literature doesn't address this topic specifically in relation to SMEs in the construction industry. Considering the two concepts as separate constructs is a limitation of the study. In Chapter 3, the research methodology will be explained in detail and the research questions will be presented.

Risk sharing is described by Lambert *et al.* (1996) in the following way:

> *Mechanisms need to be in place to ensure that not only are the benefits and the rewards of the partnership shared, but that the costs and risks are also shared. A strong commitment to shared risk is evident when either party is willing to take a short-term "hit" in order to help out the partner and to strengthen the partnership over the long-term. (p. 10)*

The definition of supply chain partnership according to Lambert *et al.* (1996) is:

> *A supply chain partnership is a tailored business relationship based on mutual trust, openness, shared risk and shared rewards that results in business performance greater than would be achieved by the two firms working together in the absence of partnership. (p. 2)*

Both concepts will be further explained in the literature review. For now, the importance of the definition of partnership is the word *tailored*, meaning that partnerships contain components that are not same than those of another partnership. The components of a partnership are defined by the two companies and can be applied with different intensities and within different levels of the organisation. "For buyers, partnerships can improve profitability, reduce purchasing costs, and increase technical cooperation. Each relationship has its own set of motivating factors driving its development as well as its own unique operating environment, the duration, breadth, strength and closeness of the partnership will vary from case to case and over time" (Lambert, 2008, p. 170).

1.3 Scope definition

To achieve the objective, a case study was selected and a research scope was defined to create a focus and to complete the study in the limited amount of time of six months.

1.3.1 The case study

The case study of this research is a medium-sized company located in The Netherlands that has the role of a specialist subcontractor in the construction industry. The case study is composed of seven embedded units of study plus two smaller units. The embedded units are the selected bilateral relationships that the focal firm (FF) has with first-tier suppliers and clients within its supply chain. A more detailed description of the case study will be presented in the research methodology chapter (Chapter 3).

1.3.2 Research scope

The focus of this research is the behaviour of risk sharing in supply chain partnerships for SMEs in construction supply chains. The case study's supply chain builds glass and steel structures; such as façades, domes, glass ceilings, and atria; which usually consists of special designs where standardisation is not possible. The focal firm doesn't always work with the same suppliers or clients, but does have a few with whom there has been collaboration for several projects and even for many years. The latter characteristics where taken into account for selecting the units of study.

1.4 Research approach

The research is organised into four parts. Table 1.1 describes what each part contains.

PART I consists of a literature review.

PART II is dedicated to the research methodology.

PART III is comprises the results and discussion.

PART IV explains the conclusions of the research, recommendations, and limitations.

Table 1.1. Research approach.

		CHAPTER 1	**Introduction to the research**
PART I	**Literature review**	CHAPTER 2	**Supply chain management (SCM)** **The need for SCM in construction** **Two approaches to risk management**
PART II	**Research methodology**	CHAPTER 3	**Research methodology**
PART III	**Results & discussion**	CHAPTER 4	**Results per unit of study**
		CHAPTER 5	**Cross-unit analysis**
		CHAPTER 6	**Discussing the results of the analysis**
PART IV	**Conclusions & recommendations**	CHAPTER 7	**Conclusions and recommendations**

Part I
Literature review

Chapter 2. Literature review

The objective of this chapter is to give an overview of the reviewed literature and to provide a theoretical framework for the subject of this research.

Sections 2.1 to 2.3 introduce the topic of supply chain management (SCM); four power regimes are described, which compare four situations between buyer and supplier in relation to dominance and dependence; and the different types of supply chain relationships are explained. Section 2.4 focuses on partnerships and three methods are described which help to determine if a partnership is the required type of relationship between two supply chain members.

Section 2.5 and Section 2.6 cover the topic of SCM in the construction industry. The nature of the industry is described, together with the types of relationships that can be found. A deeper insight into partnerships in construction is provided and its benefits are compared to those of the manufacturing industry. Section 2.7 introduces small-to-medium-sized enterprises (SMEs) and an overview is given with respect to supply chain management and their position in the construction industry.

Section 2.8 and Section 2.9 describe two ways of managing risks: project risk management and supply chain risk management. Section 2.10 focuses on risks in the construction industry, which are managed by using project risk management. A glimpse of the risks and their treatments is given. Finally, the last sub-section addresses the issue of unfair risk transfer that takes place in the construction industry.

2.1 Supply chain management

Globalisation and international competition have shaped an entirely new business environment. There is an opportunity for enhancement in the industry to minimise inefficiencies that result from inadequate supplier performance, unforeseeable customer demands, and a changing business environment (Koh, Demirbag, Bayraktar, Tatoglu and Zaim, 2007).

Facing the challenge of being in a highly competitive environment, it is no longer enough for companies to only manage their own organisation; they also need to manage the supply chain. It is becoming more apparent that having an integrated supply chain can bring benefits for companies, helping them become more competitive. Integrated supply chains can have their own individuality and function, bringing competition between supply chains, which starts to replace the individual companies competing against each other (Koh *et al.*,2007; Mentzer *et al.*, 2001).

2.1.1 Introduction to Supply Chain Management

Supply chains, or distribution channels, are present even when they are not managed. Managing supply chains requires management efforts by the members of the supply chain (Mentzer et al., 2001), which comprise the

firms that interact with the focal company including the firm's suppliers and customers, from the start of the supply chain until the end-customer (Lambert and Cooper, 2000).

The interaction between organisations in the supply chain can take place in a direct or indirect manner. A direct supply chain consists of a company, a supplier and a customer where information, services, products and finances are flowing upstream and downstream. An extended supply chain includes the suppliers of the immediate supplier and customers of immediate customers. Finally, there is the ultimate supply chain, comprising all the members in the supply chain (Mentzer et al., 2001).

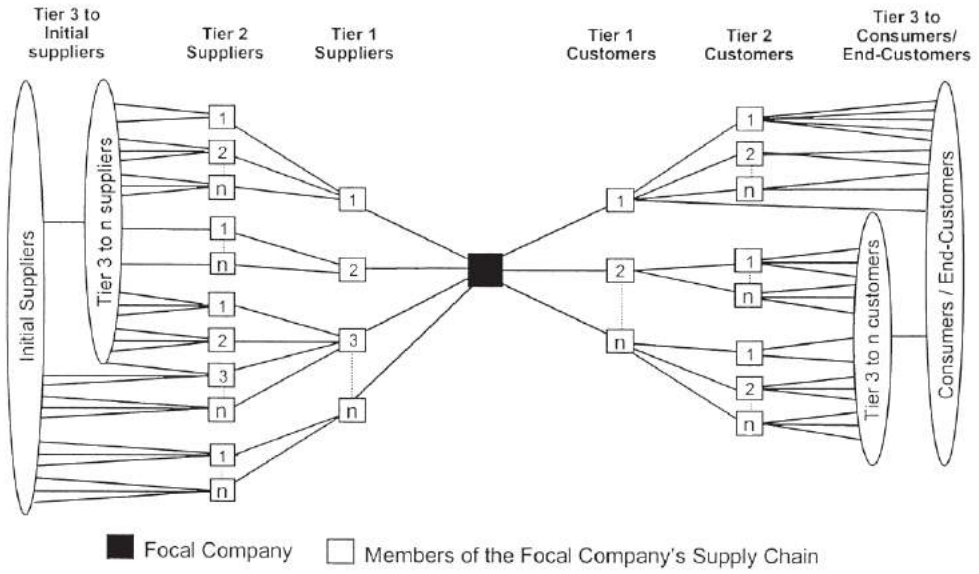

Figure 2.1. Supply chain network structure and types of intercompany business process links. Reprinted from "Supply chain management: implementation issues and research opportunities", by D.M. Lambert, M.C. Cooper, and J.D. Pagh, 1998, *The International Journal of Logistics Management*, 9(2), p. 3.

A supply chain is not linear; it is a network of interconnected suppliers and customers located at different tiers. There are three structural dimensions of a network: the horizontal structure, which encompasses the different tiers across the supply chain; vertical structure, which consists of the suppliers or customers spread within the tiers; and horizontal position, referring to the focal company's position within the horizontal structure, which can be as a supplier or a customer in an initial or end position, or somewhere in the middle (Lambert and Cooper, 2000) (See Figure 2.1).

Supply chain management was first centred on internal process integration, but it now focuses on the incorporation of internal processes of a company with those of suppliers and customers, with the goal of reaching ideal levels of performance (Thoo, Bakar, Rasli and Baharun 2012). To achieve that goal, procurement and supplier selection have a key function (Koh *et al*., 2007). Nowadays, SCM requires an approach which is proactive, strategic and corporate (Zsidisin and Ritchie, 2009). The idea behind effective SCM is the interchange of information, communications and relationship development (Asbjornslett, 2009). When engaged with each other, organisations along the supply chain can "gain a sustainable competitive advantage and profitability through leaner, more efficient, and customer-focused strategies" (Zsidisin and Ritchie, 2009, p. 2).

Supply chain management (SCM) has been given numerous definitions in literature. One of them was given by The Global Supply Chain Forum (as cited in Lambert and Cooper, 2000) defining it as "the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders" (p. 66).

Similarly, Mentzer et al. (2001) define SCM as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole" (p. 18).

A third definition is that of Handfield and Nichols (2002), who define it as "the integration and management of supply chain organisations and activities through cooperative organisational relationships, effective business processes, and high levels of information sharing to create high-performing value systems that provide member organisations a sustainable competitive advantage" (p. 8).

From these three definitions, it can be concluded that SCM is about coordinating and integrating the different business functions within a supply chain with the purpose of improving long-term performance through strategic coordination of processes and high levels of information sharing by the individual companies, in order to add value for the end-customer as a supply chain as a whole.

2.1.2 SCM implementation

SCM starts with the disposition of an individual company to strive for trust, commitment, interdependences, organisational compatibility, a vision, key processes, leadership and top-management support with other firms in the supply chain (Mentzer *et al.,* 2001). Moreover, the focal company must determine who are the key supply chain members with whom to link processes; thereafter, determine which processes should be linked; and finally, deciding what level of integration and management should be applied for each process link (Lambert and Cooper, 2000).

As a management philosophy, SCM engages "a systems approach concerning the multifirm effort to manage the total stream of goods from the supplier to the ultimate customer" (Ellram, 1990; Jones and Riley, 1985; as cited in Mentzer *et al.,* 2001, p. 7). It is also a strategy in the direction of cooperative efforts to harmonise and incorporate the operational and strategic capacities of the individual firms into an integrated system with a focus on customer value and satisfaction (Mentzer *et al*., 2001).

The management philosophy of SCM is implemented by realising the following activities: integrated behaviour, mutually sharing information, mutually sharing risks and rewards, cooperation, the same goal and the same focus on serving customers, integration of processes, and partners to build and maintain long-term relationships (Mentzer *et al*., 2001). Figure 2.2 shows the general steps of the implementation. The results of the implementation include: lower supply chain costs, increased customer value and satisfaction, higher overall performance and a greater competitive advantage (Mentzer *et al*., 2001).

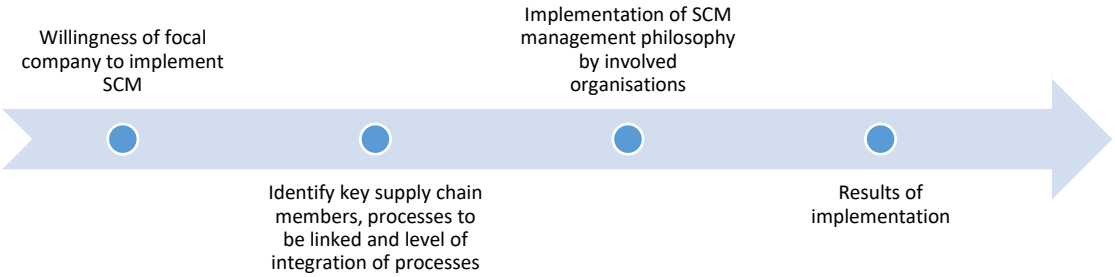

Figure 2.2. General steps of SCM implementation as described by Mentzer *et al*. (2001).

2.1.3 SCM practices

Koh *et al*. (2008) identify a set of SCM practices from literature. Table 2.1 show the practices that are more relevant for this research.

Table 2.1. SCM practices. Adapted from "The impact of supply chain management practices on performance of SMEs", by S.L. Koh, M. Demirbag, E. Bayraktar, E. Tatoglu and S. Zaim, 2007, *Industrial Management & Data Systems*, 107(1), pp. 122-123.

Practice	Description
Close partnership with suppliers	Cooperation between buyer and suppliers, followed by coordination and collaboration, including work-flow, sharing information, joint planning.
Close partnership with customers	Focuses on joint venture and/or long-term supply agreement.
Strategic planning	Firms integrate strategies to produce and sell high-quality at a low price. It focuses on the manufacturing process, technical innovation, financial considerations and market penetration.
Supply chain benchmarking	Benchmarking of supply chain performance makes it possible to compare one's supply to the competition's, allowing for continuous improvement by using key performance indicators.
Few suppliers	The buyer wants to assure a long-term relationship and the cooperation of a few key suppliers. This can create value to the buyer and result in lower transaction and production costs.
Sub-contracting	It's a practice of firms that do not have the capacity and resources to provide the needed products and services. It helps in dealing with supply chain uncertainties under limited resources.
Outsourcing	It's about setting priorities and focusing company resources on a limited number of activities and processes to gain more competitive advantages.
Many suppliers	Suppliers are selected from a large suppler base according to quality needs, delivery dates and price, promoting competition.

2.2 The power regimes

"The power perspective can enhance effective procurement and supply management" (Cox, 2001, p. 8). According to Cox (2001), power is at the core of all business-to-business relations. "Using power is often seen as unethical. However, power, influence, and dependence do exist. Ignoring them will not make them less important for understanding buyer-seller relationships" (Burt, Starling and Dobler, 2003, p. 91). Moreover, even if power is not always used, it can still impact decisions and strategies (Burt *et al*., 2003).

Cox (2004) refers to *power regime analysis* as the method of understanding the association between operational practice and commercial exchange. The understanding of the power and leverage situation in a supply chain power regime can be done with help of the buyer and supplier matrix (Figure 2.3). A more detailed version of

the matrix can be found in Appendix 2.A. Cox (2001) describes the situation of the buyer in each of the four quadrants of the power matrix as follows:

- **BUYER DOMINANCE BOX:** The buyer has power attributes relative to the supplier, which is the foundation to control the supplier's performance on quality and/or cost improvement, allowing the supplier to receive only normal returns.
- **INTERDEPENDENCE BOX:** Both parties own resources that require them to work closely with one another, since neither firm can ask the other to do something it doesn't want to do.
- **INDEPENDENCE BOX:** Neither party has substantial leverage opportunities over the other, so both must accept the dominant price and quality levels.
- **SUPPLIER DOMINANCE BOX:** the supplier has all the levels of power, since there are not many competitors in the market, therefore, the supplier has above normal returns. The buyer will accept the price and quality that is offered.

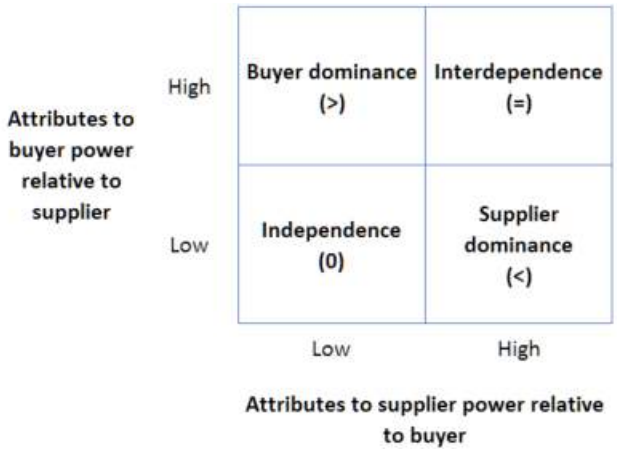

Figure 2.3. The power matrix: the attributes of buyer and supplier power. Adapted from *Supply chain management: a guide to best practice*, by A. Cox, P. Ireland, C. Lonsdale, J. Sanderson, and G. Watson, 2003, London: Financial Times Prentice Hall.

2.3 Types of relationships in SCM

It is important to distinguish the different types of relationships that can exist between organisations. According to Lambert, Emmelhainz and Gardner (1996), from weakest to strongest, the different types of relationships are: arm's length, partnerships, joint ventures, and vertical integration between two companies.

2.3.1 Arm's-length relationships

An *arm's length relationship* involves a one-time exchange or even multiple transactions, but there is no sense of joint commitment, since a supplier is usually selling standard products or services to a large range of customers. In some occasions, an arm's length relationship should develop into a partnership, since it could bring important benefits to both parties (Lambert *et al*., 1996).

2.3.2 Partnerships

A *partnership* can be viewed as an inter-organisational relationship which is neither a contractual arm's length relationship nor vertical integration, it is, instead, somewhere in the middle. Also, each type has its own characteristics; Lambert *et al*. (1996) recognise three types of partnerships:

- **TYPE I**, where firms recognise each other as partners and coordinate activities on a limited basis with a short-term focus, involving only one functional area within each organisation;
- **TYPE II**, in which the parties have a long-term view and multiple functional areas are involved; and
- **TYPE III**, where a significant level of operational integration is shared with no "end date."

Partnerships with clients

Moss Kanter (as cited in Vrijhoef, 1998) mentions that "client-companies and suppliers should collaborate actively and develop mechanisms, structures and processes for bridging inter-organisational differences in order to achieve sustainable benefit from the relationship" (p.36). In addition, effective communication and coordination can yield from multiple connections and integration across different organisation levels, which shifts the relationship from traditional negotiation and purchasing to building a relationship and maybe a partnership (Kanter, 1994, as cited in Vrijhoef, 1998).

Partnerships with suppliers

Lamming (as cited in Vrijhoef, 1998) stated that a very powerful strategy is to have partnerships with suppliers, since it promotes joint solution thinking for problems, and it can yield to substantial cost reductions and quality enhancements. Working closely with suppliers can yield to the reduction of waste and to solve problems by analysing them in a systematic way (Lamming, 1993, as cited in Vrijhoef, 1998).

2.3.3 Joint ventures

A joint venture is a business unit created by two or more firms. It can be seen as a new firm formed to achieve specific objectives, such as a project. A joint venture requires some degree of shared ownership from both parties (Lambert *et al.*, 1996), shared returns and risks, and a shared governance.

2.3.4 Vertical integration

Vertical integration (VI) refers to the situation when two businesses of different stages of production merge, i.e., "to extend their operational control through acquisition to their suppliers and business customers" (Beach, Webster and Cambell, 2005, p. 613).

2.4 A deeper look into supply chain partnerships

Nowadays, organisations are leaner and need to "form closer relationships with key suppliers, customers and third-party providers in order to maintain a leadership position and grow" (Lambert *et al*., 1996, p. 15). Partnering serves as a way to take advantage of the unique skills and expertise of each partner to become stronger against competitors (Lambert *et al*., 1996).

A supply chain partnership can be defined as "a tailored business relationship based on mutual trust, openness, shared risk and shared rewards that results in business performance greater than would be achieved by the two firms working together in the absence of partnership" (Lambert *et al*., 1996, p. 2). In other words, a supply chain partnership is a relationship formed between two individual organisations in a supply chain with high levels of information sharing, in order to achieve specific goals and resulting in cost reduction and promising a win-win situation (Yu, Yan and Cheng, 2001). Partnerships should lessen traditional competitive barriers between supply chain members as a result of increased information flows, reduced uncertainty, and a more lucrative supply chain (Maloni and Benton, 1997).

2.4.1 Characteristics of supply chain partnerships

Partnerships are a fundamental concept in SCM and are a main driver for it to be effective (Rezaei, Ortt and Trott, 2014). Supply chain partnerships must benefit all partners with reduced risk and reduced uncertainty through common objectives and information exchange (Ellram, 1991). These long-term relationships reduce the wall between buyer and supplier, allowing manufacturers to work jointly with a smaller supplier base. In that way, the end-customer receives a higher quality and cost-effective product or service with a higher value within a shorter delivery time (Maloni and Benton, 1997).

According to Maloni and Benton (1997), the traditional American and European manufacturers' supply strategy consists of having an ample collection of suppliers, which boosts competition, allowing the manufacturer to negotiate lower costs, higher quality, acceptable delivery times, and special requests. This strategy gives bargaining power, enabling protection against interruptions in supply due to unforeseen problems. Notwithstanding, many Asian, American and European firms have already noted the benefits of the opposite concept of reducing the supplier base which leads to a reduction of adversarial attitudes, lower switching costs, and decreased shipping errors (Maloni and Benton, 1997). Maloni and Benton (1997) made a comparison between traditional supply relationships versus supply chain partnerships, and it is show in Table 2.2.

Table 2.2. Traditional versus partnership supply strategies. Adapted from "Supplier chain partnerships: Opportunities for operations research", by M.J. Maloni and W.C. Benton, 1997, *European Journal of Operational Research*, 101(3), p. 422.

Traditional supply relationships	**Supply chain partnerships**
• Price emphasis for supplier selection	• Multiple criteria for supplier selection
• Short-term contracts for suppliers	• Long-term alliances with suppliers
• Bid evaluation	• Intensive evaluation of supplier value-added
• Large supplier base	• Few suppliers
• Proprietary information	• Shared information
• Power driven problem solving, improvement, and success sharing	• Mutual problem solving, improvement, and success sharing

2.4.2 Three approaches to determine if a partnership is appropriate

In literature, different models can be found which help in identifying the elements of a partnership. Three approaches from literature were analysed and compared (Lambert *et al*., 1996; Burt *et al*., 2003; and Christopher

and Jüttner, 2000). Only the first approach, that of Lambert *et al.*, is described in detail since it will be used in the next chapters.

The first approach: The Partnership Model

Lambert et al. (1996) argue that there is a basic premise that seems to pervade business, which is that partnerships are an essential element of business strategies, reason why managers should attempt to achieve such relationships with every customer and supplier. Nonetheless, this premise is erroneous, since partnerships are not necessarily a requirement for having a successful business (Lambert et al., 1996).

Partnerships are necessary and beneficial, however, they also cost significant time and effort, which is why a firm should not partner with every supplier or customer. The limited resources should be allocated only to partnerships that would meaningfully benefit from them (Lambert et al., 1996). There is a risk for organisations to get involved in relationships that won't meet their expectations, so the potential relationship should be analysed in advance to determine if it will result in competitive advantage and if it's worthy of the time and resources needed to fully develop a partnership.

Lambert et al. (1996) also make the remark that not all partnerships are the same, reason why the authors define three types (see Sub-section 2.3.2), therefore, the real question is: "how does management know what type of relationship would provide the best pay-off?" (p. 2), which the authors attempted to answer by developing the partnership model, which can be used by companies to analyse relationships and rank them by degree of partnership present (Figure 2.4). The model has three major elements: drivers, facilitators, and components.

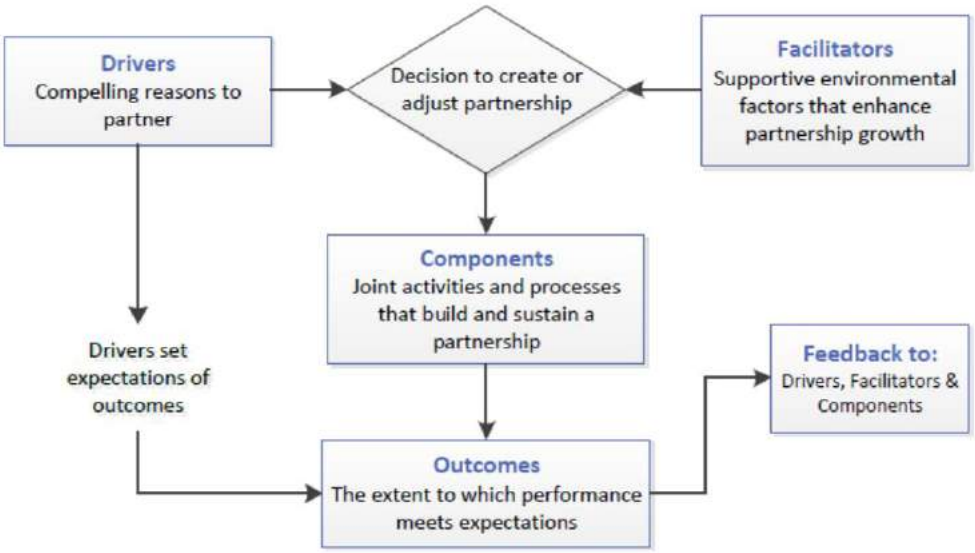

Figure 2.4. The Partnership Model. Adapted from "Developing and Implementing Supply Chain Partnerships", by D.M. Lambert, M.A., Emmelhainz, and J.T. Gardner, 1996, *The International Journal of Logistics Management*, 7(2), p. 4.

- **DRIVERS** are the motivation to partner, including the significant benefits that wouldn't be obtained without the partnership. Drivers are assessed individually within one company. Potential benefits include: asset and cost efficiencies, customer service improvements, marketing advantage, and profit stability or growth. Even if the drivers are an incentive and there is a wish for building a partnership, if

any of both corporations is not undertaking efforts towards a close relationship, then the chance of success declines. On the contrary, a supportive environment where integration takes place increases the chance of success (Lambert *et al*., 1996).

- **FACILITATORS** are the basis of a good relationship. They are elements of a corporate environment which allow a partnership to grow and become stronger. Facilitators should be assessed jointly between the two firms. Examples are: corporate compatibility, similar managerial philosophy and techniques, mutuality, and symmetry. The presence of facilitators increases the probability of success of the relationship and vice versa. Other facilitators are exclusivity, shared competitors, physical proximity, a prior history of working with the partner, and a shared high value end user success (Lambert *et al*., 1996).

- **COMPONENTS** are the activities and processes that are established and controlled by the management throughout the duration of the partnership. Components make the relationship operational and help managers achieve the benefits of partnering. Examples of components include: planning, joint operating controls, communications, risk/reward sharing, trust and commitment, contract style, scope, and financial investment (see Table 2.3).

Table 2.3. Components of a partnership (Lambert *et al*., 1996).

Component	Description
Planning	Joint planning can range from sharing existing plans to the joint development of strategic objectives.
Joint operating controls	Both parties should be able to change operations of the other for the good of the partnership. Can range from giving a suggestion to having the power of operationalise a change without approval.
Communications	Effective communication, on both a daily basis and a non-routine basis, is a key component for a successful partnership. The deeper the communication, the stronger the partnership. Communication links should be across all levels of the organisations including strategical, tactical, operational, interpersonal and cultural.
Risk/reward sharing	Mechanisms need to be in place to ensure that not only are the benefits and rewards of partnerships shared, but that the costs and risks are also shared. A strong commitment to shared risk is evident when either party is willing to take a short-term "hit" in order to help out the partner and to strengthen partnership over the long-term.
Trust and commitment	Elements of trust and loyalty include loyalty to each other, loyalty to the partnership and a long-term focus. Additionally, there are no worries of being replaced.
Contract style	The strongest partnerships have the shortest and least specific agreements or not agreement at all. A one two-page document, outlining the basic philosophy and vision for the partnership, is all that is needed when the parties are truly integrated.
Financial investment	Shared assets, joint investment in technology, exchange of key personnel, and a joint research and development reflect a high decree if financial interdependence.

Drivers and facilitators should be assessed to determine the potential for a partnership (Figure 2.5). This is done by answering the assessments for drivers and facilitators provided in the Appendix 2.B.1 Nonetheless, the management components and how they are implemented is what determines the type of relationships that actually taking place. After the decision is made regarding the appropriate type of relationship, the level of the component implementation must be agreed upon by the companies, and how each component is going to be

implemented and managed. For example, a Type III partnership should implement most of components at a high level. Appendix 2.B.2 addresses the level of implementation of the components.

		Driver points		
		8-11 points	12-15 points	16-25 points
Facilitator points	8-11 points	Arm's length	Type I	Type II
	12-15 points	Type I	Type II	Type III
	16-25 points	Type II	Type III	Type III

Figure 2.5. Propensity to partner matrix. Adapted from "Developing and Implementing Supply Chain Partnerships", by D.M. Lambert, M.A. Emmelhainz, and J.T. Gardner, 1996, *The International Journal of Logistics Management*, 7(2), p. 10.

Improved performance of both companies should be an outcome of the partnership. Other outcomes of effective partnerships include profit enhancement, process improvements, and increased competitive advantage (Lambert *et al*., 1996).

The partnership model of Lambert *et al*. (1996) provides a systematic approach to partnering with a common language of drivers, facilitators, and components and serves as a screen tool when deciding where to allocate limited resources, while aiding in the management of partnerships in the most beneficial way for both firms. Top management must not only adopt partnership ideals, but must also recognise and reward cooperative behaviour (Lambert *et al*., 1996). The model also helps parties implementing it to identify the difference between a partnership and a long-term contract. It can also be used to strengthen existing relationships and to determine how the partnership might be managed more effectively.

The second approach: Addressing questions

Burt *et al*. (2003) make a distinction between a transactional relationship, a collaborative relationship and a strategic alliance. Instead of using the term partnership, the authors prefer to use the last two terms. Nonetheless, how they describe the three types can be compared to the arm's length relationship and the Level I and Level III partnerships from the model of Lambert *et al*. (1996).

Transactional relationships, are neither good or bad and the relationship is arm's length (Burt *et al*., 2003). In *collaborative relationships*, there is an awareness of the interdependence and need for cooperation. These relationships include the elements of trust building, communications, joint efforts and planning and fostering interdependence and studied and managed to achieve competitive advantage (Ibid, n.d., as cited in Burt *et al*., 2003).

In *supply alliances*, there is the presence of institutional trust. These relationships receive the benefits of physical asset and human specialisation. Burt *et al*. (2003) argue that physical asset specialisation allows for product differentiation and improvement of the overall quality by increasing product integrity. With human specialisation, persons across companies have significant experience in working together and are able to communicate and coordinate effectively with each other through the development of common language and accumulated, learned knowledge (Burt *et al*., 2003). Furthermore, the authors present some characteristics, these include:

- Achieving simultaneous objectives and continuous improvements
- Presence of interdependence and commitment
- Atmosphere of cooperation
- Formal and informal interpersonal connections, information systems, and internal infrastructures
- There is openness in terms of cost, long-term objectives, technology and the supply chain.
- Objectives that create new benefits for both parties
- Shared vision for the future
- Ethical practices
- Adaptable
- Improved quality at lower cost
- Win-win negotiations
- Executive commitment

For knowing which type of relationship is appropriate, Burt et al. (2003) propose answering three sets of key questions that can guide companies towards making a decision (See Appendix 2.C).

The third approach: A framework for developing strategic supply chain partnerships

Christopher and Jüttner (2000) sought to identify a framework to guide managers towards developing strategic supply chain partnerships by performing six case studies covering a broad spectrum of commercial activity. The authors identified six elements, which they included in the framework, by taking a dyadic view, involving supplier and buyer. The developed framework can be found in Figure 2.6.

Figure 2.6. A framework to manage supply chain relationships. Adapted from "Developing strategic partnerships in the supply chain: a practitioner perspective", by M. Christopher and U. Jüttner, 2000, *European Journal of Purchasing & Supply Management*, 6(2), p. 119.

Christopher and Jüttner (2000) conclude that when companies are willing to create long-term relationships, such as partnerships, with other parties in the supply chain, they need to know how to manage these relationships. Relationship management is crucial if firms are considering partnerships in their business strategies. The model developed is not rigid, but is rather a theoretical foundation based on case studies, which the authors refer to as the "theory in use" by practitioners (Zaltman, 1982, as cited in Christopher and Jüttner, 2000).

Three works have proposed approaches on how to determine when are partnerships appropriate. It is evident that The Partnership Model created by Lambert *et al*. (1996) was developed in a way that it can be directly used by companies due to its systematic and detailed steps. Similarly, Burt *et al*. (2003) present some questions that could aid in the decision process of forming a partnership, but the questions are broader than those of Lambert *et al*. (1996) and it is not possible to make an accurate assessment to determine which type of relationship, of the ones presented, is more appropriate. Lambert *et al*. present detailed questions for the drivers and facilitators and then suggest the management of the partnership components, which can be done at different levels; while Burt *et al*. (2003) only classify three types of relationships and don't develop on the details of each one.

Finally, the third approach was by Christopher and Jüttner (2000), who created a framework consisting of six elements which were identified in six different case studies. The elements represent key areas for applying relationship management principles. The framework is a theoretical foundation that serves to guide managers when they are willing to form strategic partnerships with supply chain members. Christopher and Jüttner (2000) make it clear that it is not possible to have partnerships with all parties within the supply chain, nevertheless, the model is not very specific about the aspects that should be considered before forming a partnership.

2.4.3 Supply chain partnership success factors

Maloni and Benton (1997) list several critical elements for success that the partnership implementation process requires, they are show in Table 2.4:

Table 2.4. Critical success factors of partnership implementation. Adapted from "Supplier chain partnerships: Opportunities for operations research", by M.J. Maloni and W.C. Benton, 1997, *European Journal of Operational Research*, 101(3), p. 424.

Throughout	**Initial strategic analysis phase**	**Supplier evaluation and selection phase**	**Partnership establishment phase**	**Maintenance phase**
• Top management support • Communication • Central coordination	• Social and attitudinal barriers • Procedural and structural barriers	• Total cost and profit benefit • Cultural compatibility • Financial stability • Partner capabilities • Management compatibility • Location	• Perception and needs analysis • Intense interaction • Documentation	• Trust • Goodwill • Flexibility • Conflict management skills • Social exchange • Boundary personnel • Performance measurement

On the contrary, according to Forrest and Martin (as cited in Hoyt and Huq, 2000) reasons why a partnership could fail are:

- The partner doesn't pay enough attention to the relationship;
- lack of continuous and mutual trust;
- changes in the market;
- the partner was perceived to be a potential competitor; or

- the project was too long

2.4.4 Risks of partnerships

Supply chain partnerships have benefits, but also immanent risks that can damage the involved parties. The anticipation of sharing of risks and rewards across the chain affects long-term commitment of channel members (Lambert and Cooper, 2000). Maloni and Benton (1997) mention the following risks: first, the heavy dependence on one partner can be disastrous if the partner does not meet the expectations; furthermore, firms risk to become less competitive in case of loss of partnership control and over-specialisation with one partner; finally, firms may overestimate partnership benefits while ignoring potential weaknesses.

Uncertainties are caused by delivery delays, machine breakdowns, and order fluctuations, among others, and will propagate through the supply chain in the form of increased logistics costs and inefficient use of resources (Yu *et al*., 2001). Another risk involves lead-times; after the September 11 attacks, many US and European companies started to reconsider having overseas suppliers. Foreign suppliers are sometimes less costly and therefore chosen, however, they require longer lead-times and may be more vulnerable to disruptions in the transportation system. On the other hand, local suppliers may be more expensive, but are closer in distance and therefore able to respond faster (Sheffi, 2001).

Nonetheless, Sheffi (2001) recommends to include both, foreign and local suppliers; foreign suppliers for the majority of the procurement volume and local suppliers for their capability to fill the needs in case of disruptions. The incremental cost of using the local suppliers can be seen as the premium paid for the reduced risk of disruption. A difficulty is deciding whether components are critical or not within the procurement volume. Also, there is the risk of local suppliers getting busy and unable to supply.

Supply chain literature has been extremely optimistic about the promise of win-win supply chain partnerships, but supply chain integration in the industry has not been as effective as assured. Opportunism by the firms with more power can cause difficulties in accomplishing equality and cooperation (Maloni and Benton, 1997). Also, risks that the focal company bears are not the same than those of the customers and suppliers, making it not necessarily a win-win situation when taking risk-related decisions (Christopher and Lee, 2001).

2.5 Construction supply chain management

Construction projects are amid the most varied and challenging in which society is involved (Edkins, 2009). Even projects in other sectors can be more technically complex or bigger, construction projects vary considerably in terms of number, size and complexity, making it more difficult to have an equal supply chain among the different projects. In these projects, which can be both simple and complex, there is a high chance for groups of suppliers to have to work with each other, either because of previously established strategic alliances or partnership agreements, or because they are obligated as a result of project-specific competitive tender (Edkins, 2009).

2.5.1 Traditional construction supply chains

According to Dainty, Briscoe and Millett (2001a), in the construction sector, the network of organisations can often be extremely complex, especially that of large projects where the number of suppliers could be more than hundred. In traditional structure of construction supply networks, the main contractor is at the core of the network, with links to the client, main suppliers and to specialist management service providers (including design), all of which are external to the main contractor (Dainty et al., 2001a).

The typical supply chain consists of tiers: Tier 1 refers to the contractual or financial relationship between the main contractor with the client; Tier 2 refers to the direct contract of the sub-contractors and suppliers with the main contractor; Tier 3 refers to the sub-contractors and suppliers working for sub-contractors; and so on, as it is represented in Figure 2.7.

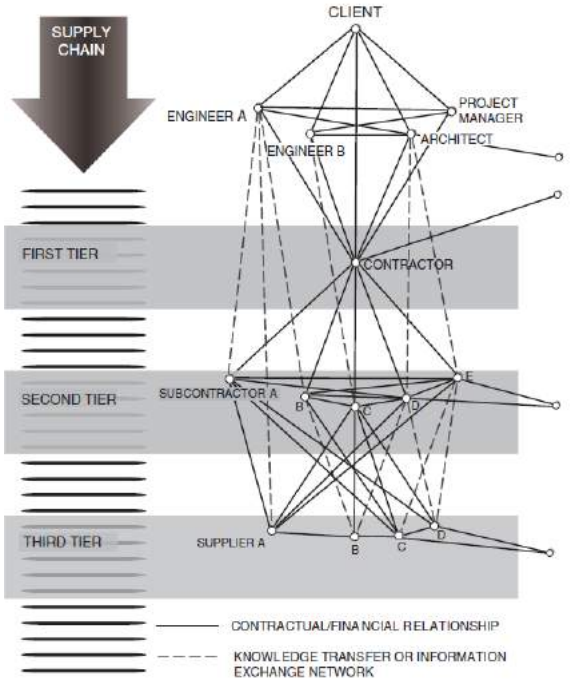

Figure 2.7. Construction supply chain and network. Reprinted from *Construction supply chain management: concepts and case studies* by S. Pryke, 2009, Chichester, UK: Wiley-Blackwell.

According to Edkins (2009), the construction industry is a project-dominated industry, nevertheless, it doesn't face unique challenges; the aerospace, pharmaceuticals and IT industries also rely heavily on projects. Construction projects were traditionally located on the final position of the building or structure, except for design and other consultancy services which are completed at other locations. Nevertheless, this is shifting from uniquely building at site to building and assembling in different locations, through offsite manufacturing and assembly techniques. Increased fragmentation results from this increased specialisation, reason why the management of those specialised product or service providers is becoming more important (Edkins, 2009).

Supply chains in construction are characterised by adversarial short-term relationships that are the result of a competitive bidding process, very little information sharing, and little enthusiasm for continuous learning. Traditional methods seek to enhance individual processes; however, this supports fragmentation (O'Brien, 2001). Similarly, Vrijhoef (1998) argues that in contrast to manufacturing, construction projects are usually

unique and temporary and that this situation suggests a temporary organisation for each project with participants that have short-term objectives. Furthermore, this combination of actors involves a frequent change of participants. The parties depend on each other, but act through a range of contractual agreements and detailed procedures. Vrijhoef (1998) also mentions that many participants are very specialised and operate at different phases of the construction process. There is also a tendency for self-interest and there is even a changing distribution of authority and responsibility, increasing even more the industry's fragmented nature.

As stated by Vrijhoef (1998), fragmentation and adversarial relationships create a difficulty to solve problems, to collect data and to take suitable measures; affecting negatively the efficiency and efficacy towards customer satisfaction. Furthermore, major problems result from this, such as deficient communication, ambiguous contracts, unfair distribution of risks and inadequate description of procedures and responsibilities (Vrijhoef, 1998), in addition to conflict and confrontation, corruption, bid-shopping, uncertainty of payment and supply chain exploitation (Loosemore and Lim, 2015).

2.5.2 The emergence of SCM in construction

SCM emerged in the manufacturing industry given the growth of competitive pressure that firms were facing and had the goal of increasing efficiency and effectiveness, achieve organisational objectives, and create a larger synergy (Harland, 1996, as cited in Aloini, Dulmin, Mininno, and Ponticelli, 2012). As an evolutionary concept, SCM started the creation of innovative tools and techniques and it was gradually introduced in the construction industry due to the call for substantial improvements in project performance and profits (Aloini *et al*., 2012).

Table 2.5. Differences between a traditional supply chain and SCM. Adapted from "The four roles of supply chain management in construction" by R. Vrijhoef and L. Koskela, 2000, *European Journal of Purchasing & Supply Management*, 6(3-4), p. 136.

	Traditional Management	**Supply Chain Management**
Time horizon	Short term	Long term
Information sharing and monitoring	Limited to needs of current transaction	As required for planning and monitoring processes
Coordination	Single contact for the transaction between channel pairs	Multiple contacts between levels in firms and of channel
Joint planning	Transaction-based	Ongoing
Supplier base	Large to increase competition and spread risks	Small to increase coordination
Sharing risks and rewards	Each on its own	Risks and rewards shared over the long term

In the construction industry, the concept of SCM was introduced with the purpose of reducing fragmentation and adversarial problems within the different parties involved in the delivery of a project. Construction supply chain management (CSCM) has the objective of increasing coordination and integration within construction projects, achieving a greater optimisation, and increasing efficiency and effectiveness of all project stages. CSCM offers a new approach to reduce costs of construction while performing work in less time, adding value and increasing customer satisfaction.

CSCM offers the opportunity for significant improvements in client and stakeholder value through a strategic view of profitability (Behera, Mohanty and Prakash, 2015) and it guaranties an engineering foundation to design, plan, and manage construction projects in a collaborative manner (O'Brien, 2001). Table 2.5 compares the traditional management style with that of SCM in construction.

There have been attempts to reproduce the good results obtained by supply chains in other industries, however SCM initiatives have not made yet the breakthrough in the construction industry (Aloini *et al*., 2012). Construction deals with temporary multiple organisations, which are a big obstacle for SCM application, since it hampers the establishment of trust (Cheng, Law, Bjornsson, Jones and Sriram, 2010), due to the large number of parties involved in supplying materials, components and services.

There have been attempts to reproduce the good results obtained by supply chains in other industries, however SCM initiatives have not made yet the breakthrough in the construction industry (Aloini *et al*., 2012). Construction deals with temporary multiple organisations, which are a big obstacle for SCM application, since it hampers the establishment of trust (Cheng, Law, Bjornsson, Jones and Sriram, 2010), due to the large number of parties involved in supplying materials, components and services.

The main reason why the implementation of SCM has been difficult and ineffective, according to Rimmer (2009), is the procurement route chosen by the client, especially those that exclude contractors and specialist subcontractors from both strategic and detailed design decisions until relatively late in the overall process of design and construction. Also, the insistence on competitive tendering has become an barrier towards effective the collaboration.

The main scope of SCM in construction should include: (1) a focus on the delivery of value, (2) the creation of contractual arrangements in which SCM tools could flourish, (3) investment in product development, (4) elimination of waste, and (4) performance measurement and bench-marking (Rimmer, 2009).

As said by Rimmer (2009), unless sufficient private clients are persuaded to provide the strong leadership needs for the implementation of SCM-type techniques, the construction industry is unlikely to transform itself, reason why the industry requires a massive culture change (Potts, 2009).

2.6 Types of relationships in the construction industry

Beach, Webster and Campell (2005) mention that relationships can have several forms in the construction industry, some of them ranging from market forces to those structured around common ownership. The stated types are market relationships, vertical integration, and strategic and project partnering.

2.6.1 Market relationships

Beach *et al*. (2005) describe market relationships as those that allow for products to be purchased at the lowest possible cost. These relationships are based purely on market forces and can sometimes be create distrust among the firms and even be antagonistic. They are also related to opportunistic behaviour, little information sharing, and keeping an arm's-length distance, while keeping the benefits for one self (Beach *et al*., 2005).

The authors argue, that in the construction industry, this type of relationship is directly associated to defensive behaviour, adversarial relationships and large costs that result from trying to define responsibilities and minimising risks, which involve practices like the negotiation of contractual agreements, tendering, and setting-up and running governance structures to monitor contracts and settle disputes. Nevertheless, contract specifications cannot eliminate the possibility of unanticipated costs to occur, which is common in an environment of uncertainty (Beach *et al*., 2005).

2.6.2 Vertical Integration

Vertical integration (VI) consists of a principal organisation extending operational control through acquisition to their suppliers and business customers. According to Beach *et al*. (2005), its purpose is to eliminate one of the risks of outsourcing, which is that over time, suppliers can become more powerful than the buyer as they gain advantage from learning by doing, information asymmetry, economies of specialisation and economies of scale. Even if the goal of outsourcing is having competitive advantage by focusing on core activities only, there is also the threat that organisations lose capabilities that become critical to their operations (Beach *et al*., 2005).

According to Beach *et* al. (2005), VI was successful in some sectors, e.g., the car industry, however not in construction. This could be related to the fluctuating workloads and the large capital investment required. VI also involves several disadvantages like the difficulties in achieving the economies of scale that external specialist suppliers can; the *risk of complacency*, which results from the removal of external competition; the potential loss of operational flexibility; and the difficulties in maintaining a core competencies focus. (Slack and Lewis, 2002, as cited in Beach *et al*., 2005).

2.6.3 Partnering

Supply chain partnering is associated with creating more value than market relationships and it offers the possibility of achieving the closeness and coordination that can be achieved through VI, but without requiring the significant investment; together with the service performance and continuous improvement benefits of traditional market trading. Furthermore, it avoids the transaction costs related to managing larger supplier networks (Beach *et al*., 2005).

Beach *et al*. (2005) explain the two types of partnership in construction, which are long-term (strategic) partnering and short-term (project) partnering; the former is intended to last for significant periods of time, including several projects and seek gains in the long -term; while the latter are created and sustained for the duration of a specific project and focus on short-term benefits.

Moreover, Beach *et al*. (2005) studied the development of supply chain partnerships in the UK construction industry, examining the partnering experiences of main contractors with main subcontractors for structural steel products. In this study, clients were found to be the major barriers to the industry's adoption of partnering. Even if some main contractors have already taken steps to apply the principles of partnering to their suppliers, which includes main subcontractors, it is still a concept that doesn't seem to pass below the Tier 2 in the supply chain.

Vrijhoef (1998) notes that partnering is matter of enthusiasm rather than contracts since contracts only establish the legal framework of formal relationships. In the end, partnering is a matter of teambuilding and creating a win-win situation.

Benefits of partnering

In their research, Beach *et al*. (2005) identified a number of tangible and intangible benefits that result from partnering, which are listed in Table 2.6.

Table 2.6. Benefits of partnering in the construction industry (Beach, Webster and Campell, 2005, p. 614).

Tangible benefits	**Intangible benefits**
Lower bidding prices	Increased willingness to share risk
Reduced costs	Increased confidence of success
Fewer disputes	Reduced exposure project risk
Reduced claims	Enhanced transfer of practices and processes to other projects
Improved time-scales	Improved cooperation
Reductions in design cycle	Increased understanding of parties
Fewer schedule overruns	Less adversarial relationships
Improved quality	Better team spirit
improved design	More effective communication
Fewer defects	Improving overall company competitiveness
Reduced supervision costs	Increased customer satisfaction
Fewer cost overruns	Improved employee skills
Improved return on resources	Improved motivation of employees.
Increased market share	

Same benefits, different industries

In the manufacturing industry, some benefits of include reductions in total costs and inventories, win-win situations, increased information flows, reduced risk and uncertainty, and more profitability (Yu *et al*., 2001; Maloni and Benton, 1997). Other advantages of partnering comprise higher quality and cost effective products, shorter delivery times, reduction of adversarial attitudes, decreased shipping errors, and mutual problem solving (Maloni and Benton, 1997).

When comparing to the benefits listed by Beach *et al*. (1997) in Table 2.6, we can find similarities between the benefits of partnering in the manufacturing industry and the construction industry. However, the construction industry has benefits that are different from the manufacturing industry, such as: fewer cost and schedule overruns, fewer disputes, and reduced supervision costs. This difference can be due to the fact the building sector works with projects rather than in the production of a single product multiple times. In construction, it is common to have schedule and cost overruns due to many environmental and internal factors that affect the project directly and indirectly, and because every project is unique in terms of project team, size, location, stakeholders, and cost, the use of learning curves is not a common practice and new uncertainties are present within every project.

2.7 Small-to-medium-sized enterprises

The OECD Statistics Directorate (2005) defines small-to-medium-sized enterprises (SMEs) as "non-subsidiary, independent firms which employ fewer than a given number of employees." The number varies across countries, but the most frequent upper limit is 250 employees, as in the European Union (OECD Statistics Directorate, 2005). Nonetheless, in the United States, SMEs have an upper limit of 500 employees. Table 2.7 presents the different sizes of SMEs, their number range of employees, and their financial ceilings.

Table 2.7. Characteristics of SMEs (OECD Statistics Directorate, 2005).

	Employees	**Maximum turnover**	**Balance sheet maximum**
Medium enterprises	50-249	EUR 50 million	EUR 43 million
Small enterprises	10-49	EUR 10 million	EUR 10 million
Micro enterprises	<10	EUR 2 million	EUR 2 million

SMEs are a large source of dynamism, innovation and flexibility within the economies of industrialised countries and emerging and developing nations, since they contribute significantly to economic development and employment creation (Koh *et al*., 2008). In the supply chain context, they can have different functions such as suppliers, distributors, producers and customers (Hong and Jeong, 2006).

2.7.1 SMEs in a supply chain management context

The survival and growth of SMEs can be difficult in the current competitive business environment, due to the increasing customer demands and changes in business models that involve lower production costs and increasing customer value. The increasing challenges lead to the need of forming and managing relationships with other business organisations (Thoo *et al.*, 2012).

SMEs may face resource gaps in skills, knowledge, or technology, reason why they depend on the capacity of their suppliers. Supplier relationships are often essential to satisfy customer requirements when the demand is high, since they can boost SCM performance (Thoo *et al*., 2012). Also, a lack of resources or a lack of means to grow motivates SMEs to embark on partnerships with other supply chain participants (Nooteboom, 1994, as cited in Rezaei, 2012).

Moreover, a big advantage for SMEs is their more horizontal structure with less management levels, which allows for an easier application of organisational change, since there is a shorter communication line across the teams within the firm. Initiating and implementing changes is easier for SMEs in comparison to monolithic companies, since their small size enables them to be easily managed and flexible in adapting a new way of working, and to try new and untested technologies thanks to their flexibility (Thoo *et al*., 2012).

Thoo *et al*. (2012) list some barriers that could influence negatively the implementation of SCM in SMEs, these are: SMEs' limited financial capacities, management and personnel dimensions; limited use of information technology; large customer dependence; and being bound by economic, governmental, political, socio-cultural and technological external pressures.

Comparing SMEs to LEs

Many studies of SCM focus on practices of large firms, while small firms are treated mostly from the viewpoint of larger firms (Lambert and Cooper, 2000). Hong and Jeong (2006) compare SMEs and large enterprises (LEs) in different categories related to SCM, one of them being their goals regarding SCM processes; pointing out that LEs focus on operational effectiveness with multiple performance outcome requirements and within a big scope of information and product flows, while SMEs are focused on performance outcome requirements at a smaller scope.

Furthermore, LEs use command and control towards smaller suppliers and distributors, and collaborate with more dominant ones; and, on the other hand, SMEs either accept command and control or use their negotiation strengths with LEs (Hong and Jeong, 2006). Another difference stated by Hong and Jeong (2006) is that SMEs focus on specific core competencies development, while LEs develop multiple core competencies. Lastly, with respect to key strategies, LEs form strategic alliances with suppliers and distributors and have impact downstream and upstream in the supply chain; while SMEs focus on a specialised market.

Supply chain management practices of SMEs

SMEs have significant impacts on supply chain processes, since they play different crucial roles within a supply chain. They are involved in value creating activities, such as the supply raw materials, production, and distribution of completed products to customers (Hong and Jeong, 2006). An SME that focuses on a value-added strategy and their position in the supply chain is high, can stay in the business as dominant members, due to their strong negotiating position and their internal competencies in relation to value creation capabilities. SMEs that have a high position in the supply chain hold dominant value qualities, such as: reputation, brand image, management leadership and relational strengths (Hong and Jeong, 2006).

A poor fit between SMEs and supply chain management

According to Meehan and Muir (2008), SMEs can benefit from SCM, however, several studies have proven that SMEs do not benefit always from SCM, such as that of Arend and Winser (2005), where the authors explain that SCM can be negatively associated with SME performance

On one hand its seems that SCM can offer SMEs benefits related to quality, cost, customer service, leverage and risk reduction; and on the other hand, SCM can also expose the SME to larger management and control threats, while reducing its own distinct advantages (Arend and Wisner, 2005). The authors emphasise that studies regarding SCM do not contemplate the size of the firms involved, therefore, they focused on comparing the implementation of LEs to that of SMEs and it appears that SMEs implement SCM in a less deep manner, which results in fewer advantages for the SME.

Arend and Wisner (2005) explain that it is possible that the poor fit between SCM and SMEs is due to four possible reasons: The first one is that SMEs are not suited to implement SCM in an effective way. The second reason is that, in general, SMEs do not use SCM in a strategic manner. The third reason is concerned the context, since SMEs often pursue SCM in easier circumstances; it appears that SMEs that focus on short-term and easy SCM initiation without establishing a good partner selection criteria have a fall in performance. Finally, a fourth

explanation is that sometimes, SMEs want to stay key suppliers to their customers, so when they are pushed into forming supply chain partnerships by their customers, they accept to remain in this position, however, SMEs can suffer performance loss.

Furthermore, Rezaei (2012) made a study focusing on both organisational and functional perspectives of SMEs and SCM. Organisational refers to partnerships being formed by organisations as a whole, while the functional perspective refers to partnerships being formed by business functions; such as marketing and sales, R&D, logistics and purchasing, production, and finance; within the organisations (Rezaei, 2012). It was determined that SMEs could benefit from supply partnerships when implemented in specific business functions only, for example, the study shows that if an SME wants to improve its performance in R&D, then it is suggested to have a functional partnership in R&D.

2.7.2 SMEs in construction supply chains

SMEs account for over 99% of the overall population in each of the main industry sectors (Department for Business, Innovation and Skills, 2015), including construction. In the context of construction supply chains, SMEs are most of the time located on the second or third tier and are mainly specialist subcontractors and suppliers. Edkins (2009) states that construction is an example of a project-dominated industry where increased specialisation is needed in order to achieve certain tasks, requiring the management of highly specialised service providers.

Dainty *et al*. (2001a) argue that the *Rethinking Construction Report* (Egan, 1998), which was released in the UK as a start towards the implementation of initiatives of the manufacturing industry in the construction industry, pays little attention to the integration of SMEs of the subcontractor and supply tiers. Studies have only shown how effective SCM practices can be when implemented by clients, consultants and large contracting organisations (Dainty *et al*., 2001a)

Egan (1998) advised to use partnering, integrated production teams, and persistent monitoring of the effect of performance improvement. Many positive examples of partnering between main contractors and clients can be found in literature, however, partnering agreements between main contractors with subcontractors or suppliers are uncommon. SCM performance improvement initiatives seem to be taken by large companies, while subcontractors and suppliers provide very little decision-making contributions (London *et al*., 1998, as cited in Dainty *et al*., 2001a).

Subcontractors and suppliers within partnering and strategic alliancing have largely been ignored, despite of their role and influence in the industry (Dainty *et al*., 2001b). Notman states that the lack of acknowledgement of the importance of SMEs is made more evident with the lack of attention given to them within the partnering literature (as cited in Dainty *et al*., 2001a). The subcontractor is subject to pressure due to his subordinated position, due to contractual responsibility when conflicts emerge during projects. As a result, relationships between main contractors and subcontractors are adversarial (Latham, 1994). The process seems to be also affected by the prevalence of labour-only subcontracting, which generates multiple tiers of subcontractors

within a single project, creating a barrier for a successful integration of the parties involved in the project process (Dainty *et al.*, 2001a).

In addition, SMEs have contributed in a very low scale in the implementation of SCM in the construction industry in comparison to LEs (London *et al.,* 1998, as cited in Dainty *et* al., 2001b). Given this situation, Dainty *et al*. (2001a) list changes that main contractors need to make to lessen barriers to subcontractor integration in the supply chain, by including fair payment, a need to focus on value rather than price, generating trust, with less reliance on contracts, and more education on partnering, among others.

2.8 Project risk management

Change is present in projects and it cannot be avoided. It can cause unsought effects, such as failing to meet deadlines and cost and quality targets. By applying the principles of risk management, engineers can improve the management of change. Time and cost overruns are risks that can weaken the economic case for a project, turning a potentially profitable investment into a considerable loss (Smith, Merna and Jobling, 2006). According to Smith *et* al. (2006), risk management is not about predicting the future, but about understanding the project and making better decisions regarding its management, being a possible decision to abandon the project completely.

2.8.1 Introduction to risks and project risk management

Risk, in a project context, can be defined as "the chance of something happening that will have an impact upon project objectives" (Cooper, Grey, Raymond and Walker, 2005, p. 3). Risk is given several definitions in literature, depending on the context it is used. The definition of Cooper *et al*. (2005) refers to engineering projects. *Uncertainty* is also a common term when dealing with risk management, however, it has a different meaning than risk. Uncertainty it is the chance of an event from happening from which not much is known, except for the idea that it may occur (Smith *et al.,* 2006).

Project risk management (PRM) is an actual process to make decision within project management (Smith *et al*., 2006, p. 2). PRM is used in projects with the purpose of identifying risks, assessing them, and choosing the best treatment strategies. PRM brings benefits to projects due to the minimisation of risks that would be an obstacle towards reaching project objectives and by assisting in the identification of opportunities that could be exploited. With PRM, project managers can set priorities, allocate resources and implement actions to reduce risks that would affect the project (Cooper *et al*., 2005).

Merritt and Smith (as cited in Munier, 2014, p. 1) define the PRM procedure as "the set techniques for controlling the uncertainty in a project". PRM is not an exact science and is subject to the specific conditions of a project, even in comparable projects (Munier, 2014). Furthermore, the PRM process is continuous and is repeated in the different project stages, and even several times within a project stage, since, as more knowledge becomes available, managers become aware of more possible risk events.

Risk sources

The US Department of Transportation (2013) (as cited in Munier 2014, p. 6) identify different aspects that can be considered sources of risk:

- Performance, scope, quality, and technology issues
- Environmental, safety, and health concerns
- Scope, cost, and schedule uncertainty
- Political concerns

Internal and external risks

Two different types of project risks are taken into account in PRM, these are internal and external risks. Internal risks are those inherent to the project or the firm developing it, and therefore, they can be considered manageable. Examples of internal risk causes are: an unclear scope, the contractor doesn't have enough equipment, uncertainties concerning unavailability of data, new technologies, overseas suppliers, cash flow problems, problematic relationship with the project owner, project site is isolated, and environmental impact watch, among others (Munier, 2014).

External risks, on the contrary to internal risks, are external to the firm and the project, and, for that reason, are very difficult or even impossible to manage. Examples of external risk causes are: government policies, weather conditions, supplier delays, volume of sales of the product to be manufactured by the project and the prices, inflation, political problems, religions, and differing site conditions, among others (Munier, 2014).

Areas of project risks

There are areas of a project with more risk than others, reason why identifying the riskiest is important. According to Munier (2014), risks are commonly found in the following areas:

- Technical
- Execution (Performance)
- Economy/Financing
- Schedule
- Cost
- Environment Societal Opinion
- Quality
- Communications
- Legal
- Closing
- External factors

2.8.2 PRM process components

The PRM process consists of six general steps. Figure 2.8 shows that steps described in ISO 31000:2009 standard, developed by the International Organization for Standardization, which is a standard-setting body composed of representatives from several organisations of national. With ISO 31000:2009 it is intended to harmonise the risk management processes for existing and future standards, by providing a common approach in support of standards dealing with specific risks and/or sectors, and it does not replace those standards (ISO, 2013).

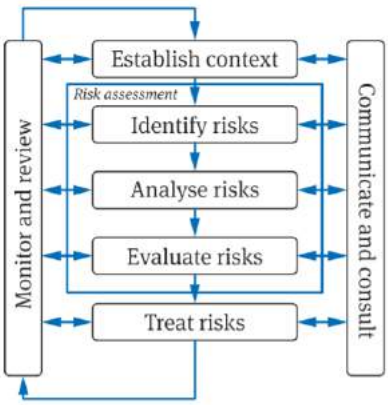

Figure 2.8. The ISO 31000:2009 risk management process. Reprinted from *ISO 31000: Risk management – A practical guide for SMEs* by J. Lark. Switzerland: ISO 2015.

2.8.3 Opportunity management

Risk management has not only the objective of identifying, analysing and responding to a risk to minimise adverse effects, but should also be implemented for maximising positive events. Traditional PRM in construction involves the identification and management of both negative and positive risks. Nonetheless, the view of risk is in many cases negative, mainly portraying risks as *threats* with adverse consequences on project targets. There is also an upside to risk, which is known as an *opportunity*. Munier (2014) states that the acceptance of the possibility of a risk event occurring can lead to discovering sources of opportunity and a successive application of opportunity management.

Table 2.8. Generalising threat responses to deal with opportunities. Adapted from "Effective Strategies for Exploiting Opportunities", by D. Hillson, 2001, Proceedings, *Project Management Institute Annual Seminars and Symposium*. Nashville, Tennessee.

Threat response	**Generic strategy**	**Opportunity response**
Avoid	Eliminate uncertainty	Exploit
Transfer	Allocate ownership	Share
Mitigate	Modify exposure	Enhance
Accept	Include in baseline	Ignore

Opportunities, on the contrary to threats, can have a beneficial effect on project objectives. Unfortunately, professionals often pay more attention to negative risks, which is why, in literature, the presence of risk response/treatment strategies focusing on threats (i.e. accept, avoid, mitigate, and transfer) is common (Hillson, 2001). Hillson (2001) mentions that the treatment strategies seen in common practice are not applicable for managing opportunities, reason why he describes four risk response/treatment strategies that can be used when identifying opportunities that can be equivalent to those used for negative risks (Table 2.8).

2.9 Supply chain risk management

It is essential for companies to plan for disruptions and to develop contingency plans as they design or redesign their supply chains. "A *supply chain risk* is an event that adversely affects supply chain operations and, hence, its desired performance measures" (Tummala and Schoenherr, 2011, p. 474).

PRM has been proven to be useful when applied for individual project decisions, however, with supply chain risk management (SCRM), the broader context of the supply chain is considered. As in PRM, the likelihood of occurrence of the identified risk factors is assessed, together with the seriousness of the consequences (Tummala and Schoenherr, 2011).

2.9.1 Introduction to supply chain risk management

Nowadays, supply chain structures are becoming increasingly lengthy and complex, reflecting the dynamic and global marketplace, with multiple physical and virtual relationships, and multiple internal and external interfaces (Asbjornslett, 2009). They have different shapes with lateral and horizontal interconnections and two-way exchanges within the upstream and downstream activities that take place among the supply chain members (Jüttner, Peck and Christopher, 2003).

SCRM aims to identify the potential sources of risk and implement appropriate actions to avoid or contain supply chain vulnerability (SCV), serving also as a competitive advantage, and therefore, it can be defined as "the identification and management of risks for the supply chain, through a co-ordinated approach amongst supply chain members, to reduce SCV as a whole" (Jüttner *et al.*, 2003, p. 9). Firms are not only vulnerable to disruptions in their own assets, but also to disruptions to their suppliers, customers, transportation providers, and communication lines (Sheffi, 2001).

SCRM is not only about analysing, assessing and managing internal risks and trying to plan for business continuity for the own company; its purpose is to widen the approach to the chain of suppliers and suppliers' suppliers. As a proactive approach, it involves suppliers and motivates them to implement SCRM as well, which guarantees a further spread upstream. Therefore, the approach is not just about analysing and assessing suppliers, but about making them implement it as well (Norman and Jansson 2004).

2.9.2 SCRM process components

Tummala and Schoenherr (2011) state that the process starts with the presence of internal and external risk drivers and, thereafter, the SCRM process can be divided into three phases:

- Phase 1, which includes risk identification, risk assessment and risk measurement;
- Phase 2, that includes risk evaluation and risk mitigation and contingency plans; and
- Phase 3, which involves risk control and monitoring.

Some examples of potential risk treatment solutions are listed by Jüttner *et al*. (2003) in their framework for directing future research in SCRM and can be found in Table 2.9.

Table 2.9. Risk treatment strategies in supply chains. Adapted from "Supply chain risk management: outlining an agenda for future research," by U. Jüttner, H, Peck, and M. Christopher, 2003, *International Journal of Logistics Research and Applications*, 6(4), p. 210.

Risk treatment strategy	Examples
Avoidance	○ Dropping specific products/geographical markets/supplier and/or customer organisations.
Control	○ Vertical integration ○ Increased stockpiling and the use of buffer inventory ○ Maintaining excess capacity in production, storage, handling and/or transport ○ Imposing contractual obligations on suppliers
Cooperation	○ Joint effort to improve supply chain visibility and understanding ○ Joint efforts to share risk-related information ○ Joint efforts to prepare supply chain continuity plans
Flexibility	○ Postponement by delaying a decision ○ Multiple sourcing, which is a traditional form of managing risk by spreading risk ○ Localised sourcing with short lead-times and potential for quick responses

2.9.3 Classification of supply chain risks

Different classifications for supply chain risks can be found in literature, reason why Araújo, Kamel and Alexandre (2014) proposed a supply chain classification system based on the literature written by different authors and it is shown in Figure 2.9. The main components of the classification are the processes of the SCOR model, which is a model that describes the business processes required to satisfy a customer's demands. Descriptions and examples for each category are listed in Appendix 2.D.

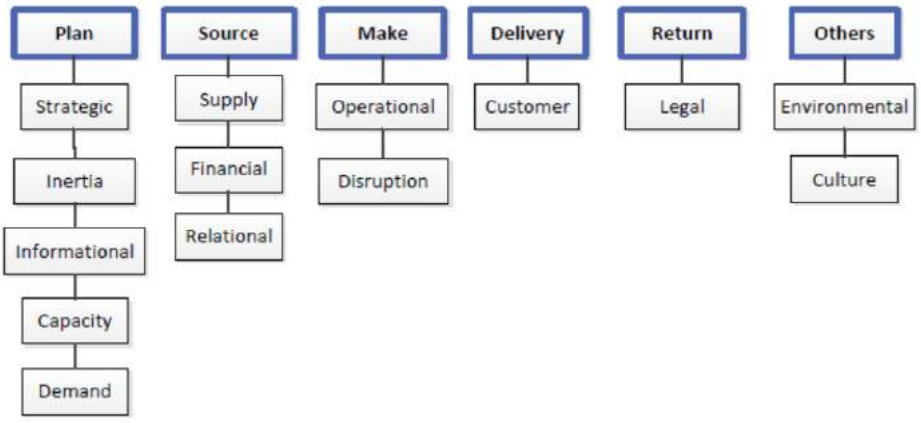

Figure 2.9. Proposed supply chain risk classification system. Adapted from "Supply chain risk classification: discussion and proposal", by D. Araújo, T. Kamel and M.S. Alexandre, 2014, *International Journal of Production Research*, 53(22), p. 6885.

The system includes 14 types of risk that describe the SCVs to which a supply chain can be exposed. It indicates the process in which the risk can occur among the plan, source, make deliver and return processes (Araújo *et al.*, 2014).

SCOR stands for *Supply Chain Operations Reference* and the model's processes are Plan, Source, Make, Plan, Deliver and Return. The six processes are performed by each company in the supply chain. Deliver of one party is the Source of the next party in the supply chain, and so on (see Appendix 2.E for more information on the SCOR model).

2.10 Risk management in the construction industry

The construction industry, with its complex and dynamic project environment, is subject to high uncertainty and risk. It is vulnerable to different types of risk, such as technical, socio-political and business risks. Even though there is an awareness of the vulnerabilities of the industry, history shows innumerable failures in projects with respect to quality and operational requirements, cost overruns and overwhelming delays in schedule. Effective practices of risk management for construction projects is still a challenging job for professionals in the sector (Ehsan, Mirza, Alam and Ishaque, 2010).

2.10.1 Project risk management in construction

Risk is immanent within all the activities and processes in a project. In the construction sector, which is a project-based industry, a common way of managing risks is by implementing project risk management (PRM). It includes activities that aim to maximise the consequences associated with positive events and to minimise the impact of negative events (Ehsan *et al*., 2010).

In construction projects, the three main targets are cost, time and quality, and they are subject to risk and uncertainty. Project managers should undertake or propose actions which eliminate or reduce the impact of risks before they occur. "Risks should be taken care of if they occur when this is possible and cost effective" (Smith *et al*., 2006, p. 2). It is possible to prevent risk by identifying risk drivers in a timely manner; this way they can be identified and managed before the risk event and its consequences occur.

Factors affecting risk

According to Ehsan *et al*. (2010), there are several factors affecting risk in construction projects, these are:

- History, which means that the more times projects of similar nature are realised, the less the risk;
- Management stability, relating to the vision and direction that the management team has to share in order to achieve goals;
- Staff expertise and experience, referring to working knowledge and experience in the area;
- Team size, since there is a tendency for more problems when teams are too large, e.g., due to communication problems;
- Resource availability, since resources help the team in securing against risks;
- Time compression, meaning risks are magnified if there is a highly compressed time schedule and, with more flexibility and time available, there is more opportunity to treat the risks; and
- Complexity, since there are more risks in highly complex projects.

Risk categories

Furthermore, Ehsan *et al.* (2010) categorise risks into broad categories, which are:

- Technical risks, such as inadequate site investigation, incomplete design, appropriateness of specifications, uncertainty over the source and availability of materials;
- Logistical risks, including availability of sufficient transportation facilities and of resources such as construction equipment spare parts, fuel and labour;
- Management related risks, for example, uncertain productivity of resources and industrial relations problems;
- Environmental risks, including weather implications and natural disasters;
- Financial risks, involving availability and fluctuation in foreign exchange, delays in payment, inflations, local taxes, and repatriation of funds; and
- Socio-political risks, involving constraints on the availability and employment of expatriate staff; customs and imports procedures, disposal of plant and equipment and insistence on use of local firms and agents.

Common sources of risk

Ehsan *et al.* (2010) argue that common sources of risk in construction projects are:

- Changes in project scope
- Design errors and omissions
- Inadequately skilled staff
- Subcontractors
- Inadequate contractor experience
- Uncertainty about the fundamental relationships between project participants
- New technology
- Unfamiliarity with local conditions
- Force majeure

Response to risk

In construction, there are five common categories of risk response strategies. Ehsan *et* al. (2010) describe them as follows:

- Accepting the risk, which means to become aware of the risk but not doing anything about it;
- Risk avoiding, referring to not doing a part of the project in order to prevent completely that risk, affecting thus, the scope of the project;
- Monitoring the risk, which can be done by employing a predictive indicator and having contingency plans in case the risk fires, such as by having a contingency fund for unforeseen cost overruns;
- Risk transferring, which is commonly done by purchasing an insurance for risks such as theft and fire, but it comes in other forms such as fixed price and fixed schedule contracts which include penalties in case of overruns, which is the reason why higher bids are made; and
- Risk mitigating, involving actions after the risk event occurs.

2.10.2 Supply chain risk management in construction

According to O'Brien (2001), SCM does not only improve supply chain performance, but is an aid to identify risks of disruptions in the network in an end-to-end coverage. A good SCM includes the principles of risk management, however the discipline of SCRM is not yet structured in the construction industry. Nonetheless, more knowledge on SCM helps to better predict risks of disruption and to implement contracts that include the true costs of changes, which enhances trust and information sharing (O'Brien, 2001) between a collection of project actors that are linked to achieve delivery of a project for a client (Edkins, 2009).

In construction, there are many risks that bring negative consequences to projects. There are also risks of commercial nature that have direct effects on cost or profitability, and how a company is affected depends on its position in the supply chain (Edkins, 2009). According to Edkins (2009), the failure of large construction projects can be due to the incapability to allocate risks appropriately in the supply chain, together with the issues in flows of information and the power position of the supply chain members. A lack of information flow can lead to consequences that go downstream from decisions coming from upper levels. Risks need a suitable management, which involves managing a varied set of relationships and for this to be possible, working recurrently with the same parties needs to become a more common practice (Edkins, 2009).

Edkins (2009) describes contracts as a formal way of establishing expectations, roles, responsibilities, and providing incentives and penalties. From a management perspective, they are a key component of risk management. However, within a SCM approach, the basis for the management of the construction project is the management of the project relationships. Therefore, it becomes clear there are two risk management routes: use of the contract or management of the relationship.

2.10.3 Unfair distribution of risk and reward in the construction industry

The management of risks is not the same in an SCM approach than in traditional PRM. In PRM, there is a commonly used treatment strategy known as *risk transfer*. Risks are usually allocated to one party, which should be the one best able to handle it. Unfortunately, in construction, risk is often allocated on the foundation of commercial and negotiating power, meaning that stronger parties will allocate the risk in a way that they don't have to deal with it, leaving it and its consequences in hands of weaker parties, such as subcontractors and suppliers.

Allocating risk to one party is not ideal in a SCM approach, since a disruption at any location of the supply chain can have consequences that affect not only one actor, but have serious effects on the entire network and project outcomes. One of the objectives of SCM in construction is the elimination of unfair and inappropriate risk transfer, and proposes to deal with risk in a collaborative manner instead, which is known as *risk sharing*.

This is corroborated by Loosemore and Lim (2015), who put an emphasis on the fact that there is a culture of opportunistic behaviour and risk transfer which commonly begins when the client relieves from unmanageable risks by transferring them to contractors and not willing to pay suitable risk premiums. The result of this is that main contractors pass these risks down the contractual chain through contracts with subcontractors who are even less prepared to manage them (Loosemore and Lim, 2015). Smaller subcontractors often lack the

bargaining power to defend themselves from the strategies of larger contractors, reason why they don't include the high costs of these risks in their quotations, contributing to the inequitable redistribution of risk and reward through the construction supply chain (Loosemore and Lim, 2015).

According to a study by Uher (as cited in Loosemore and Lim, 2015), in the Australian construction industry, the large majority of the subcontractors that responded to the survey perceived their subcontract conditions as unfair, and had factored a significant degree of risk allowance, ranging from 6.6% to 8.5%, into their bids. A study by Zaghloul and Hartman (as cited in Loosemore and Lim, 2015), revealed that in the Canadian construction industry, there is a high level of mistrust and that contractors had a factorised a risk premium of 8-20% in their bid.

Regarding distribution of rewards, Winch (as cited in Loosemore and Lim, 2015) argues that each firm in the construction supply chain competes to obtain the greatest proportion of the client's value-stream, however, the power differences and tactical strategies between parties ensure that in most projects, this value may not be gathered proportionately or fairly through the supply chain (Loosemore, 1999, as cited In Loosemore and Lim, 2015). This also results in contracts being awarded not to those with the best value, but to those with the cheapest price.

Suggestions to solve the problem

Loosemore and Lim (2015) argue that from a practical perspective, the solution to this problem seems to depend on supply chain integration and on changing to perspective of professionals regarding subcontracting models; instead of horizontally dispersed, the authors propose vertically integrated business models to increase efficacy. For fairness regarding risk and reward, the construction industry requires for businesses and their supply chains to work in new organisational alignments, in a way that they can defy typical competitive relationships (Loosemore and Lim, 2015).

The results obtained my Loosemore and Lim (2015) indicate that new contractual structures and organisational relationships could be solutions for these challenges. "Notions of collaboration will need to replace traditional competition as a way to share complementary ideas, resources and capabilities to mutual advantage" (Loosemore and Lim, 2015, p. 322). In addition, new communication technologies could also ease the process by enhancing communication and allowing integration and collaboration.

Procurement reforms are also of extreme importance, i.e., partnerships, alliances and relational contracting appear to be mechanisms that enable a more integrated way of working. The results of these reforms would be deeply integrated supply chains where all members work cooperatively to share risks and rewards; in addition to innovation achieved in an open, transparent and collaborative environment; collective responsibility where there is interest on the supply chain as a whole; and where resources are shared and used in the best manner (Loosemore and Lim, 2015). With supply chain integration, not only there will be more fairness, but also improved trust and reduced levels of conflict.

Part II
Research methodology

Chapter 3. Research methodology

The objective of this chapter is to present the research methodology chosen and explain why this methodology in particular was selected. The quality tests for validity and reliability can be found in Appendix 3.A.

3.1 Case study methodology

The methodology selected for this research is a case-study methodology, which is a qualitative research method. With a case study methodology, the researcher answers questions about a social phenomenon in an in-depth manner and within its real-life context (Yin, 2013). This methodology consists of an *intensive research*, where many variables of a case are studied, which is the contrary to *extensive* research, that includes many units of study and only few variables are studied (Swanborn, 2000).

Moreover, a research can be independent, a pre-research or an after-research. It can also be theory-oriented or practice-oriented. This study was an independent and theory-oriented research. According to Swanborn (2000), an independent research has a whole stand on its own. When it is *theory-oriented,* the goal is to generalise from a number of cases (Swanborn, 2000) and contribute towards the development of theories in a certain field, that is, to develop a new theory or to complement an existing theory due to the existence of *gaps* (Verschuren, Doorewaard and Mellion, 2010). A research can also be descriptive, explanatory and exploratory (Yin, 2013). This study consisted of an exploratory research since it has the objective of exploring a phenomenon in the collected data.

Yin (2013) mentions that a research can consist of a single case study or of multiple-case studies. He further discusses that a multiple-case study is preferred over a single-case study due to the analytic benefit it encompasses. Case studies can also be either be *holistic* or *embedded*. Holistic design refers to when the global nature of the unit of analysis is examined. On the other hand, embedded design refers to when a unit of analysis contains subunits to be studied. In this design, the subunits are studied, but the researcher needs to go back to the main unit of analysis. If no investigation is done at the level of the original case, then the project becomes a multiple-case study (Yin, 2013).

Table 3.1. Case study methodology.

Case study methodology	
Phenomenon of study	Unfair distribution of risk in construction supply chains affecting SMEs
Intensive or extensive research	Intensive
Context of the research	Theory-oriented and independent research
Descriptive, exploratory or explanatory	Exploratory
Single or multiple	Single
Holistic or with embedded units	Embedded units
Research design	Replication logic

For this research, a single case study with embedded units was chosen and the research design was based in *replication logic*. In r*eplication logic*, units of study must be carefully selected either to predict similar results (a *literal replication*) or to predict contrasting results but for anticipatable reasons (a *theoretical replication*) (Yin, 2013).

Replication logic differs from *sampling logic*. *Sampling logic* is implemented through surveys that a selected group of respondents answers, and their answers are used to reflect the entire universe or pool; this approach is common when the researcher is trying to determine the prevalence or frequency of a particular phenomenon; and it involves following statistical procedure for selecting a specific subset of respondents to be surveyed (Yin, 2013). Table 5.1 shows the characteristics of this research.

Case study research has its disadvantages and they cannot be ignored when choosing this type of methodology. Yin (2013) mentions some concerns that are related to case studies as a research method:

- Lack of rigor, when the researcher doesn't follow systematic procedures or has equivocal evidence or biased views;
- Little basis for scientific generalisation, meaning that case studies are generalizable to theoretical propositions but not to universes; and
- Case studies can take too long.

3.2 Research design

The main components of the research are the following:

1. Existing Theory
2. Research questions
3. Units of analysis
4. Cross-unit analysis
5. Proposition building

3.2.1 Existing theory

Figure 3.1 shows the research design, where a link can be made between the theory explained in the literature review (Chapter 2) and the research methodology.

3.2.2 Research questions

The second component includes the main research question and sub-questions, which were an outcome of the exploration of the different topics included in the literature review :

MQ: What is the behaviour of risk sharing in partnerships of construction supply chains, taking the perspective of a small-to-medium-sized enterprise?

SQ 1: What are the main drivers for companies in construction supply chains to form partnerships?

SQ 2: What are the main supply chain risks in construction supply chains?

SQ 3: How are supply chain risks in construction supply chains treated?

SQ 4: How do small-to-medium-sized enterprises benefit from handling supply chain risks?

The research questions will serve as a guide towards achieving the research objective.

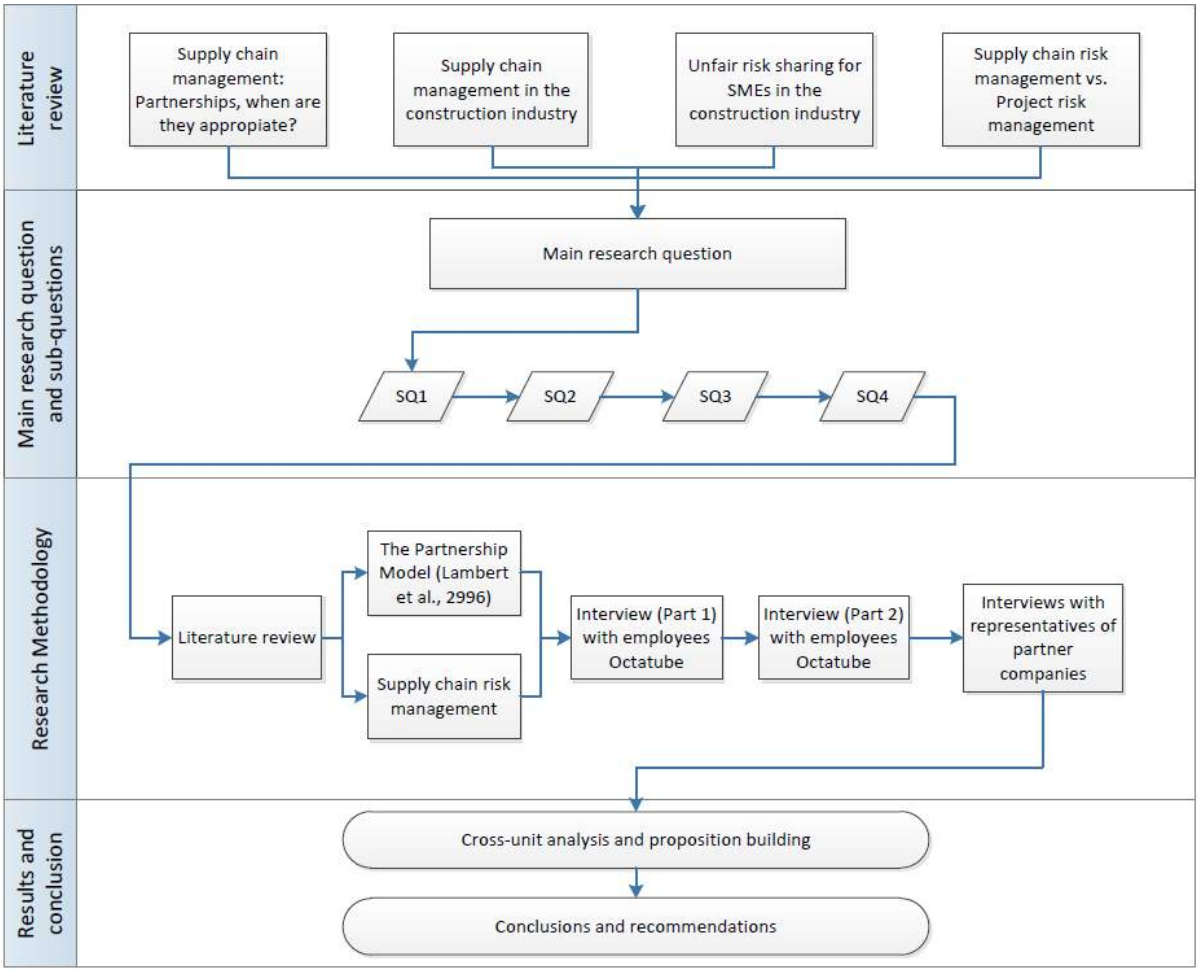

Figure 3.1. Research design.

3.2.3 Units of analysis

The purpose of this component is to define and bound the units of analysis. Yin (2013) explains that *defining the case* consists of selecting an individual, organisation, process, programme, institution or an event to be studied; while *bounding the case* consists of defining the boundaries of the case study. The research questions can help in identifying the relevant information to be collected about the unit(s) of analysis. Swanborn (2000) argues that there is no defined number of cases to be chosen, nonetheless, the more cases the better, since trust and validity of the results grow and the legitimacy of a model or theory can only be increased.

The case study: the focal firm of the supply chain

The focal firm (FF), was selected as the *main case* given the fact that this firm is an SME in the construction industry that has relationships with different types of suppliers and clients. The relationships range from arm's-length relationships to high levels of partnership. The fact that FF is a Design-and-Build company made it possible to choose from a variety of companies with whom the firm has relationships of different kinds. FF is a high-class design, engineering and manufacturing company, as well as a specialised (sub)contractor. The company is located in The Netherlands and has over 90 employees working in the different departments.

The selected units of study

A group of direct (or first-tier) suppliers and clients of FF were chosen to form part of the *embedded units of analysis*. More specifically, the relationship between FF and those selected suppliers and clients were the units of study. It was important that within FF, employees from the different departments were going to be accessible for interviews and, thanks to the good relationships with the selected units of analysis, it was going to be feasible to interview representatives from those companies, as well.

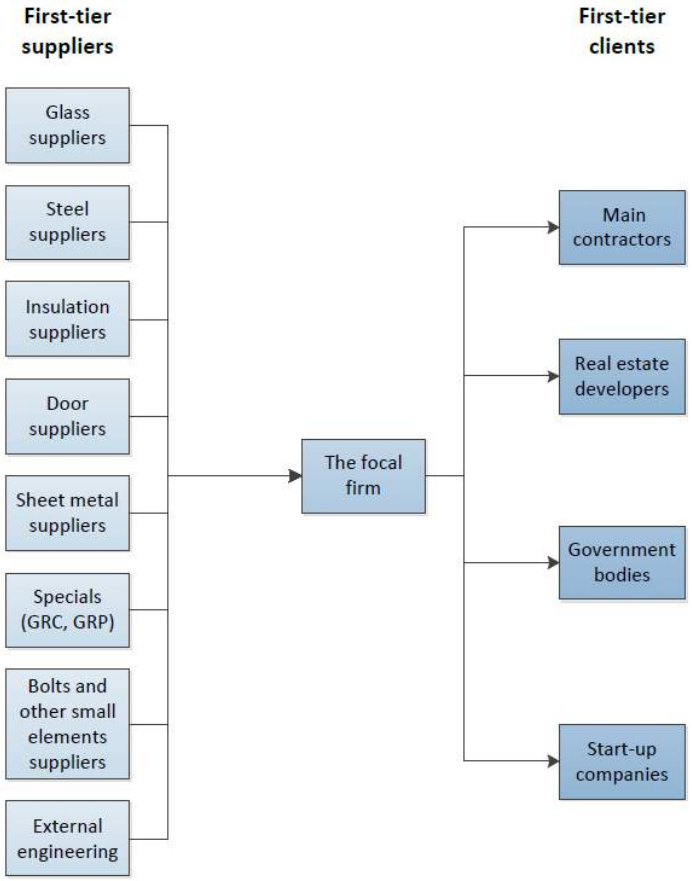

Figure 3.2. Overview of the focal firm's supply chain showing the first tier of suppliers and clients.

Figure 3.2 is based on Figure 2.1 (see Chapter 2) and shows a simple overview of FF's supply chain with its first-tier suppliers and clients. To select the cases, pragmatic criteria were defined. The first criterion was that a good relationship existed. Nonetheless, *good* is a vague adjective. More specifically, the criterion consisted on the selection of companies with whom there was a certain level of trust. Another criterion was the possibility for the two companies to work together in more projects in the future. A third pragmatic criterion was the quality of the collaboration towards problem-solving in past projects, meaning that companies with whom there was a high level of collaboration were preferred over those with whom there had been less collaboration. Finally, the last criterion was the possibility of interviewing a representative of the selected companies.

Criteria were also established based on substantive grounds. Swanborn (2000) mentions that units of study that differ from each other can be chosen when a certain social model has already been tested in the past, therefore, there is the possibility to examine the scope or the sensitivity of the model by varying the parameters of the

study. The relevant theories in this research have been tested in the past are: first, the need for supply chain management in the construction industry; second, the presence of unfair distribution of risk in construction supply chains affecting SMEs; and third, risk sharing as a component of supply chain partnerships. By having different types of units of study, it was going to be possible to obtain more results that could relate the type of partnership and the types of companies involved in the partnerships to the level of risk sharing.

Meetings with project leaders, staff from the sales department and the company director were held with the purpose of selecting the most appropriate units of study according to the established criteria. Before starting with the selected units, two *pilot case studies* were selected. Pilot case studies help in redefining data collection plans in respect to the contents of the data and the procedures to be followed (Yin, 2013).

Table 3.2. Units of study: clients.

	Type of client	Code	Description
1	Main contractor	MC	Construction, development and property services company.
2	Start-up company	SU	Fast-charging stations for electric cars looking to expand to other countries. Stations have glass roofs with solar panels.

Table 3.3. Units of study: suppliers.

	Type of supplier	Code	Description
1	Sheet metal supplier 1	SM1	Manufacturing company specialised in stainless steel and non-ferrous metals.
2	Sheet metal supplier 2	SM2	Company specialised in the engineering, manufacturing and installation of metal facade cladding, using mainly aluminium.
3	Glass supplier 1	GL1	A family owned company in Spain which processes glass.
4	Glazing systems supplier	GS	A company that supplies standard glazing systems, which have been tested and approved.
5	Steel supplier 1	ST1	The firm produces, builds and maintains steel construction.
6	Glass supplier 2	GL2	The firm offers a wide range of glass solutions. It produces, processes and distributes flat glass for different.
7	Steel supplier 2	ST2	The firm produces and builds steel construction.

Originally, four units of study had been selected for the research, which included the two pilot studies. However, during the course of the data collection, it became clear that a research with more validity could be conducted by including more units of study. Therefore, a larger list of units of study was made with the objective of trying to study as many of these units as possible. The list includes seven units of study plus two smaller units (last two supplier columns), which weren't completed but the data collected can be useful in drawing conclusions. Table 3.2 and Table 3.3 present a summary of the selected units of study. In both tables, the first unit of study was the pilot study.

A code was used to maintain the anonymity of each client and supplier. The codes' letter represent the service or type of company and a number is used if there are to companies of the same type.

3.2.4 Cross-unit analysis

Yin (2013) proposes five techniques for analysing the collected data out of which cross-case synthesis was selected to analyse the results of this research,

Cross-case synthesis, can only be applied if multiple cases were studied. For this research, cross-case synthesis was realised for the different units of study within the studied case. Yin (2013) suggests to create word tables that display the data from the individual cases. This way, it is possible to find similarities. Examination of the word tables will rely on argumentative interpretation.

3.2.5 Study propositions

This research is a theory-developing research, new theoretical propositions will be formulated after the data has been collected and analysed.

3.3 Data collection

The first step towards data collection process was to define the sources of data and the method of data collection. For each unit of study, interviews and surveys needed to be made. The set-up of the interviews and surveys will be explained in this section. The data collection process for this research followed the principles proposed by Yin (2013) which includes the following three principles which will be explained in more detail in this section:

- Principle 1: Multiple sources of evidence
- Principle 2: Create a case study data base
- Principle 3: Maintain a chain of evidence

Principle 1: Multiple sources of evidence

The first principle contributes in increasing construct validity. Using multiple sources of evidence is known as triangulation (Swanborn, 2000; Yin, 2013). Triangulation of data sources, or *data triangulation*, was used for obtaining information using different means. The main data sources for this research were surveys and focused interviews. Company documents and an audio file were also used as sources of evidence.

Table 3.4. Table of information included in each transcript.

Type of document	Interview transcript
Date	
Interviewee	
Company and job position of interviewee	
Company discussed	
Topics discussed	
Original interview language	
Duration	
Times reviewed	

All interviews were audio-recorded with permission of the participant. A transcript was made shortly after the interview, the next day at the most. Each transcript was reviewed at least once by listening to the recording. Each transcript included a table that contained relevant information about the interview (see Table 3.4). In the

case of not being able to audio-record the session, notes were done during the interview and reviewed and copied into a Word file immediately after the session for the information to be as accurate as possible.

Moreover, the transcripts were saved with the following name format: "Transcript Interview – *Name of interviewee – date – name of company discussed*", e.g., "Transcript interview – Sam Smith – 1 May 2017 – Blue Steel".

First round of interviews

Data sources:

- Survey with close-ended questions, with the opportunity to justify answers
- Interview with open-ended questions

The first set of interviews were done within the focal firm, the *main case*. An objective was established for each unit of study, i.e., each of the selected suppliers and clients (see Table 3.2 and Table 3.3); the objective was that at least two interviews would be done internally for each unit. The ideal and realistic goal of three interviews per unit was set. Also, it was preferred that the selected interviewees had significant experience in working with the respective company and that not all the of the interviewees per unit had the same role within the company.

The interviewee selection was done covering the four goals Maxwell (2005) lists to achieve purposeful selection:

1. Achieving representativeness or typicality of the settings, individuals, or activities selected;
2. Adequately capturing heterogeneity in the population;
3. Examine cases that are typical for theories being studied; and
4. Establish comparisons to clarify reasons for differences between settings or individuals, which can be done when having multiple-case studies.

The selection procedure of interviewees depended of each case. Participants were chosen in a way that heterogeneity could be achieved, regarding function or department they work in, but also based on their past collaboration with those companies. For clients, the most common strategy used was to ask the head of the project management department to recommend the most relevant project manager for each client, based on their experience in past projects with that specific client. The second and third interview would be selected based on what that project manager recommended. Interviewees were principally project managers and sales engineering staff, since they are the only employees that have direct contact with the client.

The selection of interviewees for the suppliers depended on the type of supplier. For glass suppliers, the glass expert in the company was interviewed, due to his experience and daily contact with those companies. For the rest, the selection depended to a large extent on what the people within the company recommended, since certain employees have more experience in working with certain suppliers, this could only be known by "asking around". Staff from the engineering, shop drawings, and production departments seemed to have more involvement with suppliers than project managers, nonetheless, all views were important and taken into account.

Table 3.5 and Table 3.6 show the list of interviewees for each unit of study. On the top row, the code given to the company is displayed in bold letters. The first column shows the number of the interview, the second column has the code of the company (FF for focal firm) where the interviewee is employed, and the third column shows the role of each interviewee.

As previously mentioned, there are two smaller units of study, which are marked with grey background. These units weren't completed since it wasn't possible to have an interview with a representative of the other firm due to their unavailability.

Table 3.5. Interviewees for units of study: clients.

MC			**SU**		
1	FF	Project manager in FF	1	FF	Project manager/engineer
2	FF	Project manager	2	FF	Head of engineering
3	FF	Head of sales engineering	3	SU	Director of network development
4	MC	Commerce & finance			

Table 3.6. Interviewees for units of study: suppliers.

SM1			**SM2**		
1	FF	Project manager	1	FF	Project manager/civil engineer
2	FF	Factory/production/stainless steel expert	2	FF	Factory/production/stainless steel expert
3	FF	Shop drawings	3	SM2	Management director
4	SM1	Management director			
GL1			**GS**		
1	FF	Glass expert/purchase	1	FF	Project manager
2	FF	Quality management	2	FF	Sales engineer
3	GL1	International sales	3	FF	Glass expert/purchase
			4	GS	President
			5	GS	International sales
ST1					
1	FF	Project manager/engineer			
2	FF	Production/assembly/steel specialist			
3	ST1	Head of sales + Some project leading and purchase			
GL2 (Incomplete unit)			**ST2 (Incomplete unit)**		
1	FF	Project manager	1	FF	Project manager/civil engineer
2	FF	Sales engineer	2	FF	Production/assembly/steel specialist

The interviews within FF were conducted with two purposes: To evaluate the type of relationship there was with the relevant company and to discuss about the risks and risk management. To cover the two purposes, the interviews were divided in two parts.

Part 1 consisted on a survey with close-ended questions, but with the opportunity to justify the selected answers. Before starting the survey, it was asked to the interviewee to give an overview of the relationship between FF and the company, and to explain his personal involvement in this relationship. Thereafter, the procedure to answer the survey was explained. The used survey is the assessment of drivers and facilitators of *The Partnership Model*, which was first introduced by Lambert, Emmelhainz and Gardner in 1996 (see Figure 2.4). The model has been explained in Chapter 2, Sub-section 2.4.2, where other two approaches where also introduced to be able to compare them and choose the most appropriate for this study. The three approaches

serve as a basis of determining whether a company should form partnerships or more collaborative relationships with other members in the supply chain.

The model of Lambert *et al*. (1996) was chosen due to the assessments it offers. It covers both drivers and facilitators, enabling the focal firm to assess its relationships with other supply chain members, to know which type of relationship/partnership there is or could be. The assessment can be found in Appendix 2.B.1. This assessment uses close-ended questions based on a scale that ranges from 0% probability to 100% probability. Each question is provided with examples that help the respondent in understanding the question. The assessment includes dichotomous questions as well (i.e., Yes or No) and in the end, all the points are summed up.

The assessment used was adapted from its most recent version, which can be found in Douglas M. Lambert's book *Supply Chain Management: Processes, Partnerships, Performance,* originally published in 2004, for which four editions have already been released, the latest in 2008. The model is used by global leading companies, increasing its reliability:

The Partnership Model provides a structured and repeatable process to effectively and efficiently build and maintain tailored business relationships that may become an asset for executives looking for competitive advantage. One example is the Wendy's and Tyson relationship, which was the basis for a 2004 article in Harvard Business Review.

(The Partnership Model, n.d.)

The biggest advantage of using this model is that it covers different topics or points of interest of tailored relationships between two companies. The questions of the assessment could be simply answered by choosing one of the numbers in the scale, nevertheless, most of the interviewees opted for justifying their answers, which made the interview achieve a higher quality and validity.

Part 2 of the interview consisted on open-ended questions about risk and risk management. The questions can be found in Appendix 3.B and Appendix 3.C; the former shows the questions asked when the interview was about a client, and the latter shows the questions asked when discussing a supplier.

Second round of interviews

Data sources:

- Interview with open-ended questions

The second round of interviews consisted on interviewing at least one representative of the suppliers and clients. The contact person had to be first contacted by an employee in the focal firm, thereafter, a meeting could me scheduled. It could also be the case that the visit of a representative due to business related issues was used as an opportunity to have an interview with that person. In case that the representative didn't consider him or herself to be the ideal person for the interview, he would contact a more suitable co-worker.

The goal for doing interviews with the representatives of the partner companies was to learn about their view on the relationship their company has with the focal firm, and ask them about the possibility of doing joint risk

management, considering the supply chain risks learned from the first round of interviews. Their view on the risks and the way risks are or could be managed was crucial for making conclusions.

The set of open-ended questions can be found in Appendix 3.D. As in the first round of interviews, the session was recorded with permission of the participant, and thereafter a transcript was made, including a table like that of Table 3.4. In the case of not being able to audio-record the session, notes were done during the interview and reviewed and copied into a Word file immediately after the session for the information to be as accurate as possible. The name of the files had the same format as in the first round of interviews.

Company documents

Data sources:

- Company documents with supplier evaluation or evaluation by client.
- Audio recording of interview with client

To gain a deeper insight within each unit of study, additional files were studied. This was specifically used for units that involved clients. In the computer system of the focal firm, files of the different projects are available, including evaluations made by clients regarding the outcome of the project. For one of the units, an audio interview from a project manager to a client was available, which was made with the objective of learning about the client journey. Information relevant to this research was included in the results.

Principle 2: Create a case study data base

All the collected data was added to the case study data base. The outline in Figure 3.3 shows how the files were organised.

- **Computer folder: "Company X" (unit of study)**
  - **Computer folder: "Transcripts and notes - Interviews Focal Firm"**
    - Word file: "Transcript interview – Sam Smith – 1 May – Company X"
    - Word file: "Notes interview – John Doe – 2 May – Company X"
    - …
  - **Computer folder: "Transcripts and notes - Interviews Representatives Company X"**
    - Word file: "Transcript interview – Peter Pitt – 3 May – Company X"
    - Word file: "Notes interview – Ali Hopkins – 4 May – Company X"
    - …
  - **Computer folder: Audio files**
    - Audio file: "Audio interview – Sam Smith – 1 May – Company X"
    - …

Figure 3.3. Digital organisation of case study data base.

Excel sheet

Also, an Excel Sheet was realised to efficiently insert the results of Part 1 of the interviews done within FF, i.e., the assessment of driver and facilitators of The Partnership Model. The goal of this was to insert the scores obtained for each question for each respondent, and to find, as a result, the type of partnership according to the answers of all respondents. The average results of each question were used to determine the result. If a respondent didn't answer one or more questions, these questions were neglected and not considered in the average. The following example makes it more clear:

Question 1 was answered by the three respondents. The points obtained from the answers were 1, 2 and 3. The average result for this question was 2.

For question 2, one of the three respondents didn't answer. The answers available were 1 and 3, while the third answer was left blank. The average result for this question was 2, since only the two answered questions were considered.

Narratives

As mentioned earlier, Part I of the interviews done internally in FF consisted of a survey with close-ended questions, however, participants were allowed to justify their answers. From the transcripts, it was possible to write a narrative to describe in a formal way the relevant information about the units of study that would be later used for the data analysis.

Tables

In each company computer folder, an additional file was added that included the results of the Part 2 of all the interviews in tabular form, i.e., the data gathered regarding the risks and risk management. These tables had the purpose of systematically listing the risks mentioned in the interviews, indicate whether they were mentioned by more than one interviewee and classify them according to the classification of supply chain risks listed in Appendix 2.D.

Principle 3: Maintain a chain of evidence

Maintaining a chain of evidence helps in increasing reliability. Reason why every conclusion will be linked to either, the collected data, the literature review, the research questions, and/or the propositions.

Part III
Results & discussion

Chapter 4. Results per unit of study

This chapter presents the results of drivers and facilitators, the power regimes and the supply chain risks within the units for study, which are the bilateral relationships between the focal firm (FF) and the selected clients and suppliers introduced in Chapter 3 (Research Methodology). Each section will be dedicated to one unit of study.

Drivers and facilitators

The main drivers and the facilitators that make the bilateral relation feasible are presented based on the results of interviews done with employees of the focal firm and the representatives of the other companies (See Chapter 3, Section 3.3). For each unit of study, for the focal company, per unit of study, the drivers with the highest scores are presented and described. The number in parenthesis in the tables represents the average score given by the interviewees within the focal firm. From the perspective of the other company, due to the format of the interview, no score is provided for the drivers, however, based on the answers, it is still possible to know what their main drivers are and why. The two facilitators with the highest score are also presented. The score in the table is based on the interviews within the focal firm, but the description is based on all interviews.

Also, the units of study are classified within one of the four quadrants of the power regime analysis by Cox (2004), which can be found in Section 2.2 and Appendix 2.A. Also, each unit will be compared to the literature relevant to SCM and partnership practices, which was presented in Part 1 of this report.

Supply chain risks

The risks here presented were obtained from the interviews with employees of the focal firm, as well as representatives of the suppliers and clients of each unit of study. In every interview, different risks were mentioned, sometimes by using different names. The names given to the risks were derived from the explanation or examples given by the interviewees, and were named in a way that it would make it possible to compare them across the units of study. The risks are supply chain risks classified within the following categories: Plan, Source, Make, Delivery, Return, others. These categories were proposed by Araújo *et al*. (2014) and were introduced in Chapter 2, Sub-section 2.9.3, and can be found in Appendix 2.D. Since this classification of risks requires for a company to be the focal firm.

The risks here mentioned affect or benefit both companies and they are considered supply chain risks. Allocated risk means one company is 100% responsible. If the risk fires, then that company has to make it right. A shared risk means that the consequences will be dealt with by the two companies or that the opportunities will be exploited by both. Either allocated or shared, the companies could find solutions together. Furthermore, delay penalties are discussed and a link to literature on risk management will be made per unit of study. Finally, Appendix 4.A provides descriptions for the risks found in each unit of study.

4.1 Unit of study 1: Main Contractor and the focal firm

Main Contractor (MC) is a privately-owned construction, development and property services company in the United Kingdom. The focal firm has been hired as a specialised subcontractor on multiple occasions by MC. The directors of the two companies have had meetings to discuss the development of a partnership. The companies have developed a trust relationship and future collaboration has been discussed. Both firms are family-owned, which makes it evident that certain values are shared by both, despite of their difference in size. Table 4.1 shows the drivers and facilitators found in this relationship.

Table 4.1. Summary of drivers and facilitators for Main Contractor and the focal firm.

	Focal firm	**Main Contractor**
Position in supply chain	Specialised subcontractor	Main contractor
Company size	Medium (~90 employees)	Large (~4.000 employees)
Type of partnership (Focal firm's view)	Type III Drivers average score: 19 (High) Facilitators average score: 15.67 (Medium/High)	
Main driver 1	Profit stability and growth (4.33) – Growth – Sales volume	Customer service – Improved on-time delivery – Accurate order deliveries – Process improvements
Main driver 2	Marketing advantage (4.00) – New market entry – Promotion (joint advertising, sales promotion) – Place (expanded geographic coverage)	Marketing advantage – Product (jointly developed product innovation) – Innovation potential
Facilitators	Mutuality (5.00) Management skilled at: – Two-sided thinking and action – Taking the perspective of the other company – Expressing goals and sharing expectations – Taking a longer-term view – Mutual respect Corporate compatibility (4.00) – Both firms place value in keeping commitments – Employees viewed as long-term assets – Strategic plans and objectives are consistent – Commitment to partnership ideas	
Additional facilitators	– Shared competitors – Prior experience with partnerships – Shared end user	

4.1.1 The focal firm's main drivers

PROFIT STABILITY AND GROWTH: MC has offered out-of-schedule payments to the focal firm as support in difficult situations during projects, reason why the focal firm will have the confidence to participate in larger projects that involve greater risks. More and larger projects in the UK can result in growth and profit stability.

MARKETING ADVANTAGE: A partnership with MC gives the focal firm a name in the UK, due to the possible promotion of the partnership for future projects with future clients. Also, having such a partner gives the focal firm a greater reputation.

4.1.2 Main contractor's main drivers

CUSTOMER SERVICE: MC wants a partner with expertise in technical design, manufacturing and installation of curtain walling and façades for future complex projects due to the elements' criticality in buildings. Delivery according to the programme is also crucial due to the effect cladding has on a building regarding the rest of the activities. The focal firm has become an asset for buildings that require an innovative design and engineering for satisfying clients' needs.

MARKETING ADVANTAGE: MC wants a partner that is involved early, during the tendering phase to increase chances of winning a tender. The focal firm's expertise can help in anticipating risks and providing ideas for the specific components of the design and engineering.

4.1.3 SCM practices

A close partnership with suppliers is an element of SCM according to Koh *et al*. (2008). MC wants to keep the focal firm in its supply chain due to the drivers previously mentioned and has a long-term view for the partnership. This involves cooperation, coordination, information sharing and joint planning. In the same way, the focal firm wants to keep a close partnership with customers, in this case with MC, which is also an element of SCM.

4.1.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *interdependence box*, in which the buyer (MC) has a relatively high percentage share of the total market for the supplier (focal firm), in this case being the UK market, and the supplier's offering is relatively unique, which is the 'design and build' service that the focal firm offers.

4.1.5 Supply chain risks

During the pre-contractual phase, the critical points relevant to risks are discussed, in order to see how the parties can help each other. Also, MC holds a meeting with most of the parties involved in the project to discuss goals and expectations. Risks are also discussed in this meeting, and actions on how to avoid them or prevent them are also thought of. The meeting is done with the objective of persuading the teams to work collaboratively towards the same objectives. Also, parties are informed that risks affect everyone and nobody should have an opportunistic behaviour in the case that risks fire. These meetings are held a few times during the course of the project, however, the focal firm has only assisted once. Table 4.2 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.1 gives a better view of the risk allocation or sharing.

According to MC, delay penalties are implemented because they are there as a way of motivating the parties to perform, but they are rarely actually implemented, due to the quite extensive chain of events that has to be followed in order to prove that a party is responsible for a delay. It also involves lawyers and litigation. Most of the times, there is a reached agreement before the client opts for the delay penalty.

4.1.6 Delay penalties

Contracts between MC and the focal firm include clauses specifying penalties for the case that work is not finished when agreed upon. So, formally, there is transferring of risks. The focal firm negotiates delay penalties out of contracts, since they cause for the parties to act in defense-mode, rather than solution mode. MC smooths the process when the focal firm doesn't agree with certain responsibilities. Nonetheless, there is a trust relationship in which both parties 'back up' each other in case needed.

Table 4.2. Categorisation of supply chain risks for Main Contractor and the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
O1	Early involvement (derogation schedule, win tenders)	Plan: Inertia	Shared
T1	Information for engineering design	Plan: Informational	Allocated to MC
T2	Waste quality	Plan: Demand	Shared
T3	Programme performance from main contractor's side	Source: Supply	Ideally shared[1]
T4	Sub-subcontractors/suppliers	Source: Supply	Could be shared, but currently FF's risk[2]
T5	Payments	Source: Financial	Allocated to MC
T6	Exchange rate	Source: Financial	Allocated to MC
T7	Bankruptcy of subcontractors	Source: Financial	Shared
O2	Contractual process	Source: Relational	Shared
T8	Unclear responsibility of an issue	Source: Relational	Shared
T9	Insufficient quality	Make: Operational	Shared
T10	Technical feasibility of design	Make: Operational	Allocated to FF
T11	Programme performance from focal firm (supplier)'s side	Make: Operational	Ideally shared (As in T4)
T12	Changes in engineering design	Delivery: Customer	Shared
T13	Brexit	Others: Environmental	?

4.1.7 Link to literature on risk management

MC is willing to share risks with the focal firm since it believes that they are a component of partnerships. Nonetheless, a supply chain management approach for risk management is something that differs to what the company does in practice. MC follows a project risk management approach, as it is often done in the construction industry, and it is done internally. That means that there is no intention of sharing the risk register with its suppliers and customers. However, MC's interest on keeping the focal firm in its supply chain as a partner is an incentive to share risks, so the smaller firm doesn't have to carry dangerous risks on its own and can continue taking risks as those projects in the UK with MC.

[1] Programme risks are dependent of the situation. In an ideal world, the risk could be shared, however, this would require a change of mentality in the whole industry. MC is willing to share the risk with the focal firm, but it remains a delicate topic that varies per situation.

[2] MC is willing to share the risk if he had more input in supplier and subcontractor selection with the focal firm. Nonetheless, if a subcontractor of the focal firm fails, it is currently the focal firm's risk.

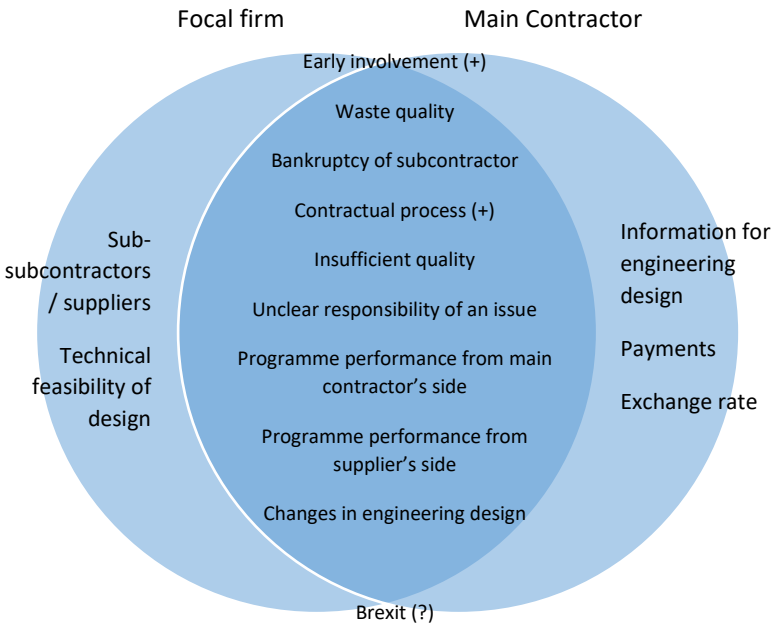

Figure 4.1. Allocation of risks for Main Contractor and the focal firm.

4.2 Unit of study 2: Start-Up and focal firm

Start-Up (SU) is a start-up company building charging stations for electric cars along the highways and in urban areas. The focal company became involved when SU needed a design for a new station for urban areas. SU is a company that believes in openness and collaboration between supply chain members, reason why it demands to its suppliers to work with an open budget, which means to be transparent about all costs to everyone in the supply chain.

The focal firm accepted to design, engineer and build the first station with the open budget condition, nonetheless, results weren't as expected by neither company with respect to price. There was a large increase of price was for two main reasons: first, the focal firm underestimated the work in the initial phase and, second, changes in the design were made by SU, which required a high number of man-hours in engineering. The problem was discussed openly by the two companies in the meeting where the directors were present and reached an agreement. For the second station, the design and engineering was made more efficient in terms of costs, but the cost is still considered high by SU.

SU wants a partner like the focal firm, even if there yet not a certain agreement on the future of the relationship. Both companies have their drivers to continue collaborating, even if cost efficiency is not one of them yet. A third station has been discussed, but still not made official. Table 4.3 shows the drivers and facilitators found in this relationship.

4.2.1 The focal firm's main drivers

CUSTOMER SERVICE: The relationship began in the interest of the focal firm in helping and giving some advice to SU with its new design. Thereafter, the firms decided to work together and signed a contract.

MARKETING ADVANTAGE: The opportunity of entering the market of charging stations for electric cars is something that the focal firm wants to exploit, since the project involves glass with solar cells. The focal firm values the

ideology of SU. The design of the stations is something the focal firm had never built before, reason why there is innovation potential.

PROFIT STABILITY/GROWTH: The ideal situation for the focal firm is to build more than one station at a time, which would result in a higher profit, or at least a significant sales volume, but SU prefers smaller batches. Thus, how their relation will continue still needs to be decided upon by the two companies.

4.2.2 Start-Up's main drivers

CUSTOMER SERVICE: At the time of the first contact between the two firms, SU needed a supplier who would deliver the station in a fast manner. The focal firm is a Design and Build company, reason why it could comply with this quick delivery. Looking for a new supply chain for this station would have taken more time for SU. Moreover, SU could trust that the focal firm would deliver with good materials and satisfy the requirements.

MARKETING ADVANTAGE: The focal firm has experience with building in the UK and Germany and SU wants to build stations in both countries, reason why having such a partner would facilitate the process considerably. Also, the focal firm's expertise in glass and steel can contribute to the station's design.

Table 4.3. Summary of drivers and facilitators for Start-Up and the focal firm.

	Focal firm	**Start-Up**
Position in supply chain	Specialised subcontractor	Start-up company
Company size	Medium (~90 employees)	Small (~25)
Type of partnership (Focal firm's view)	Type III Drivers average score: 15 (Medium) Facilitators average score: 16.5 (High)	
Main driver 1	Customer service (4.00) – Accurate order deliveries – Process improvements	Customer service – Improved on-time delivery – Accurate order deliveries
Main driver 2 & 3	Marketing advantage (3.00) – New market entry – Innovation potential Profit stability/growth (3.00) – Sales volume	Marketing advantage – Place (Expanded geographic coverage) – Access to technology – Innovation potential
Facilitators	Corporate compatibility (3.50) Culture – Both firms place value in keeping commitments – Employees viewed as long-term assets	
Additional facilitators	– Shared competitors – Close proximity – Exclusivity – Prior experience with partnerships	

4.2.3 SCM practices

Principles of SCM are the basis of the way SU works. For the stations being built along the national highways, SU has already built a supply chain whose members agreed upon an open budget, were everybody is aware of the expenses and profit of the rest, which is a characteristic of a supply alliance (Burt *et al.,* 2003), which according to its characteristics, it can be a synonym of a partnership. Other characteristics of supply alliances mentioned by Burt *et al.* (2003) are atmosphere of cooperation, presence of interdependence and commitment, and win-win negotiations.

Furthermore, SU is committed to not following the traditional practices of the construction industry. Some suppliers and contractors walked away when they were asked to make their budget open. In the end, the company could convince the suppliers to be transparent about their price and to be open about their expenses in materials and man-hours, and even their percentage of profit for past projects. SU is aware that the construction industry still behaves in an old-fashioned manner and that in many cases that parties want all the profit for themselves, which can yield to adversarial relationships, which coincides with what Loosemore and Lim (2015) argue regarding the parties wanting to obtain the greatest proportion of the client's value stream.

As Vrijhoef (1998) explains, adversarial relationships make it difficult solve problems and will affect negatively the efficiency and efficacy towards customer satisfaction. SU is also aware that many contractors and suppliers can have an opportunistic behaviour, with little information sharing, as also Beach *et al.* (2005) describe, and this is something the firm attempted to solve by obligating the suppliers to be open about their costs and profits, which has worked very well until now.

4.2.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *supplier dominance box*, since the supplier (the focal company) has little dependence on the buyer (SU) for revenue and has many alternatives, the supplier's offering is relatively unique, and also the buyer's account is not particularly attractive to the supplier. Additionally, the supplier has substantial information asymmetry advantages over buyer in relation to engineering, nevertheless, the situation will change since SU is making an effort in learning on the subject. There is supplier dominance, but this doesn't mean that SU doesn't have other alternatives, especially considering the costs of building with the focal firm.

4.2.5 Supply chain risks

The focal firm and SU have never discussed the risks as such, since the company with the whole responsibility of the engineering, materials and building was the focal firm. SU had little input on those aspects, reason why it had to trust the focal firm completely. The biggest risk for SU was the price increase, which occurred and ended up affecting the focal firm as well. This risk was shared to some extent, nonetheless, the price was still too high for SU in comparison to the price of other stations it has built with its other supply chain. Furthermore, SU perceived that communication could've been better, referring the price increase, since it was informed by the focal firm at a late stage.

SU has learned more about the industry and is willing to collaborate in the price reduction of the station that the focal firm engineered, by training its employees, so they can also become experts on 3D modelling and engineering. Doing this would allow both firms to cooperate in the engineering, rather than the focal firm being the only one who understands it. This will reduce the uncertainty for SU and could lead to lower costs and more shared risk between the two companies. Table 4.4 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.2 gives a better view of the risk allocation or sharing.

Table 4.4. Categorisation of supply chain risks for Start-Up the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
T1	Bankruptcy of client	Plan: Strategic	Allocated to SU
O1	Market entry	Plan: Inertia	Shared
T2	Sub-sub-contractors/suppliers	Source: Supply	Allocated to FF
T3	Profit loss (cause is high price)	Source: Financial	Shared
T4	Change of supplier (cause is high price)	Delivery: Customer	Allocated to SU

4.2.6 Delay penalties

SU doesn't include delay penalties in its suppliers' contracts, however, SU accepts for its suppliers to include a risk premium in their budgets. If a supplier is delayed, then it becomes a risk SU is taking. With the focal firm, there weren't delay penalties; the only condition was to agree on having an open budget.

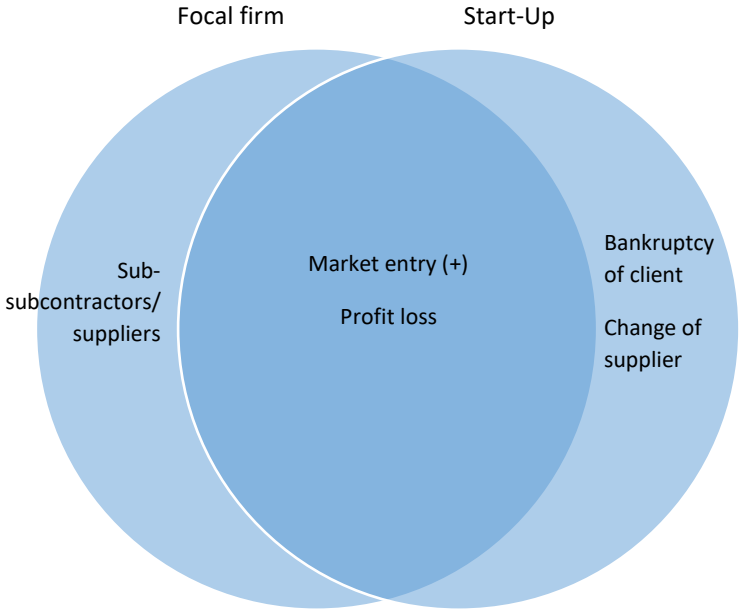

Figure 4.2. Allocation of risks for Start-Up and the focal firm.

4.2.7 Link to literature on risk management

As it was mentioned in the previous chapter, Start-Up (SU) believes in openness and this includes the sharing of rewards in the long term. The way SU creates partnerships with suppliers that will be in charge of building all of the stations fits into the way Yu, Yan and Cheng (2011) describe partnerships. Partnerships are described as a long-term oriented relationship with high levels of information sharing promising win-win situations. Win-win situation involves that all companies have a similar profit.

Supply chain partnerships must also benefit both parties by reduced risk and reduced uncertainty, according to Ellram (1991), which can be also found in SU's supply chain. Nonetheless, SU loses control of the supply chain if the focal firm becomes takes the responsibility of designing and building. Information sharing becomes more limited creating more uncertainty for SU.

4.3 Unit of study 3: Sheet Metal Supplier 1 and the focal firm

Sheet Metal Supplier 1 (SM1) is a production company specialized in stainless steel and non-ferrous metals. The markets in which the company operates include construction and interior-building industry, offshore, and food

industry, among others. The focal firm trusts SM1 as a partner for the delivery of aluminium sheet metal, stainless steel elements, and sometimes sendzimir galvanised sheets.

SM1 builds unique products for its customers and has the machinery and tools to achieve the quality required by the focal firm. The main advantages of having SM1 as a trusted supplier are the quick delivery and high quality of their materials. SM1 responds positively to last minute orders and delivers with the required quality. SM1 values working for the focal firm, reason why an effort to keep the relationship has not only given from the focal firm's side, but also SM1's side. Even if there was a disagreement with price between the two firms not long ago, the relationship is still valued and maintained. Table 4.5 shows the drivers and facilitators found in this relationship.

Table 4.5. Summary of drivers and facilitators for Sheet Metal Supplier 1 and the focal firm.

	Focal firm	**Sheet Metal Supplier 1**
Position in supply chain	Specialised subcontractor	Supplier
Company size	Medium (90 employees)	Small (45 employees)
Type of partnership (Focal firm's view)	Type III Drivers average score: 11.83 (Low/Medium) Facilitators average score: 18.50 (High)	
Main driver 1	Customer service (3.67) – Improved on-time delivery – Accurate order deliveries	Profit stability and growth – Sales volume
Main driver 2	Asset and cost efficiency (3.00) – Managerial efficiencies	Marketing advantage – Promotion (joint advertising, sales promotion) – Product (jointly developed product innovation) – Place (expanded geographic coverage)
Facilitators	Corporate compatibility (3.67) – Both firms place value in keeping commitments – Employees viewed as long-term assets – Strategic plans and objectives are consistent – Commitment to partnership ideas – Willingness to change Mutuality (3.67) Management skilled at: – Two-sided thinking and action – Taking the perspective of the other company – Expressing goals and expectation – Taking a longer-term view – Mutual respect Management willing to: – Integrate systems	
Additional facilitators	– Shared competitors – Close proximity – Exclusivity – Prior experience partnerships – Shared end user	

4.3.1 The focal firm's main drivers

CUSTOMER SERVICE: The focal company can achieve improved on-time delivery since it is given a priority position by the supplier when submitting an order. The two companies work with the same 3D modelling programme, reason why the focal firm can be confident that there will be accurate order deliveries.

ASSET AND COST EFFICIENCY: The relationship is based on knowing each other's expertise and the quality that can be delivered, so managerial efficiencies are achieved, since the both know how to work together.

4.3.2 Sheet Metal Supplier 1's main drivers

MARKETING ADVANTAGE: SM1 believes that the relationship makes both companies stronger, since together can come up with design solutions that they could promote and can serve as a marketing advantage. Also, SM1 has the opportunity to work with the focal company in other countries.

PROFIT STABILITY AND GROWTH: SM1 is interested in keeping selling to the focal firm, since all the factory employees can work on those jobs, which doesn't happen with other clients.

4.3.3 SCM practices

Trust and commitment is an important component of this partnership. This component includes elements loyalty and trust with a long-term focus. Both firms have the same focus on customer value and satisfaction, which can be reflected in the quality of the work. SM1 believes in long-term relationships, rather than just realising projects together for profit only, even if that means that there will not always be profit.

4.3.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *buyer dominance box*, since there are few buyers and many suppliers in the type of work the focal firm offers to SM1. SM1 sells in other markets as well, but in the specific market were the focal firm operates, the supplier is highly dependent on the buyer (the focal firm) for revenue.

Table 4.6. Categorisation of supply chain risks for Sheet Metal Supplier 1 and the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
T1	First quotation diff. from final design	Plan: Strategic	Allocated to FF if detected by SM1
O1	Early involvement/Flexibility	Plan: Inertia	Shared
T2	Waste quality (Visible parts)	Plan: Demand	Shared
O2	Meaning of quality	Source: Supply	Shared
O3	IT compatibility	Source: Supply	Shared
O4	Programme performance from supplier's side	Source: Supply	Shared
T3	Insufficient quality	Source: Supply	Allocated to SM1
T4	Transportation (Packaging and loading)	Source: Supply	Allocated to SM1[3]
T5	Transportation (During ride and arrival)	Source: Supply	Allocated to FF[4]
T6	High product price	Source: Financial	Allocated to FF

4.3.5 Supply chain risks

The companies work together during the engineering/workshop drawings phase of projects. They have a discussion on how the drawing created by the focal firm can be changed for better and to make it cheaper, which

[3] The focal firm hires the transport to pick the material from SM1's factory and to take it where necessary, but SM1 is in charge of loading correctly the truck and protecting the materials, since not doing it correctly could damage the products.

[4] Since the FF is the party that is usually in charge of the transportation, this is its risk.

would result in profit for both parties. In these discussions, sometimes risks are brought up. The focal firm has preference over this supplier when a product is needed urgently, since SM1 can do that with the required quality. The communication has also improved recently, since SM1 decided to invest in a 3D modelling programme compatible with that of the focal firm. Table 4.6 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.3 gives a better view of the risk allocation or sharing.

4.3.6 Delay penalties

SM1 doesn't accept delay penalties, since delays can occur for many reasons that are out of the firm's control. The supplier prefers to not take part of the project rather than accepting the penalty, for this reason, it is considered that programme delays (which are not common with this supplier), are shared, since there is trust.

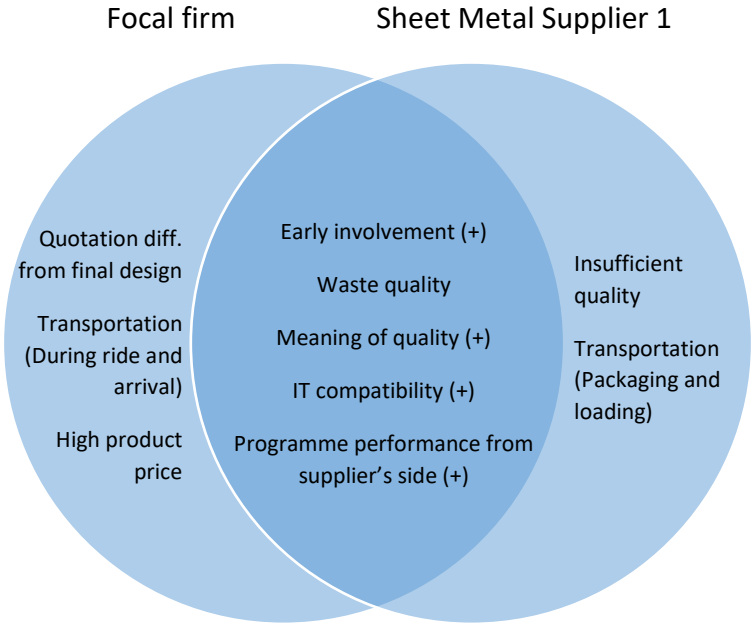

Figure 4.3. Allocation of risks for Sheet Metal Supplier 1 and the focal firm.

4.3.7 Link to literature on risk management

Cooper and Ellram (1993) state that risk and rewards are shared over the long-term in supper chain management, instead of each party focusing on its own risks and rewards, as it is done traditionally. SM1 has taken risks with the focal firm in certain projects, that have resulted in more costs that expected for both firms, but in the end, neither company is willing to stop maintaining the relationship. They both believe in long-term commitment and even if it is not always a win-win situation, other components of the partnership are still present. Also, SM1 always discusses the design with the focal firm, in order to make it better and make it less-costly, resulting in profit for both, which can be seen as an exploited opportunity in the financial category through early involvement and flexibility.

4.4 Unit of study 4: Sheet Metal Supplier 2 and the focal firm

Sheet Metal Supplier 2 (SM2) is a Design and Build firm specialised in cladding and supplies aluminium sheet metal for the focal firm. SM2 is one of the focal firm's main sheet metal suppliers, nonetheless, it is also possible

the companies find each other working in the same project as subcontractors, since both are focused on non-standard buildings, that is, the projects involve unusual geometrical shapes. Also, the focal firm and ST2 can complement each other in the market, due to the type of work each delivers.

SM2 believes in partnerships, reason why it has one supplier for almost each material or service required to deliver its final product. The company follows a lean management philosophy, which is why its customers can trust that high quality will be delivered and on time. Table 4.7 shows the drivers and facilitators found in this relationship.

Table 4.7. Summary of drivers and facilitators for Sheet Metal Supplier 2 and the focal firm.

	Focal firm O	**Sheet Metal Supplier 2**
Position in supply chain	Specialised subcontractor	Supplier/sub-subcontractor
Company size	Medium (90 employees)	Medium (60 employees)
Type of partnership (Focal firm's view)	Type III Drivers average score: 16.50 (High) Facilitators average score: 17 (High)	
Main driver 1	Marketing advantage (4.00) – Promotion (joint advertising, sales promotion) – Product (jointly developed product innovation) – Innovation potential	Marketing advantage – Promotion (joint advertising, sales promotion) – Product (jointly developed product innovation) – Innovation potential
Main driver 2	Profit stability and growth (3.50) – Assurance of supply	Asset and costs efficiency – Assets to the relationship
Facilitators	Management philosophy and techniques (4.00) – Organisational structure – Commitment to continuous improvement – Degree of top management support	
Additional facilitators	– Shared competitors – Close proximity – Prior experience with partnerships – Shared end user	

4.4.1 The focal firm's main drivers

MARKETING ADVANTAGE: SM2 is involved in large and special façade projects, in which the focal firm could be part of by supplying the glass, for example. The two companies working together can be attractive to architects, offering more opportunities in the market. The companies complement each other with their expertise and innovation potential, to come up with a strong design.

PROFIT STABILITY AND GROWTH: The focal firm can rely on SM2 for projects when necessary,

4.4.2 Sheet Metal Supplier 2's main drivers

MARKETING ADVANTAGE: SM2 sees the relationship as an opportunity to join forces to win special projects and believes that both complement each other to create special products.

ASSET AND COSTS EFFICIENCY: SM2 is aware that the focal firm makes the payments according to what was agreed upon. Also, in relation to assets to the relationship, the focal firm once 'lent' one of the engineers to SM2 for a short period of time due to the lack of work.

4.4.3 SCM practices

Close partnership with suppliers and customers is an important practice for SM2; it has only few suppliers. An example is the fact that SM2 has only one supplier that supplies all the aluminium. With this supplier, there is information sharing, coordination and joint planning for the long-term. SM2 also has partnerships with the powder coating and transportation companies, with whom processes are fully integrated.

With a customer, for example, the focal firm, there is information sharing and the firm is allowed to visit SM2's factory at any time. Moreover, the close relationship between the firms helps them anticipate technical risks and increase chances of winning a tender.

4.4.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *interdependence box*, since both firms are to some extent unique within their kind. Both have few alternatives to find a similar supplier/buyer and the firms can complement each other in the types of projects they are involved. The two firms complement each other for projects with unique building shapes and special products.

4.4.5 Supply chain risks

The companies work together during the engineering phase to find the best solutions for projects with non-standard-shaped buildings. An alliance of both firms can bring important opportunities for them to exploit jointly in the market, nonetheless, lack of compatibility in IT has resulted in significant delays in the past. SM2 looks for solutions in collaboration with supplier, when there is a delay, it tries to find a middle point that benefits both, instead of attacking the other. Table 4.8 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.4 gives a better view of the risk allocation or sharing.

Table 4.8. Categorisation of supply chain risks for Sheet Metal Supplier 2 and the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
O1	Market entry	Plan: Inertia	Shared
O2	Flexibility/Technical project solutions	Plan: Inertia	Shared
T1	Underestimated amount of work & technical complexity during sales phase	Plan: Demand	Shared
T2	Programme performance from supplier's side	Source: Supply	Shared
T3	IT compatibility	Source: Supply	Shared
T4	Meaning of quality	Source: Supply	Allocated to SM2
T5	Insufficient quality	Source: Supply	Allocated to SM2
T6	Transportation (Packaging, loading, ride and arrival by supplier)	Source: Supply	Allocated to SM2

4.4.6 Delay penalties

SM2 doesn't accept delay penalties, since it firmly believes that they are not a component of partnerships. The firm also doesn't implement them, since giving a supplier a penalty when he was late would be of no use if the firms still needs this supplier.

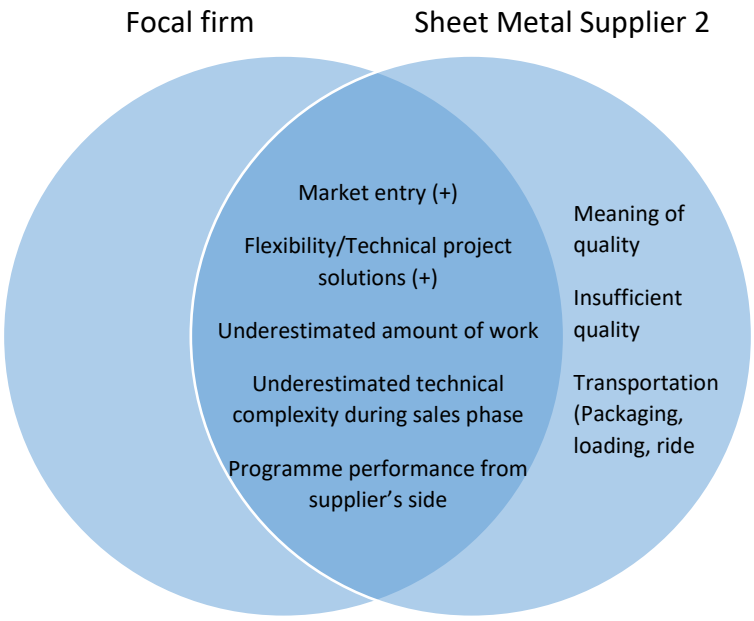

Figure 4.4. Allocation of risks for Sheet Metal Supplier 2 and the focal firm.

4.4.7 Link to literature on risk management

SM2's point of view regarding delay penalties coincides with the comparison Edkins (2009) makes a distinction between the use of contract and the management of the relationship as two different routes towards risk management. The former refers to the use contracts as a formal way of providing incentives and penalties to establish expectations and responsibilities, while the latter refers to taking a SCM approach. The philosophy of SM2 is relevant to the SCM approach, not only because of the exclusion of the delay penalties, but also since the supplier chooses to have few suppliers and chooses partnerships if it results in benefits for the company.

4.5 Unit of study 5: Glass Supplier 1 and the focal firm

Glass Supplier (GL1) is a company in Spain that processes glass to make insulated glass units, or IGUs. GL1 and the focal firm are both family-owned company. GL1 changed its market strategy from selling standard products locally to providing personal services to firms in other countries around the world. GL1 is open to find solutions with its client and is flexible with its products, which is very important when working with the focal firm. Table 4.9 shows the drivers and facilitators found in this relationship.

4.5.1 The focal firm's main drivers

ASSET AND COST EFFICIENCIES: GL1's products are cheaper than other larger suppliers, which is an important reason buy from this supplier. Lower glass products can help compensate losses in other areas of projects for the focal firm.

PROFIT STABILITY AND GROWTH: Due to GL1's lower prices, there is an opportunity to increase the focal firm's profit. Also, due to GL1's flexibility regarding glass products, once they understand the focal firm's quality standards, there is an opportunity for the focal firm to grow having such a flexible partner that is willing to deliver more than just standard products.

4.5.2 Glass Supplier 1's main drivers

MARKETING ADVANTAGE: GL1 believes that having a client like the focal firm is a way to promote they products in the market. For the supplier, the focal firm is not a regular client, but that has an added value, which is the uniqueness of the projects.

PROFIT STABILITY AND GROWTH: The uniqueness of the focal firm's projects encourages GL1 to be more flexible and grow with the experience and knowledge obtained with these projects. The supplier sees this projects as a challenge that leads to professional growth, not only financial growth but also in knowledge.

Table 4.9. Summary of drivers and facilitators for Glass Supplier 1 and the focal firm.

	Focal firm O	**Supplier GL1**
Position in supply chain	Specialised subcontractor	Supplier
Company size	Medium (~90)	Medium (~60)
Type of partnership (Focal firm's view)	Type III Drivers average score: 15.50 (Medium/High) Facilitators average score: 12.20 (Medium)	
Main driver 1	Asset and cost efficiencies (4.50) – Product costs savings – Distribution cost savings	Marketing advantage – Promotion (sales promotion) – Product (jointly developed product innovation) – Innovation potential
Main driver 2	Profit stability and growth (4.00) – Growth – Assurance of supply	Profit stability and growth – Growth
Facilitators	Corporate compatibility (3.50) Culture – Both firms place a value on keeping commitments – Constancy of purpose Business – Commitment to partnership ideas – Willingness to change Mutuality (3.50) Management skilled at: – Two-sided thinking and action – Mutual respect	
Additional facilitators	– Prior experience with partnerships – Shared end user (0.50)	

4.5.3 SCM practices

GL1 is a relatively new glass supplier for the focal firm. The supplier is interested in having partners like the focal firm, and for this reason, the firm is committed to continuous improvement. There have been quality issues with the glass delivery, but GL1 is taking the short-term "hits" while it adjusts its standards to those required by the focal firm. To achieve these standards, GL1 shows commitment and cooperation towards continuous improvements, which according to Burt *et al*. (2003), they are elements of a supplier alliance, which according to its characteristics can also be a type of partnership.

4.5.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *buyer dominance box*, since the glass industry has many suppliers, including large and multinational companies. The supplier is highly

dependent on the buyer (the focal firm) for revenue. The buyer's search costs for the product that the supplier sells are low.

Table 4.10. Categorisation of supply chain risks for Glass Supplier 1 and the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
O1	Flexibility/technical project solutions	Plan: Inertia	Shared
T1	Meaning of quality	Source: Supply	Allocated to GL1[5]
T2	Sub-subcontractors/suppliers	Source: Supply	Allocated to GL1
T3	Issues in factory	Source: Supply	Allocated to GL1
T4	Insufficient quality	Source: Supply	Allocated to GL1[6]
T5	Transportation (Packaging and loading)	Source: Supply	Allocated to GL1
T6	Transportation (During ride and arrival)	Source: Supply	Allocated to party who hired transportation service
T7	Payments	Source: Financial	Allocated to FF

4.5.5 Supply chain risks

The companies don't do engineering together because GL1 doesn't have an engineering team, it just provides the product that the focal firm asks for. Table 4.10 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.5 gives a better view of the risk allocation or sharing.

4.5.6 Delay penalties

GL1 does accept delay penalties. The firm believes that by accepting them in its contracts is a way to show that it can be trusted and to give the confidence that it can deliver according to what was agreed in the contracts. Their suppliers, which consist principally of multinational glass suppliers, don't accept the penalties, therefore, GL1 doesn't transfer them to them.

4.5.7 Link to literature on risk management

GL1 is very aware of its factory risks and make themselves entirely responsible for them. The supplier has the firm goal of achieving customer satisfaction, which is one of the intangible benefits of partnering in the construction industry (Beach *et al.*, 2005). GL1 stated that in the case of a machine breakdown or a fire in the factory, the company would still make an effort on finding solutions in order to keep its partner satisfied. Machine breakdowns are an example of uncertainties that propagate through the supply chain (Sheffi, 2001), nonetheless, GL1 assures that it is already prepared for such a situation, which can increase the focal firm's confidence for success, which is another intangible benefit of partnerships (Beach *et al.*, 2005).

[5] The focal firm checks the quality of the glazing in Spain, since GL1 is a relatively new supplier that is still learning about the quality standards of the focal firm.

[6] The quality has not been sufficient in some occasions, however, the focal firm is flexible and supportive. GL1 is open to find solutions and offers to fabricate the product again. The two firms work together to find the solution to the problem, which would help GL1 in not committing the same mistake again. Nonetheless, quality defects are still allocated to GL1.

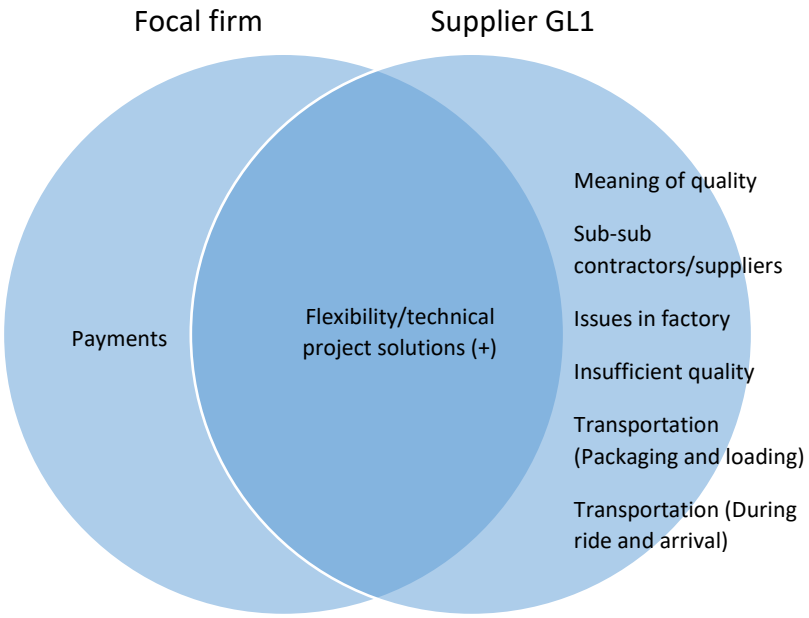

Figure 4.5. Allocation of risks for Glass Supplier 1 and the focal firm.

4.6 Unit of study 6: Glazing Systems Supplier and the focal firm

Glazing Systems Supplier (GS) is a leading supplier of customized system solutions for curtain walls, glass roofs, windows and doors; which operates worldwide. For the focal firm, GS delivers half-fabricates that are used on façades when using GS's standard glazing system, which provides air and water tightness to buildings.

The close relationship allows the focal firm to have fixed prices for certain products, which include a standard discount. In the case that the focal firm has a large project, GS can provide a special price for that project. During the focal firm's sales phase (or tendering) of a project, GS supports the focal firm by providing price information if needed.

The system has a high degree of detailing and, frequently, the focal firm's façades are not standard, making the use of the system a difficult task. For this, GS aids by providing technical knowledge and is open to discussion to find unique solutions for the unusual geometrical façade shapes. It also tries to provide a warranty even if the application is an exception for the system. Both companies value the relationship, nevertheless, there is no exclusivity, as both parties also make business with each other's competitors. Table 4.11 shows the drivers and facilitators found in this relationship.

4.6.1 The focal firm's drivers

MARKETING ADVANTAGE: One of the largest benefits for the focal firm is to have access to GS' large network architects. Moreover, important engineering solutions have been developed together, which increases the focal firm's innovation potential.

4.6.2 Glazing Systems Supplier's drivers

MARKETING ADVANTAGE: GS considers the focal company to be a professional customer with high-sophisticated projects. GS has an advantage in the market by implementing its system to building façades that have unusual geometrical shapes, something that its competitors are not as strong on or are not willing to do. These types of projects involve significant collaboration between the parties in order to come up with a jointly developed solution.

PROFIT STABILITY AND GROWTH: The unusual building shapes that the focal firm engineers challenge GS' technical department, allowing it to grow as a company.

4.6.3 SCM practices

GS sells a standard system, which has been tested and approved. If the guidelines are followed in detail, warranty is valid since the company has the certainty that it will comply with the required specifications. Adjusting the system to a building with an unusual geometrical façade can be a challenge and could become a risk if it is not done correctly. GS assures that 85% of the times that a customer asks for an exception of the system, it is accepted and a warranty is given. To do this there needs to be collaboration from the two companies, preferably from an early stage of the project. Joint product development, shared information, mutual problem solving, improvement and success sharing are all characteristics of a supply chain partnership (Lambert *et al.*, 1996; Maloni and Benton, 1997)

Table 4.11. Summary of drivers and facilitators for Glazing Systems Supplier and the focal firm.

	Focal firm O	**Supplier GS**
Position in supply chain	Specialised sub-contractor	Supplier
Company size	Medium (90)	Medium
Type of partnership (Focal firm's view)	Type II Drivers average score: 12.67 (Medium) Facilitators average score: 13.00 (Medium)	
Main driver 1	Marketing advantage (3.67) – Promotion (joint advertising, sales promotion) – Product (jointly developed product innovation) – Innovation potential	Marketing advantage – Promotion (joint advertising, sales promotion) – Product (jointly developed product innovation) – Innovation potential
Main driver 2		Profit stability and growth – Growth
Facilitators	Mutuality (3.33) Management skilled at: – Two-sided thinking and action – Taking the perspective of the other company – Mutual respect	
Additional facilitators	– Shared competitors – Prior experience with partnerships – Shared end user	

4.6.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *interdependence box*, since there are few buyers and few suppliers willing to do façades with unusual shapes. The buyer's (the focal

firm's) switching costs would be high since considerable time and effort has been invested in understanding GS' system. GS has also invested time in assisting the focal firm in solving issues with the engineering.

4.6.5 Supply chain risks

The system of Glazing Systems Supplier (GS) is a tested and approved system. GS offers a warranty when the company using the system follows the guidelines precisely. When the focal firm wants to implement the system to a building with an unusual shape, it is taking the risk of not being given a warranty by GS. As mentioned previously, GS tries to provide a warranty in these type of cases, and for this, the company provides technical assistance. If the focal company makes a mistake during the manufacturing or installation of the profiles GS provides, then the risk is allocated to the focal firm.

The warranty is a way of risk transferring to the supplier, nevertheless, for it to be valid, it's responsibility of the focal firm to follow the guidelines precisely, something that to this date has not been a simple task. Therefore, GS is open to become more involved with projects at an earlier stage, in order to prevent time-consuming loops in the technical discussion and to reduce risks of technical failure. Table 4.12 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.6 gives a better view of the risk allocation or sharing.

Table 4.12. Categorisation of supply chain risks for Glazing Systems Supplier and the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
O1	Technical project solutions	Plan: Inertia	Shared
T1	Inaccurate forecast for project specific profiles	Source: Supply	Allocated to GS
T2	Programme performance	Make: Operational	Allocated to FF
T3	Technical misunderstanding	Make: Operational	Allocated to FF[7]
T4	Manufacturing	Make: Operational	Allocated to FF
T5	Installation	Make: Operational	Allocated to FF
T6	Technical feasibility of design	Make: Operational	Allocated to GS[8]
T7	Sovereign risks	Others: Environmental	Shared

4.6.6 Delay penalties

The focal firm takes full responsibility on the way GS's system is manufactured and installed, since the party in charge of the assembly is the responsible one and GS doesn't do the assembly; it only sells the half-fabricates and provides the guidelines.

[7] GS' system is tested and proved, reason why it's implementation should go smoothly if guidelines are correctly followed. Nevertheless, focal firm seems to have some difficulties implementing it and when trying to solve these issues, there seems to me some technical misunderstanding when communicating with GS. A solution to this would be to involve GS since the engineering phase of projects, rather than later in the process.

[8] GS offers warranty in case guidelines are followed correctly and the system doesn't work as it should.

The focal firm doesn't give delay penalties to supplier GS, and therefore, is responsible given the case GS is late in delivering components. Also, the focal firm is responsible for the planning, so if it's done correctly, there shouldn't be any problems with delays.

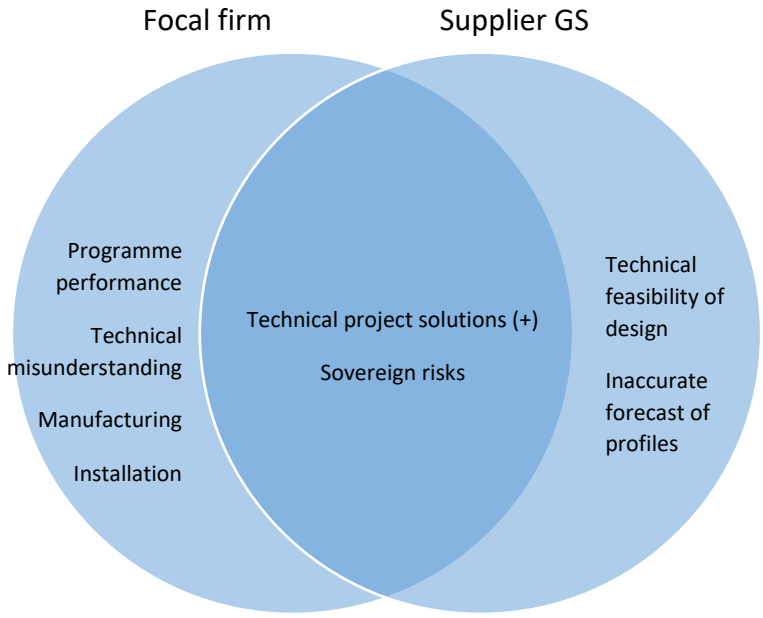

Figure 4.6. Allocation of risks for Glazing Systems Supplier and the focal firm.

4.6.7 Link to literature on risk management

Implementing the system when it is not certain that a warranty will be provided is a risk that the focal firm is taking, therefore, risks relevant to GS's system are purely internal risks, which means that it's those inherent to the project or to the firm developing it, and they can be considered manageable (Munier, 2014). In order to manage this risk, collaboration of both parties is needed from an early stage, since GS is the expert and the focal firm is the on developing the project.

4.7 Unit of study 7: Steel Supplier 1 and the focal firm

The focal firm doesn't have one preferred steel supplier due to the amount of competition in the market and price is an important decision criteria when considering the selection. Nonetheless, Steel Supplier (ST1) has proved that they can offer a good price and good quality.

In the past couple of years, the two companies haven't worked much together, but there is a long history of doing so. Recently, for a specific project, the focal firm was looking for a steel supplier that could produce cheaper than itself, and ST1 was selected due to its flexibility with dates and production volume, which could allow the focal firm to give a higher customer service level. Having such a supplier close by can result in cost savings in steel production. Table 4.13 shows the drivers and facilitators found in this relationship.

4.7.1 The focal firm's drivers

ASSET AND COST EFFICIENCIES: ST1 has proved to offer high quality work with a very competitive price. Also, ST1 has a big factory with new machines that help the focal firm get certain tasks done in a more efficient manner. The overall costs of steel production can be lower than the focal firm's if realised by ST1.

MARKETING ADVANTAGE: There is a reduced-price advantage since ST1 can produce with a lower cost due to their specialised machinery.

4.7.2 Steel Supplier 1's drivers

PROFIT STABILITY AND GROWTH: Companies like the focal firm are the reason why firms like ST1 exist, since that is how ST1 gets most of the jobs.

MARKETING ADVANTAGE: Photos of structures produced for the focal firm can be used as advertising.

Table 4.13. Summary of drivers and facilitators for Steel Supplier 1 and the focal firm.

	Focal firm O	**Supplier ST1**
Position in supply chain	Specialised subcontractor	Supplier
Company size	Medium (~90)	Small (~25)
Type of partnership (Focal firm's view)	Type III Drivers average score: 18.50 (High) Facilitators average score: 15.50 (Medium/High)	
Main driver 1	Asset and cost efficiencies (4.00) – Product costs savings	Profit stability and growth – Sales volume
Main driver 2	Marketing advantage (3.50) – Reduced-price advantage – Access to technology	Marketing advantage – Promotion (sales promotion)
Facilitators	Mutuality (3.50) – Two-sided thinking and action	
Additional facilitators	– Close physical proximity – Prior experience with partnerships	

4.7.3 SCM practices

Both companies have the expertise needed to achieve an efficient engineering design with a competitive cost, nonetheless, basic practices of SCM are lacking in this relationship. Maloni and Benton (1997) compare traditional relationships to partnerships, and this relationship has more traditional practices, such as price emphasis and short-term contracts. Nonetheless, it was recently agreed upon by both firms that together they would be building some repetitive projects in the future, which results in a cost efficiency for the focal firm. For this agreement, there is no contract and there is trust from part of the supplier that the focal firm will keep its commitment. Commitment and trust are both components of partnerships according to Lambert *et al*. (1996) and in this case, it is commitment of each party to a specific project, a characteristic of a Level I partnership.

Furthermore, ST1 has no input during the engineering phase, which doesn't allow it to contribute to more efficient design solution with respect to steel. There is potential in achieving more efficient designs if earlier collaboration was done from an earlier phase of projects, which would also result in cost savings and more accurate budgets, due to the expertise that ST1 could provide which could help the focal firm.

The firms don't consider the relationship as a partnership, even if the assessment results say so. Before the recently established agreement the relationship had the characteristics of purely an arm's length relationship.

The results obtained in the assessment of drivers and facilitators reflect the potential that the relationship has if more projects are done together and if there was more collaboration in earlier stages of projects.

4.7.4 The power regime analysis

Within the power regime analysis by Cox (2004), the relationship can be located in the *independence box*, since the supplier has little dependence on buyer for revenue and the buyer's search costs are low. Also, the offering of the supplier is a standardised commodity for which many suppliers are available in the market.

4.7.5 Supply chain risks

Steel Supplier 1 and the focal firm have been working for many years together in many projects. The relationship could have more collaboration, which could help exploit more opportunities that would benefit both parties. However, the large number of steel suppliers in the market is a reason why the focal firm has several steel suppliers and doesn't have partnerships with any of them, even if there are many years of collaboration and there is a certain level of trust. As an arm length's relationship, risks between the two companies are allocated to one of the parties. There is potential to share risks but this would need be openly discussed.

Opportunities that the two companies could exploit would be: using the same IT programme for drawings and an early involvement of ST1, that is, during the tendering phase so the focal firm's budget is accurate and the chance of winning the tender increases. This would also avoid potential losses due to miscalculation of the budget. Table 4.14 displays the supply chain risks found in this supply chain link, the risk category and whether they are shared or allocated and Figure 4.7 gives a better view of the risk allocation or sharing.

Table 4.14. Categorisation of supply chain risks for Steel Supplier 1 and the focal firm.

Risk ID	Risk title	Risk category	Shared or allocated to
O1	Early involvement	Plan: Inertia	Shared
T1	First quotation diff. from final design	Plan: Strategic	Allocated to FF
T2	IT compatibility	Source: Supply	Allocated to FF
T3	Manufacturing	Source: Supply	Allocated to ST1
T4	Mistake in drawings	Source: Supply	Allocated to ST1
T5	Insufficient quality	Source: Supply	Allocated to ST1
T6	Transportation (Packaging and loading)	Source: Supply	Allocated to ST1
T7	Transportation (During ride and arrival)	Source: Supply	Allocated to party who hired transportation service
T8	Relationship problems	Source: Relational	Allocated to FF

4.7.6 Delay penalties

ST1 accepts delay penalties only if they are worth it in relation to the expected profit. It tries to negotiate them, but in many occasions, it's not possible. However, the supplier believes it works in a fast manner and if it can be anticipated that there are going to be delivery delays, it tries to communicate it three or four weeks in advance, and reactions are commonly accepting. It believes that if, for example, the focal firm includes penalties in the contract, the reason is that they originally come from the client. However, the firm is aware that, in the end, penalties can damage a relationship since parties need one another.

4.7.7 Link to literature on risk management

This unit of study is an example of a traditional form of relationship, since there are many steel suppliers on the market from which the focal firm can choose from, which doesn't give the focal firm a reason to invest resources on building a strong relationship with only one of them. Having arm's length relationships is sometimes more convenient than building a partnership and for that reason it can be that there are no shared negative risks.

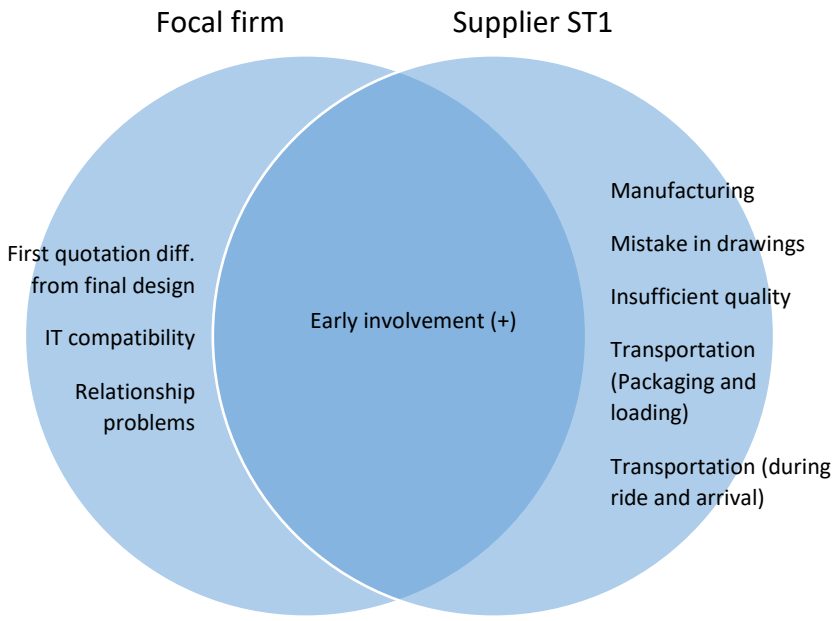

Figure 4.7. Allocation of risks for Steel Supplier 1 and the focal firm.

4.8 Additional relationships

Two more relationships were assessed within the focal firm, nonetheless, it was not possible to conduct an interview with representatives of the other firm in the dyad. The information gathered from the incomplete cases are presented in this section.

4.8.1 Glass Supplier 2

Glass Supplier 2 (GL2) is a large glass supplier which has had a relation with the focal firm for many years for multiple projects. The company supplies standard products to the industry, but is looking into the possibility of using thin glass in the construction industry, something which the focal company is willing to try once the sufficient tests have been done on the product and is ready to be sold in the market. This is a case of a relationship willing to go a step further to innovate and introduce a new product in the construction industry. The product is still being developed by Glass Supplier 2 and it is in a phase in which the focal firm is not so much involved, only a few samples have been sent; it is a slow process. If the project succeeds it would result in a new market entry for both firms.

In general, the contracts with the large glass suppliers, such as GL2, normally don't get the reduction clauses that the focal firm has in its contracts with clients, since they normally don't accept them. In these cases, the focal firm is very dependent on them to deliver on time. Large glass suppliers, like those in Germany, have a lot

of demand, reason why they are less flexible with their products and establish their own conditions for supplying. Penalties are usually not implemented because then the price becomes higher for the focal firm.

In general, the biggest risk with large glass suppliers are delays and quality. For glass, there are no problems on 3D modelling, since usually the drawings that the focal firm makes are sufficient for the glass orders. The quality risk is managed by making a benchmark sample which can be put in the contract as reference, where the quality specifications are well defined. There are numerous norms that are general and protective of the glass industry, but the focal firm's demand of quality and detailing is of tighter tolerances, that is, better than standard. The delay risk can be managed by ordering on time and giving a lead time. The focal company also makes in between visits to the supplier's factory to check the current state of the product and to see how much is ready, before it's too late to make programme changes. With respect to the innovation with thin glass, the focal firm can't promote nor sell the product yet, since GL2 hasn't shown as much commitment as expected, which could represent a risk in the future for the focal firm.

4.8.2 Steel Supplier 2

Steel Supplier 2 (ST2) is a steel supplier that offers good prices. ST2 can be of big support when the focal firm doesn't have sufficient capacity to produce the steel itself. For that reason, ST2 was contracted recently to supply for a project. The party gained the trust that it could supply the required product on-time and with the required quality. As mentioned earlier, a common practice of the focal firm is to visit its suppliers´ factory to see how to progress of the production is going, but at that time, it was difficult to arrange a meeting to visit the factory.

When the visit finally occurred, it became evident for the focal firm that certain risks were being taken when ordering products to ST2. The result was finding out that the quality wasn't sufficient and that the current progress wasn't going to comply with the deadline. In another time, for the same project, the supplier failed in having the product ready when the transport was scheduled to arrive, resulting in extra costs for the focal firm, who hired the transport. Delay and quality are two risks that need to be considered in the next project with ST2. A lack of communication was also present, since ST2 didn't warn the focal firm about the delays. The focal firm states that delay isn't always an issue as long as it is communicated on time. The sum of the events has led to a loss of trust from the part of the focal company. This encourages the focal firm's employees to think more about choosing a supplier based on low price.

Chapter 5. Cross-unit analysis

The purpose of this chapter is to make a comparison between the units of analysis. The results relevant to the characteristics of the studied relationships and the supply chain risks (Chapter 4) will be compared across the study units.

To prevent confusions to the reader, an important distinction needs to be made. When referring to *unit* or *unit of study X,* the text is concerning the relationship between the focal firm and company *X*. When the text doesn't refer to a unit, just to a name, for example, "X's driver is…", X is the name of the firm.

> EXAMPLE 1: The **unit MC** scored high for the customer service driver (3.33). This refers that in the **unit of study** MC, the focal firm scored 3.33 for the driver customer service. The driver is the focal firm's for partnering with Main Contractor.
>
> EXAMPLE 2: **MC's** main driver is customer service. That means that Main Contractor's driver is customer service for partnering with the focal firm.

5.1 Cross-unit analysis of drivers and facilitators

The first step for performing the cross-unit analysis was to create a table comparing the different average scores of the drivers and facilitators assessment answers by the focal firm's respondents (Tables 5.1 and 5.2). The last two rows of the units of analysis involving suppliers are presented with a grey font colour to make a reminder that those two units of study where not completed, since it was not possible to interview a representative of those companies, nevertheless, the assessment was realised internally within the focal firm.

Table 5.1. Results of assessment of drivers about the relationship with clients and suppliers by the focal firm.

Drivers: client units of study						
Client unit of study	Asset/cost efficiency	Customer service	Marketing advantage	Profit stability/ growth	S.C.A.	Final score
	Average scores					
MC	**3.67**	**3.33**	**4.00**	**4.33**	Yes	19 (H)
SU	2.00	**4.00**	3.00	3.00	Yes	15 (M)
Drivers: supplier units of study						
Supplier unit of study	Asset/cost efficiency	Customer service	Marketing advantage	Profit stability/ growth	S.C.A.	Final score
	Average scores					
SM1	3.00	**3.67**	2.00	2.00	Yes	12 (M)
SM2	3.00	3.00	**4.00**	**3.50**	Yes	17 (H)
GL1	**4.50**	3.00	1.50	**4.00**	Yes	16 (H)
GS	3.00	3.00	**3.67**	2.67	No	13 (M)
ST1	**4.00**	3.00	**3.50**	3.00	Yes	18 (H)
Additional units of study						
	Average scores					
GL2	3.00	**4.00**	**5.00**	3.00	Yes	17 (H)
ST2	3.00	3.00	**3.50**	**4.50**	-	16 (H)

All answers averaging above the score of 3.00 are marked with bold letters, since they are considered high scores In the drivers' assessment, the prevailing response regarding a sustainable competitive advantage (S.C.A.) is also indicated, which was a yes/no question. If there is a tie of the responses, it is indicated with a hyphen (-) since there is no agreement by the respondents.

Table 5.2. Results of assessment of facilitators about the relationship with clients and suppliers by the focal firm.

Facilitators: client units of study						
Client unit of study	Corporate compatibility	Management philosophy/ techniques	Mutuality	Symmetry	Add. Fac.	Final score
	Average scores					
MC	**4.00**	2.33	**5.00**	1.67	SC, PP, SE	16 (H)
SU	**3.50**	3.00	3.00	2.50	SC, CP, E, PP	17 (H)
Facilitators: supplier units of study						
Supplier unit of study	Corporate compatibility	Management philosophy/ techniques	Mutuality	Symmetry	Add. Fac.	Final score
	Average scores					
SM1	**3.67**	**3.50**	**3.67**	2.67	SC, CP, E, PP, SE	19 (H)
SM2	3.00	**4.00**	3.00	2.50	SC, CP, PP, SE	17 (H)
GL1	**3.50**	1.70	**3.50**	2.00	PP	12 (M)
GS	2.50	2.50	3.33	1.67	SC, PP, SE	13 (M)
ST1	-	2.50	**3.50**	2.50	CP, PP	16 (H)
Additional units of study						
	Average scores					
GL2	1.50	1.50	2.00	1.50	PP, SE	10 (L)
ST2	**3.50**	3.00	2.50	2.00	CP, PP, SE	15 (M)

In the facilitators' assessment, 'Add. Fac.", or additional facilitators, refers to the five yes/no questions asked as a bonus: shared competitors (SC), close physical proximity (CP), exclusivity (E), prior experience with partnerships (PP) and shared high value end user (SE). If most answers are yes, then that facilitator is included in the table. If there is a tie, the facilitator is not included, since there is no agreement by the respondents.

The final score for each assessment for each unit of study is indicated in the last column and in parenthesis it is specified whether the score is high (H), medium (M) or low (L).

Table 5.3. Main drivers for firms to have the focal firm in their supply chain as a client or supplier.

Client	**Main driver 1**	**Main driver 2**
MC	Customer service	Marketing advantage
SU	Customer service	Marketing advantage
Supplier	**Main driver 1**	**Main driver 2**
SM1	Profit stability and growth	Marketing advantage
SM2	Marketing advantage	Assets and costs efficiency
GL1	Marketing advantage	Profit stability and growth
GS	Marketing advantage	Profit stability and growth
ST1	Profit stability and growth	Marketing advantage

Employees of the focal firm answered the assessment of drivers and facilitators, since Lambert *et al*. (1996) recommends to the focal firm to first do the assessment internally, and if there is a decision to partner, then contact the potential partner. For that reason, this assessment was just done within the focal firm. Nonetheless,

in the interviews with representatives of the potential partners, the firm's drivers for keeping the focal firm as a client or supplier were asked. All results are presented in detail in Chapter 4, but a summary is presented in Table 5.3.

5.2 Cross-unit analysis of the power regime analysis

'The power regimes' was a topic of Chapter 2 and was included in the research to make available more characteristics to compare among the different units of study. The results obtained are based on the answers of the interviews obtained when addressing drivers and facilitators. To determine the power regime, the characteristics of each quadrant provided by Cox (2004) were used as a guide (See Appendix 2.A). The results are in Figure 5.1.

<table>
<tr><td rowspan="2">Attributes to buyer power relative to supplier</td><td>High</td><td>Buyer dominance
Sheet metal supplier 1
Glass supplier 1</td><td>Interdependence
Main contractor
Sheet metal supplier 2
Glazing systems supplier</td></tr>
<tr><td>Low</td><td>Independence
Steel supplier 1
Glass supplier 2
Steel supplier 2</td><td>Supplier dominance
Start-Up</td></tr>
<tr><td></td><td></td><td>Low</td><td>High</td></tr>
<tr><td colspan="3">Attributes to supplier power relative to buyer</td></tr>
</table>

Figure 5.1. The units of study in the power matrix based on Cox (2004).

The resulting matrix (Figure 5.1) shows that the focal firm is located to be dominant in three occasions (SU, SM1 and GL1). In three cases the focal firm and the other firm are independent of each other (MC, SM2 and GS). Only one of the units is a case of independence (ST1), in addition to the two incomplete units, which proved to be cases of independence as well, due to the large selection of suppliers of the kind while for them, selling to the focal firm is not crucial for their business.

5.3 Cross-unit analysis of supply chain risks

The second step in this chapter was to analyse all the supply chain risks mentioned by all the interviewees for each unit of study. In Chapter 4, the risks were categorised conforming to the SCOR model categories by Araújo *et al.* (2014) and further categorised in either *shared* or *allocated* according to the interviews. A chart was made to compare the number of risks shared or allocated of all the units of study. From those tables, percentages were obtained for each unit of study, with the purpose of having comparable numbers with regards to:

- The percentage of shared positive risks out of the total number of risks
- The percentage of shared negative risks out of the total number of negative risks
- The percentage of allocated negative risks out of the total number of negative risks

The results are shown in Table 5.4. From this table it is also possible to look at the distribution of allocated negative risks among the firms.

Table 5.4. Percentage of risks shared and allocated per unit of study.[9]

Client unit of study	Total # risks	# Shared **positive** risks (+)	Total # **negative** risks	# Shared negative risks	# Negative risks allocated **to client**	# Risks allocated **to FF**
MC	15	2 (13,33%)	13	8 (60,54%)	3 (23,08%)	2 (15,38%)
SU	5	1 (20%)	4	1 (25%)	2 (50%)	1 (25%)
Supplier unit of study	Total # risks	# Shared **positive** risks	Total # **negative** risks	# Shared negative risks	# Negative risks allocated **to supplier**	# Negative risks allocated **to FF**
SM1	10	4 (40%)	6	1 (16,67%)	2 (33,33%)	3 (50%)
SM2	8	2 (25%)	6	3 (50%)	3 (50%)	0
GL1	7	1 (14,29%)	6	0	5 (83%)	1 (16,67%)
GS	8	1 (12,5%)	7	1 (14,28%)	2 (28,57%)	4 (57,14%)
ST1	8	1 (12,5%)	7	0	4 (57,14%)	3 (42,86%)

The next step was to put the risks of all the units of study in one single table (Table 5.5), count them and group them in broader categories by using colours. The table has the function to visually represent if a supply chain risk is mentioned more than once across the units of study, and if in all cases it was categorised the same or not in terms of *shared* or *allocated.*

For each risk, it is indicated in which units of study it was mentioned, whose code names are written either in the *shared* column or in the *allocated to* column. Based on the table, it was possible to know which supply chain risks are more common, and if they are mostly shared or allocated.

Positive risks, or opportunities, are those with a (+); the rest are negative risks, or threats. In the *allocated to* column, 'FF' is used when the risk is allocated to the focal firm and in parenthesis the name code of the unit of study can be found. If the risk is allocated to the other firm (not the focal firm), then only the name code is used. The following examples make it more clear:

> **EXAMPLE 1:** In the *shared* column, 'MC(+)' means that the focal firm shares with Main Contractor (MC) the risk, which in this case is an opportunity. In this same column, 'SU' means that the risk, which is negative, is shared with Start Up (SU).
>
> **EXAMPLE 2:** In the *allocated to* column, 'FF(MC)' means that the risk is allocated to the focal firm (FF) in the Main Contractor (MC) unit of analysis.
>
> **EXAMPLE 3:** In the *allocated to* column, 'MC' means that the risk is allocated to Main Contractor (MC), in the Main Contractor (MC) unit of analysis.

[9] The transportation risk during ride and arrival is usually allocated to the firm in charge of hiring the service, therefore not considered in the tables.

Table 5.5. Condensed supply risk table of all units of study.

SCOR category	SCOR subcategory	Supply risk name	Shared	Allocated to	Risk group name	Risk count
Plan	Strategic	Bankruptcy of client		– SU		1x allocated to client
		First quotation diff. from final design		– FF (if detected by SM1, else SM1) – FF(ST1)		2x allocated to FF
	Inertia	Flexibility/Technical project solutions/Early involvement	– MC(+) – SM1(+) – SM2 – GL1(+) – GS(+) – ST1(+)		Joint- & early stage-solution thinking	6x as shared opportunity
		Market entry	– SU(+) – SM2 (+)			2x shared opportunity
	Informational	Information for engineering design		– MC		1x allocated to client
	Demand	Underestimated amount of work	– SM2		Wrong estimation of work	4x shared 1x allocated to FF
		Underestimated technical complexity during sales phase	– SM2			
		Wasted quality	– MC – SM1			
Source	Supply	Programme performance from main contractor's side	– MC (ideally)		Programme performance	3x shared
		Programme performance from supplier's side	– SM1 (+) – SM2			
		Sub-subcontractors/suppliers	– MC (could be)	– FF(MC) – FF(SU) – GL1		2x allocated to FF by client 1x allocated to supplier
		IT compatibility	– SM1(+) – SM2	– FF(ST1)		1x shared opportunity 1x shared threat 1x allocated to FF by supplier
		Inaccurate forecast of project specific profiles		– GS	Product as required	1x allocated to supplier by
		Transportation (Packaging and loading)		– SM1 – SM2 – GL1 – ST1		3x allocated to the supplier
		Transportation (During ride and arrival)		– FF(SM1) – SM2 – Responsible party (GL1, ST1)		4x allocated to company who hires transport

SCOR category	SCOR subcategory	Supply risk name	Shared	Allocated to	Risk group name	Risk count
Source	Supply	Meaning of quality	– SM1(+)	– SM2 – GL1	Product as required	1x shared opportunity 2x allocated to the supplier
		Insufficient quality	MC	– SM1 – SM2 – GL1 – ST1	Product as required	1x shared with client 4x allocated to the supplier
		Mistake in drawings		– ST1	Product as required	1x allocated to supplier
	Financial	Exchange rate		– MC		1x allocated to client
		Bankruptcy of subcontractors	– MC			1x shared with client
		Profit loss	– SU		Consequence of high price of product	1x shared with client
		High product price		– FF (SM1)		1x allocated to FF by supplier
		Payments		– FF (GL1)		1x allocated to FF by supplier
	Relational	Contractual process	– MC(+)			1x shared opportunity
		Unclear responsibility of an issue	– MC			1x shared with client
		Relationship problems		– FF(ST1)		1x allocated to FF by supplier
Make	Operational	Programme performance from FF side	– MC (ideally)	– FF(MC) – FF(GS)	Programme performance	1x shared 1x allocated to FF
		Technical misunderstanding		– FF(GS)	Wrong estimation of work	1x allocated to FF by supplier
		Technical feasibility of design		– FF(MC) – GS	Product as required	1x allocated to FF by client 2x allocated to manufacturing party
		Manufacturing/Issues in factory (Also source: supply)		– FF(GS) – GL1 – ST1		
		Installation		– FF(GS)		1x allocated to installing party
Delivery	Customer	Change in engineering design	– MC			1x shared with client
		Change of supplier		– SU	Consequence of high price of product	1x allocated to client
Return	Legal	Derogation schedule	– MC		Consequence of early involvement	1x shared with client
Others	Environmental	Sovereign risks (e.g. Brexit)	– GS – MC (?)	MC (?)		1x shared 1x ?

5.4 Distribution of supply chain risks: link to drivers, facilitators and power regimes

Finding the link between partnership and risk sharing is not possible, since it would be too general. For that reason, the term *partnership* was broken down to smaller elements, which are the drivers, facilitators and the power regimes found across the relationships; while the term *risk sharing* was broken down to groups of risks.

5.4.1 Risk sharing and the power regimes

First, the results of the power regime analysis were directly compared to the percentage of risk sharing and allocation of Table 5.4. Figure 5.2 shows on the left side, the percentage of negative shared risks and the power regime per unit of study. On the right, Figure 5.2 shows the percentage of shared opportunities and the power regime. The units of study are in descending order of percentage of shared risks.

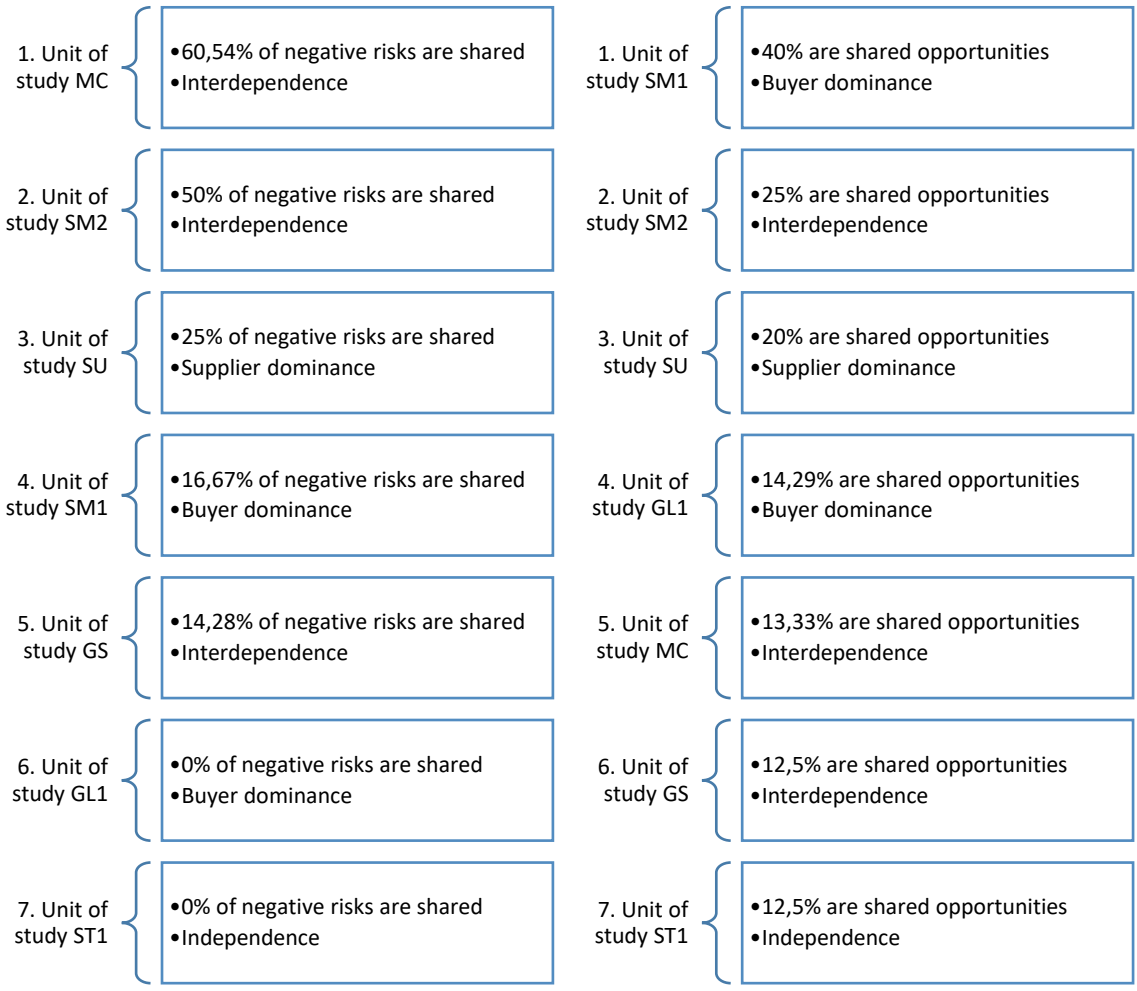

Figure 5.2. Shared negative risks (left) and opportunities (right) with power regime.

In Figure 5.2, the two cases of interdependence, MC and SM2, have the largest percentage of shared negative risks. Unit GS is also an interdependence case and got a low score for negative shared risks which can be due to the type of service that GS offers; GS offers a system and its half-fabricates, not a complete end-product. With respect to buyer dominance or supplier dominance, it can be said that supplier dominance can result in more negative risk sharing than with buyer dominance. The percentage of opportunity sharing cannot be related to

the power regime. On the other hand, the only case of independence, ST1, showed the lowest percentage of overall shared risks (positive and negative).

Figure 5.3 shows the percentage of allocated negative risks to buyer (left) and seller (right), together with the power regimes per unit of study. The units of study are ordered from highest percentage to lowest percentage of risk allocation. The four units with the highest percentage of allocated risks to the buyer have all different power regimes and the percentages are very close to each other that it is not possible to find a relationship. Within the two units with the highest percentage of allocated negative risks to the seller, one is a buyer dominance case and none is a supplier dominance case; therefore, it can be said that there is a higher chance that more negative risks will be allocated to the seller in cases where there is buyer dominance than when there is supplier dominance, such as in units GL1 and SM1.

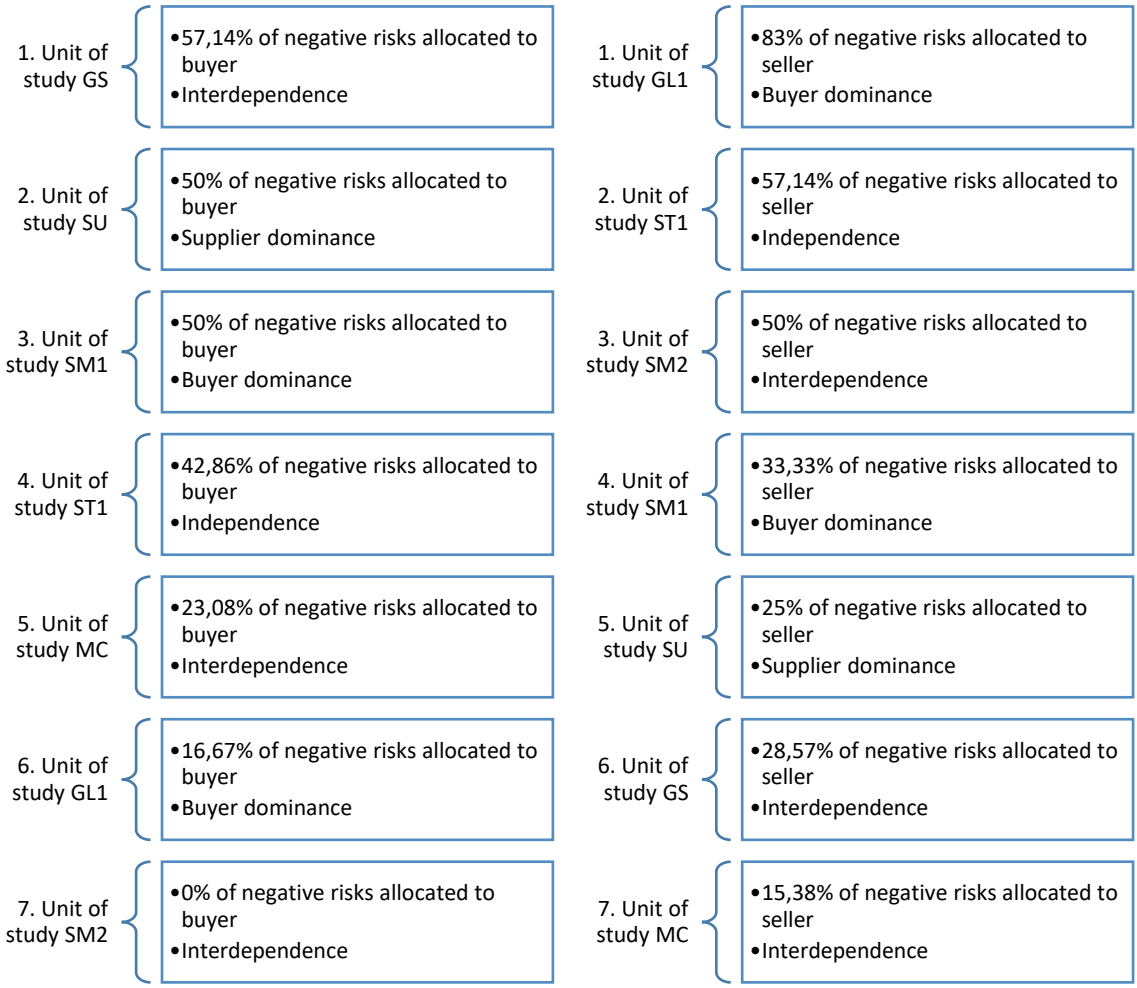

Figure 5.3. Allocated negative risks to buyer (left) and seller (right) with power regimes.

5.4.2 Risk sharing, drivers and facilitators, and the power regimes

After the comparison between power regimes and risk sharing was made, the results of drivers and facilitators were also analysed and compared to the risk sharing and allocating. The following statements resulted from the analysis:

- Positive risks, or opportunities, are found to be shared in all units. There are opportunities that could benefit one firm only, but since the discussion is about supply chain risks, both parties of the dyad should be affected, in this case positively. 6 out of 7 units shared the opportunity of early involvement and joint solution thinking. Early involvement has proven in the past to better results. In two of the cases (units GS and ST1), the suppliers both believe in improvement possibilities for exploiting this opportunity. From these two units, it was learnt that early involvement would reduce the risk of technical failure, time-consuming loops or could even decrease costs. In unit SU, this opportunity is not shared, since SU has a lack of knowledge in engineering, so most decisions were made by the focal firm, but SU is willing to improve this by training personnel, so it is an opportunity that might be exploited in the future.

- Unit MC has the highest percentage of shared negative risks (60,54%). The percentage could increase due to the partnership; some risks that are currently allocated could be shared (programme performance and sub-subcontractors) if some changes were made in the way of working, but that is currently not the case. It was the only unit of study that obtained a high score in the four drivers and the only one with a perfect score of 5.00 in one of the facilitators. MC's drivers to partner up with FF are mainly customer service, since the FF can allow for better project results in terms of on-time delivery and accurate order deliveries, and marketing advantage due to FF's high degree of specialisation. MC is one of the parties were a partnership has been discussed openly between the two companies, and there is willingness to be collaborate. Also, the unit is located in the *interdependence box* of the power regime analysis, meaning the parties depend on one another.

- Unit SM1 has the most shared positive risks, or opportunities (4). Two of the opportunities it shares are allocated negative risks in other units of study, those are: meaning of quality, allocated to SM1 and GL1; and IT compatibility allocated to SM1 and ST1. SM1 was the only supplier that obtained a high score in customer service (driver) and the only supplier that got three high scores in facilitators (corporate compatibility, management philosophy and techniques and mutuality). Drivers for SM1 for maintaining a close relationship with FF are marketing advantage and profit stability/growth, while for FF the main drivers are customer service and asset/cost efficiency, covering the four drivers. Unit SM1 is in the buyer dominance box.

- Unit SM2 is the supplier unit that has the highest percentage of shared negative risks (50%). FF scored high for unit SM2 in management philosophy and techniques (4.00), which can be explained because the two companies are working on the same type of (unique) projects in the market, both are design-and-build companies, both are medium companies and their type of work is complementary in the industry. Moreover, the main driver for both firms in the dyad is marketing advantage, meaning they both think that working together can provide better opportunities in the market. An important reason why risks are shared is the lean management philosophy of SM2, since maintaining a close relationship

with few parties is very important, and to do that there has to be collaboration and trust, which can be reflected in sharing of risks. Also, the unit is located in the *interdependence box* of the power regime analysis, meaning the parties depend on one another.

- Unit GL1 has the highest percentage of the negative allocated risks to the supplier. Unit GL1 obtained the lowest score for management philosophy and techniques (1.70). GL1 is located in the *buyer dominance box* of the power regime analysis. GL1's main driver is marketing advantage while FF's is asset and cost efficiencies; that is because GL1 is very interested in maintaining a relationship with a company with high prestige as the focal firm, while FF is interested mainly in the low price, else taking the risks with quality wouldn't be worth it. The drivers are different, and the buyer has the dominance, reason why GL1 accepts the allocation of many risks. GL1 is taking short-term hits since quality has been insufficient several times, but it has been accepting on it and trying again; there is a willingness to learn and become better.

- Similar to the last point, unit ST1 scored the second highest percentage of negative allocated risks from FF to the supplier. ST1 also scored asset and cost efficiencies as the highest driver for the focal firm (4.00), while ST1's main and only driver is marketing advantage. GL1 and ST1 are very similar in this sense. They are also similar in the fact the both have 0 shared negative risks. The difference is in the power regime analysis, ST1 is located in the *independence box*. Another difference is that GL1 is trying hard to reach the required level of quality while ST1 senses that the relationship could be taken to a higher level, however, there are a lot of steel suppliers on the market.

- GS is the supplier that the most risks allocated to the focal firm. This is due to the nature of the product/service that GS sells. GS was the only one to obtain just one high score in facilitators (mutuality) and one drivers, marketing advantage. Marketing advantage is also RC's main driver to have a close relationship with FF.

- MC is the client with the more equal distribution of negative risks (3 allocated to MC and 2 to FF). The unit is located in the interdependence box. MC's main driver is customer service. The highest facilitator was mutuality with a perfect high score of 5.00. MC and SM1 are among the three most equal distribution of risk, both scored highest in mutuality. In both units, the buyer's main driver is customer service.

- ST1 is the supplier that has more equal distribution of negative risks, with respect to allocation (4 allocated to ST1 and 3 to FF), followed by SM1 (2 to SM1 and 3 to FF). The power regime analysis doesn't relate to the way of distributing the risks, since ST1 is in the independence box and SM1 in the buyer dominance box. The equal distribution can be due to the fact that both firms are present in more

than one industry, not just construction. Both had similar and high scores in mutuality, since there is two-sided thinking an action. SM1 and ST2 are both small companies.

5.4.3 Shared (negative) risks present in at least two units of study

The overall distribution of shared and allocated supply chain risks was previously discussed. In this sub-section, shared negative (groups of) risks are analysed across the units of study and linked to the characteristics of the relationship.

RISKS ONLY SHARED WITH CLIENTS: Some risks are shared only with clients (MC and SU). With MC they are: bankruptcy of subcontractors, unclear responsibility of an issue, change in engineering design and derogation schedule with MC; and with SU the risk of profit loss. In both cases, the parties involved have talked about collaboration in future projects, reason why a close relationship where there is trust would be more convenient.

- Neither MC or SU are located in *the buyer dominant box* of the power regime analysis.
- Both share risks in the 'Source: Financial category.'

WRONG ESTIMATION OF WORK is a group of risks. MC, SM1 and SM2 all share negative risks in this group of risks. In the units MC and SM1, the concern would be to provide more quality than needed, while with SM2 the concern is to underestimate the amount of work and technical complexity.

- MC and SM1 units both scored high for customer service (3.33 and 3.67); for corporate compatibility (4.00 and 3.67); and for mutuality (5.00 and 3.67).
- MC and SM2 both scored high for marketing advantage (both 4.00).
- MC, SM1 and SM2 are all units were early involvement is an opportunity that is or can be used to reduce this risk.

IT COMPATIBILITY is shared with SM1 (as a positive risk) and SM2 (as a negative risk). Having the same IT programme results in advantages for both companies (with SM1), but having different programs can result in time losses for the unusual geometrical shapes of the structure, which has resulted in delays in the past, affecting both parties (with SM2).

- SM1 and SM2 are both suppliers of sheet metal, both have been working with the focal firm for many years and projects, and both are SMEs.
- SM1 and SM2 both scored high on management philosophy and techniques (3.50 and 4.00), which can be related to the sharing of the risk.
- SM1 and SM2 have the same score in asset and cost efficiency (3.00).
- SM1 and SM2 have both prior experience with partnerships and give a sustainable competitive advantage to the focal firm.

PROGRAMME PERFORMANCE is shared as both, negative and positive risk; with SM1 (as a positive risk) and SM2 (as a negative risk). MC would ideally share this risk.

- FF doesn't apply a delay penalty neither SM1 or SM2. MC does apply delay penalty to FF.

- SM2 also shares this risk with third parties, since it believes in finding solutions rather than blaming the party for causing problems, which only results in loss of time.
- With SM1 programme performance is not an issue, since the focal firm relies on SM1 for urgent deliveries, making it an opportunity.
- SM1 and SM2 both scored high on management philosophy and techniques (3.50 and 4.00), which can be related to the sharing of the risk and neither of them accepts delay penalties. For both parties, there is dependence on the buyer, which is the focal firm. Both are SMEs.
- MC would also be willing to share this risk but it doesn't depend on the two parties only, other parties would need to change their mentality. This risk also varies per situation. However, MC applies delays penalties to the focal firm which means that it is rather an allocated risk.
- MC and SM1 both scored high for customer service (3.33 and 3.67); for corporate compatibility (4.00 and 3.67); and for mutuality (5.00 and 3.67).
- MC and SM2 both scored high for marketing advantage (both 4.00).
- MC, SM1 and SM2 have all prior experience with partnerships and give a sustainable competitive advantage to the focal firm.

5.4.4 Allocated (negative) risks present in at least two units of study

In this sub-section, individual, allocated negative (groups of) risks are analysed across the units of study and compared to the characteristics of the relationship.

INSUFFICIENT QUALITY is allocated to suppliers; allocated to SM1, SM2, GL1 and ST1 by the focal firm.

SM1, SM2, GL1, and ST1 are all suppliers of products that are designed according to the focal firm's specifications. Even though the quality risk is allocated to the suppliers, the focal firm visits the suppliers' factories to check progress and quality. If quality is not sufficient then the required actions need to be taken by the suppliers.

- GS is not included, because it doesn't supply special products. What GS produces are standard half-fabricates for a standard glazing system, reason why quality is not an issue.
- With MC, this risk is shared, since MC can make decision on FF's quality based on mock-ups and samples. MC is in the *interdependence box* of the power regime analysis.
- SM, SM2, GL1, and ST1 are all SMEs.
- SM1, SM2 and GL all depend on the buyer, i.e., focal firm. ST1 is independent from the focal firm, but quality still needs to be satisfied.

MEANING OF QUALITY is allocated to SM2 and GL1 by the focal firm.

- If there is an understanding of the required quality by the two parties in the relationship, it is an opportunity that can be shared, since there are process efficiencies, like it happens with SM1.
- SM2 and GL1 both scored high for profit stability and growth (3.50 and 4.00).
- SM2 and GL1 both are SMEs and both depend on the buyer.

IT COMPATIBILITY is allocated if the two companies in the relationship use different IT programme. It is allocated to FF by ST1.

- The extra hours in redrawing results in extra costs that need be paid by the focal firm in the case of ST1. This case differs to that of SM2, since in one occasion the process was more complicated than expected, resulting in more hours, nonetheless, there were no extra costs for any party.
- ST1 scored high in asset and cost efficiency (4.50), due to the good prices the supplier offers to FF. The extra cost of redrawing is an issue arising from the focal firm not using the 3D programme most steel suppliers use.
- ST1 and the focal firm are independent of each other in the market.

MANUFACTURING/FACTORY RISKS are allocated to the party in charge of manufacturing. Allocated to GL1 and ST1 by FF. Allocated to FF by GS.

The focal firm is also allocated this risk together with the installation risk by GS, since GS only supplies some products for manufacturing. Installation risk, was not mentioned by any party, except for GS, since FF is usually in charge of making the installation of the supply products, on other occasions the focal firm subcontracts, but in the end, it is still FF's responsibility.

- GL1 and ST1 are both SMEs that supply a product according the focal firm's specifications.
- GL1 and ST1 both scored high in corporate compatibility (3.50 and 4.00), asset and cost efficiency (4.50 and 4.00) and in mutuality (3.50 both).
- GL1 and ST1 are the two suppliers with the least amount of additional facilitators. In common they have prior experience with partnerships and ST1 also has close proximity.

PACKAGING AND LOADING FOR TRANSPORTATION is always allocated to the supplier, whoever was in charge of hiring the transportation is not relevant. Allocated to SM1, SM2, GL1 & ST1 by the focal firm.

- SM, SM2, GL1, and ST1 are all SMEs.
- SM1, SM2 and GL all depend on the buyer, i.e., focal firm. ST1 is independent from the focal firm, but quality still needs to be satisfied.
- GS is not included but, in reality, they are also allocated this risk. It applies for any supplier.

TRANSPORTATION DURING THE RIDE AND ARRIVAL is allocated the company who is in charge of the transportation is the one who owns the risk. Applies to SM1, SM2, GL1 & ST1.

- GS allocated this risk to the transportation company, but answered wasn't justified.
- GS is located in the *interdependence box* of the power regime analysis.

SUB-SUBCONTRACTORS/SUPPLIERS is allocated to FF by MC and SU. It is allocated to GL1 by the focal firm.

- The three units involve the buyer allocating the risk to the seller.
- MC would be willing to share this risk if it had more input in selecting the sub-subcontractors.

- Neither MC or SU are located in *the buyer dominant box* of the power regime analysis.

TECHNICAL FEASIBILITY OF THE DESIGN was allocated to FF by MC. It was allocated to GS by FF.

- In both units, the buyer allocated the risk to the seller.
- In both units, the sellers provide a warranty regarding water- and air-tightness.
- FF and GS are both SMEs.

FIRST QUOTATION DIFFERENT FROM THE FINAL DESIGN is allocated to FF by SM1 and ST1.

- SM1 and ST1 both scored high on mutuality (3.67 and 3.50).
- SM1 and ST1 are both SMEs and suppliers.
- SM1's and ST1's main driver is marketing advantage.

SOVEREIGN RISKS are shared with GS, while with MC it is not clear, but it would likely affect MC more.

- MC and GS are both located the *interdependence box* of the power regime analysis.

Chapter 6. Discussing the results of the analysis

This chapter has the objective of discussing the meaning of the findings obtained along the different phases of this study, which were the following:

1. LITERATURE REVIEW that lead to the finding of a research gap: the behaviour of risk sharing in partnerships in construction supply chains focusing on small-to-medium-sized enterprises (SMEs);
2. CASE STUDY SET-UP for finding a case study with embedded units of study that would help in filling the research gap;
3. DATA COLLECTION through surveys, interviews and corporate documents to obtain information on the relationships and supply chain risks relevant to the units of study; and
4. CROSS-CASE ANALYSIS to compare the results of units of study.

Explaining why particular findings were obtained is one of the main goals of this chapter, which allow to answer the research questions and for theory building in the form of propositions, as it was explained in Chapter 3 (research methodology).

Moreover, to be able to name this case study one with embedded units and not a multiple-case study, it is necessary to go back to the original case (Yin, 2013), reason why the first section will discuss the main case, that is, the focal firm (FF). Also, the research design was based in *replication logic*, which means that the units of study were selected either to predict similar results (a *literal replication*) or to predict contrasting results but for anticipatable reasons (a *theoretical replication*) (Yin, 2013).

6.1 The focal firm

In the research methodology chapter, it was explained that this particular firm was chosen due to its unique nature. It is a Design and Build company of inimitable architectural structures, where aesthetics play a major role. Given its nature, the focal firm depends significantly in having trust-worthy suppliers that can deliver their products with the required quality and in the specified time to satisfy its clients.

The focal firm is an SME and its clients range from (large) main contractors to government bodies, who choose to build with the focal firm due to its knowledge and expertise in designing and building high-class structures such as façades, atria, domes, canopies, and glass roofs. This characteristic differentiates the focal firm to other SMEs in the industry, which just do design or engineering, or which produce standard products that customers buy. As the main case, employees of the focal firm were the first to be surveyed and interviewed for the research. Thereafter, representatives of the other companies were interviewed.

6.1.1 Risk management

With respect to supply chain risks, it is clear that looking into risks from a supply chain perspective is new for all interviewed employees in the focal firm, since many of the mentioned risks were not supply chain risks, just own company risks. This is because in the construction industry, risks are managed project-wise, rather than with a supply chain perspective. However, in the focal firm, there is no systematic risk management; which is known since a question was made to the interviewees of the focal firm about their opinion on the way risks are managed in the company. The answers varied considerably among the employees of the different departments. Most answers agree with a need to pay more attention to the risks, as the company is getting bigger and more risks are being taken. There is a focus on short-term risks and project leaders focus on their own project only, meaning that the different project leaders could be taking large risks at the same time without being aware the total risk for the company.

Additionally, the company is getting bigger and for that, complex projects are sold without an appropriate risk discussion with the different departments. Two interviewees agreed that specifications need to be checked better with people of the production and installation departments as well, so prices can be established better. Also, certain information is sometimes not transferred on time at the start of a project.

Risks are identified and in many occasions, large risks are accepted when there is not a possibility to have an effect on them through actions. The general way of managing risks is by adding a risk premium of 5% in each project, independent of their size and complexity and including extra weeks in the planning. Adding a risk premium is a common practice by contractors in the industry, which can range from 8% to 20% in Canada and 6.6% to 8.5% in Australia (Loosemore and Lim, 2015), as it was mentioned in Sub-section 2.10.3. Comparing to literature, the focal firm's percentage is low and since it is not estimated per project, the percentage might not proportional to the complexity.

There is room for improvement on risk management, a more systematic management of risks could prevent future losses. Also, using simple tools, such as the risk register, could help project leaders learning from other projects, instead of having to rethink each risk all over again at each project start.

6.2 The bilateral relationships

The units of study are bilateral relationships between the focal firm and different suppliers and clients. This study covers two important points that Lambert *et al*. (1996) addressed: (1) most research on partnerships is based only on few interviews often with just one executive of only one party in the relationships; and (2) most research is based upon mail surveys, which limit extent and richness of the data collected. The points were covered by Lambert *et al*. (1996) in their research, but they didn't focus on partnerships of the construction industry.

Furthermore, Baba (as cited in Lambert *et al*., 1996, p. 4) expressed that "partnership studies would benefit from research designs aimed at identification and explication of integrative processes that serve to bond partners and strengthen interorganizational relationships. Future research on partnerships must have the partnership dyad as the minimum unit of analysis." This research involved the partnership dyad and the outcomes show improvement opportunities for the dyad.

Interviews outside the focal firm with representatives of the other companies made it possible to learn from a different perspective. It was evident that the drivers to do business with one another are different for each company in the relationship. Also, two perspectives regarding a certain issue could be heard.

Regarding the risks, each company in the relationship has its own view on the risks. Some firms had a more collaborative approach to it, while other had a more traditional view. These changes are related to the type of company they are and on the product they deliver. It can also be related to the years of relationship and the importance of one firm to have the other in the supply chain. Supply chain risks are those present in the supply chain, that could affect all the supply chain members, reason why they should be paid attention to by every firm involved. In this case study, it was proved that risks that are taken care of are just the technical risks, while the rest are not thought of.

6.2.2 Employees' view of the relationships

The results regarding the relationships with the selected suppliers and clients were presented in Chapter 4. The assessment of drivers and facilitators in the interviews in the focal firm reflected the kind of relationship that the focal firm had with each company. Lambert *et al*. (1996) created this assessment to aid companies in determining whether it would be convenient to them to create a partnership with a certain member of their supply chain, but it is specified that in case there is already a partnership present, the assessment could be used to evaluate the partnership.

Only some units of study can be called *partnerships,* taking into consideration the definition of partnership by Lambert *et al*. (1996) (see Chapter 1) and the need for agreement in certain components (see Appendix 2.B.2). The rest are good relationships, which is reflected in the results of the assessment, that could be taken to the next level (partnership) and could offer even better results, but that would require work from both sides, since a partnership requires agreeing on certain components (Lambert *et al*., 1996).

6.3 The research questions

This section provides the answers to the research questions stated in Chapter 1.

MAIN RESEARCH QUESTION: ***What is the behaviour of risk sharing in partnerships of construction supply chains, taking the perspective of a small-to-medium-sized enterprise?***

The focus of this research was to find the behaviour of risk sharing within partnerships in construction supply chains focusing on small-to-medium-sized enterprises (SMEs). This issue was addressed due to the unfair risk transfer present in construction supply chains and harsh contract clauses, such as delay penalties, that are affecting SMEs in the industry. Also, different literature sources are certain about the fact that a component of partnerships is risk sharing, among many others but there is no study addressing risk sharing specifically. The opposite, which is risk transferring, is mentioned in many articles and books in literature about risk management as a common risk treatment option in the construction industry. Risk transferring or risk allocation is a common practice that is not necessarily negative. Some parties are more capable of handling some risks on their own due to their experience and knowledge. It can be the case that parties have done the same product or activity

multiple times, reducing considerably the risk. Taking this into consideration, the analysis was made using the information obtained from the interviews.

It is not possible to answer this question in a general way, therefore, the concepts of *risk sharing* and *supply chain partnerships* were broken down into smaller concepts. For the concept of *risk sharing*, a list of risks was obtained from each unit of study, which were later grouped into allocated or shared. For the concept of *supply chain partnerships*, the assessment of drivers and facilitators of Lambert *et al.* (1996) was used, which is the first step of The Partnership Model and is used to determine if it would be a good decision for a company to partner up with another one in its supply chain. Thereafter, the elements of both concepts were compared to one another, to achieve replication logic.

General findings can be associated to the studied literature:

1. SMEs are aware that early involvement and open communication can lead to better and more efficient project solutions. Benefits for both result from exploiting this positive risk, which includes reducing the risk of technical failure, eliminating time-consuming loops and cost decrease. This is supported by Loosemore and Lim (2015), who believe that notions of collaboration among supply chain members should replace the traditional competition, since it can result in mutual advantage.

2. It was proven that it is possible to have a partnership between an LE and an SME, if there is reason to partner from part of the LE, which is reflected in the LE's customer service and marketing advantage drivers. Mutuality and corporate compatibility are facilitators present in the relationship, which can also be positive influencing factors. Therefore, it is possible to partner and share a number of negative risks. This can be supported with the fact the FF scored high in all drivers to partner with the LE. This result contradicts what Dainty *et al*. (2001b) said with regards to subcontractors and suppliers been largely ignored within partnering and strategic alliancing in the construction industry.

3. Marketing advantage is a main driver for all suppliers interviewed to keep having the focal firm as a customer. Lambert *et al*. (1996) state that the stronger the integration between two firms can (1) enhance a firm's marketing mix; (2) facilitate entry into new markets; and (3) allow access to technology. The five suppliers justified this driver by remarking the type of projects that the focal firm sells: The projects are very unique and are of very high prestige, and they are evidently the type that SMEs want to add to their portfolio.

4. Edkins (2009) mentioned two routes about risk management: Use of contract or management of the relationship using a SCM approach. Delay penalties are included in contracts as a formal way to establish expectations and they are present across some units of study. The characteristics of the relationships in terms of drivers and facilitators are not related to whether a firm accepts delay penalties or not.

   The first route is evident in the units were subcontractors/suppliers accept delay penalties. They accept them to show certainty that they are going to deliver on time, while the firms that apply them do it to provide a 'motivation' for the subcontractors/suppliers to comply with the programme or because their own customer gave them included penalties in their contract in the first place.

On the contrary, it is also possible to relate to Edkins' second route to risk management as well, since there are firms that don't accept delay penalties for two main reasons: (1) They are a significant financial risk for the firm since delays can be due to external causes that cannot always be controlled; and (2) they are not an element of a partnership, since blaming a party for a delay affects negatively the level of trust and support from one another.

Another important finding was that it is not possible to say that if there is risk sharing among to supply chain members, there is a supply chain partnership or vice versa. Nonetheless, when looking at the smaller elements, some association was found between a few of them, which was the objective of the cross-unit analysis:

5. A close relationship with a supplier due to that supplier's contribution in customer service level and if plenty of facilitators are present which allow the relationship to grow and be maintained can be related to the exploitation of multiple positive risks that benefit both firms.

6. Similarity in management philosophy and techniques by SMEs in a relationship and the percentage of positive and negative risks that are shared are related. The less the compatibility in the management philosophy and techniques facilitator, the more allocation/transferring of risks there will be.

7. An equal distribution of negative risks is associated with the facilitator of mutuality, specifically two-sided thinking and action. The units with the most equal distribution of allocated negative risks, had high scores in the mutuality facilitator. Furthermore, the supplier unit of study with most risks allocated to the focal firm also scored high in mutuality. Mutuality can be directly associated with the seller being able to allocate risks to the focal firm.

Mutuality can also be associated to the buyer's customer service driver. Units that scored both high in mutuality and the buyer's main driver was customer service, resulted in a more equal distribution of negative risks.

An equal distribution of negative risks is independent of the firm's sizes, since it can be found in LE-SME relationships and SME-SME relationships. Being an SME can't be associated to unfair distribution of risk.

More findings were found by analysis supply chain risks individually:

8. Non-buyer dominance and the will of a buyer and a seller to build a close relationship can be associated to the possibility of sharing risks of the financial category.

9. Wrong estimation of work is a shared risk that can be mitigated by using the opportunity of early involvement, were an early discussion about the technical aspects can take place and were quality requirements are made clear.

10. Lack of IT compatibility is a risk that brings negative consequences, such as delays or extra costs. Mitigating the risk transforms the threat into an opportunity exploited by the parties, since becoming compatible results in more collaboration opportunities, more accurate specifications and better results in quality.

11. The supplier is normally allocated the risks that fall into the 'product as required' group, which includes meaning of quality, insufficient quality, mistakes in drawings, technical feasibility if design, and manufacturing/issues in factory, together with packaging and loading and sub-subcontractors/supplier risks.

SUB-QUESTION 1*: What are the main drivers for companies in construction supply chains to form partnerships?*

The details of the answer to this question can be found in Chapter 4, where each section was dedicated to one unit of study. The drivers of each party in each unit of study were explained in sub-sections 1 and 2 of each section. The question can be answered from two perspectives: (1) seller and (2) buyer.

1. Drivers for sellers to form supply chain partnerships in the construction industry:

The focal firm's main drivers as a seller (i.e., taking into account the units of study of client firms) to partner up with buyers, are customer service and profit stability and growth. Customer service in the context of this research refers to having a closer relationship with clients in order to keep achieving more accurate order deliveries and process improvements that could benefit future projects together. On the other hand, profit stability and growth is important to the focal firm since it is willing to grow and it is looking for clients that will allow this to in addition to an increase in profit and sales.

The main driver of the focal firm's suppliers to keep the focal firm as a customer is marketing advantage. The projects of the focal firm are eye-catching, reason why suppliers want to be able to have such projects in their portfolios. This type of projects can open market opportunities for the supplier and they can use the pictures for promotion.

2. Drivers for buyers to form partnership in the construction industry:

The main driver of the focal firm as a buyer (i.e., taking into account the units of study of suppliers) to partner with its suppliers is asset and cost efficiency. This means that the company is interested in keeping a close relationship to have costs savings in production. The second main driver is customer service, since the focal firm wants close relationships with suppliers that will allow him to keep achieving customer satisfaction, usually attained with the required quality and on-time delivery.

The main driver for the focal firm's clients to have the focal firm as a subcontractor is in both cases customer service and, in second place, marketing advantage. Customer service is relevant because both firms find FF to be a unique company that has the expertise required and that has proven in the past to have the capacity of achieving good results. Marketing advantage is also important for both firms since there is innovation potential with the focal firm. Tendering with input with the focal firm can give advantage to MC, while, in the case of SU, the focal firm can guide for the expansion to new countries in Europe (new markets).

SUB-QUESTION 2: *What are the main supply chain risks in construction supply chains?*

Table 5.5 in Chapter 5 was created to visualise all the risks learnt from the interviews in one table, in order to know how many times the risks are repeated across the units of study. The list of risks per unit of study is presented in Chapter 4. The most present risk was a positive one, which are in reality three risks grouped into

the single category named *Joint- & early stage-solution thinking* which includes opportunities that the companies exploit such as flexibility, coming up with technical project solutions in a collaborative manner and early involvement.

Main negative risks found to be present in the supply chain are:

1. Wrong estimation of work, which includes the underestimation of work, as well as including quality that was not needed and, that if detected, some costs can save some costs;
2. Transportation risks, since products might get damaged if not packaged and loaded well into the truck;
3. Meaning of quality and insufficient quality, which are risks concerning the supplier's products not have the required quality when delivered, either due to human errors or to not understanding the requirements;
4. IT compatibility, since using the same or different software can be a great advantage or serious disadvantage, respectively;
5. Sub-subcontractors/supplier risks involve the party hired by the supplier, which makes it a 2nd tier party, whose performance is often responsibility of the party who hired it or bought a product from it; and
6. Programme performance, which is shared if there are no delay penalties for the seller company, or vice versa.

This mentioned risks can be all located in the table of supply chain risk categories and triggers by Tummala and Schoenherr (2011) that can be found in Appendix 3.D.

SUB-QUESTION 3: *How are supply chain risks in construction supply chains treated?*

There is not a concrete answer to this question. From the case study, it was possible to have an understanding of the way risks are managed in this particular supply chain. The following points can give an idea on how risks are treated.

1. The concept of *supply chain risk* is not unknown, yet, firms are more aware about project risks and how those risks might affect them; there is no perspective taken on how one's own risk could affect the whole supply chain.
2. Systematic (project) risk management was found to be performed in only one of the units of study; by the only large company in the case study. From this it can be generalised that SMEs don't do a systematic risk management, neither for their projects nor for their supply chain.
3. As it was explained in the introduction of this chapter, the focal firm doesn't perform systematic risk management, nor uses tools such as the risk register. The lack of systematic practice doesn't allow to have a clear view of the treatment strategies for the different risks. Every project is different and every situation is different, reason why it's difficult to answer this research question even for one single unit of study.
4. Risks that are shared are responsibility of both parties to treat, nonetheless there are no specific risk treatments planned by the two firms starting a project. Risks are discussed at early stages, in some

occasions, but these are more focused on technical aspects of the projects, as well as health and security issues, but not supply chain risks.

The previous points demonstrate that it is difficult to give a concrete answer, however, some risk-specific examples can be provided and how they are treated based on the risk responses by Hillson (2001) (Table 2.8 in Section 2.8.3), but it doesn't mean that that is the only treatment strategy nor the that is always done by firms of the case study. Trust and collaboration are key for a company to be willing to share risks. Unit of study MC was the one to provide the most examples on shared supply chain risks:

- Insufficient quality risk can be MITIGATED jointly by making and approving mock-ups and samples.
- Sub-subcontractor risks can be shared if decisions regarding sub-subcontractors were made jointly, that is, both having and influence of choosing the sub-subcontractors, which can be for example, the party installing the glass. This risk is MITIGATED by the focal firm by being constant contact with the supplier weeks before the deadline to make sure everything is going according to the planning.
- Project issues that could lead a subcontractor, in this case the focal firm, to bankruptcy, is in the interest of MC to give financial support, since this risk could cause major losses for the project. It is also in the interest of MC to have the focal firm available for future projects. MC makes an effort in MITIGATING this risk by making payments to the focal firm out of the schedule in the contract.

Other risks are most of the time ALLOCATED/TRANSFERRED to one of the parties, who will be in charge of treating the risk on its own, examples are:

- Packaging and loading the product for transportation, is in all units of study allocated to the supplier, who is in charge of carefully loading the truck so the products don't get damaged during the ride.
- Understanding of quality and insufficient quality are allocated to the supplier, but the case study shows that there is flexibility and support from part of the buyer in the cases where the focal firm is the buyer. A list of detailed specifications is the best way to transfer the needs of quality, as well as detailed drawings in 3D, provided by the focal firm to the suppliers. Furthermore, the focal firm visits the suppliers' factories to detect errors before it's too late.
- Programme performance, was not mentioned as a risk very commonly across the units of study, but it is a risk that is always present. Delay penalties are a way of allocating this risk to one party. The focal firm accepts delay penalties in contracts. Out of the seven units of study, three of the firms (apart from the focal company), do accept delay penalties. The rest don't.
- Manufacturing risk/issues in factory can happen to any supplier, including the focal firm, so it is important to be aware that any time, there can be a reason in the factory for which production is stopped without warning. It's responsibility of the supplier to have a back-up plan. Manufacturing risks due to human errors are mitigated by checking the work constantly by more than one person, but the companies need to accept that it is possible that something *slips*.

On the other hand, other risks have proved to be a challenge in many projects:

- IT compatibility is a risk that is usually ACCEPTED by the focal firm. The focal firm uses certain drawing software, which is not always compatible with that of suppliers. This issue depends considerably on the supplier and the type of project. Only in one of the units of study this risk had been treated; the supplier decided to invest in the software that the focal firm uses, while employees of the focal firm have also learned to use that supplier's software.
- Wasted quality refers to offering more quality than needed by the client. It is a risk that is sometimes MITIGATED by the focal firm by carefully looking into the specifications provided by a client to point out those that are impossible to achieve or that would only incur unnecessary costs. Customers are always very satisfied with the quality, but when compared to what other subcontractors deliver in the same project, it feels like the focal firm's quality was too much, therefore it is a risk that is not always 100% mitigated. In one supplier unit of study, wasted quality is also relevant with the fact that it is not always clear which elements or which part of the elements is more visible, the results some non-visible parts to have very high quality in the finishing; detecting it can save some costs for both parties.

SUB-QUESTION 4: *How do small-to-medium-sized enterprises benefit from handling supply chain risks?*

This question can be answered hypothetically, since the results of handling supply chain risks are not measured by the studied firms. SMEs in this case study are aware of the risks that could affect the rest of the supply chain members. By jointly detecting supply chain risks at an early stage, it is possible to find solutions together and detect possible problems that could arise. SMEs have significant impacts on supply chain processes (Hong and Jong, 2006) and can have a great influence on the decisions regarding risks, since they are the experts needed to achieve certain tasks in projects (Edkins, 2009). Decisions could be made based on their experience and high degree of specialisation. The only barrier for SMEs would be the command and control that LEs sometimes use against SMEs (Hong and Jong, 2006) in SCM processes.

If SMEs handle the risks with other members of the supply chain, it can be discovered that a risk for one company can easily be solved by the other one. Effective communication can mitigate some risks in an automatic form. Communication, on a daily basis and a non-routine basis, can make relationships stronger if it is effective across the different levels of organisations (Lambert *et al*., 1996). Trust and commitment can also lead the parties to share of information with one another, which also reduces uncertainty.

Due to their size, SMEs have an advantage due to their horizontal structure with less management levels, that allows them to have shorter communication lines (Thoo *et al*, 2012). Short communication lines can make it easier for other members in the supply chain members to communicate with an SME, which can result in higher levels of trust, and therefore, motivation for helping each other out.

6.4 Limitations of research

The most important limitation of this research is that it was mainly qualitative, reason why results obtained from the interviews might reflect subjectivity from part of the respondents, which can be influenced by personal experience and perception of reality. In the interviews, a survey was answered with the option of justifying

answers, and it was possible to detect that the numbers chosen from 1 to 5 didn't have the same meaning for each respondent. The meaning of 3 could mean a low score for one person, but another one perceived the number 3 as medium/high, which can be inferred from the respondents' justification of answers.

Furthermore, this research was a first attempt to create theory on the association between supply chain partnerships in the construction industry and risk sharing from the perspective of an SME. More research is needed to continue feeling the gap in literature. Also, literature considers risk sharing as a crucial element of partnerships, but this research considered it as two separate constructs, which is a limitation.

Moreover, the study was focused on dyads, nonetheless, the study was made from the perspective of one company and its relationships, meaning that more weight was put to the perspective of the focal firm. This approach doesn't consider both perspectives equally, which certainly has an effect on the results. Also, sharing of risks can sometimes benefit one of the firms of the dyad more than the other, which is something that wasn't measured. A question that would arise from this limitation would be: "why share?" The question could be addressed by having interviews with representatives of both firms together. Rather than personal interests, the approach could be to find group risks and group solutions that would benefit both parties in the most impartial way possible.

Supply chains in the construction industry are in constant change since the industry is project-based. There is a chance that if the same study is done two years in the future or two years back was made in the same focal firm, different results would be obtained, in which findings could be different. Apart from the timing, supply chains are different form project to project in this case study.

The case study is a construction supply chain whose focal firm is located in The Netherlands and the units of study are located inside Europe. Cultural differences in the construction industry can be found across the different countries worldwide. Legislature can vary considerably from country to country, and even more from continent to continent. Partnerships in the construction industry is a subject were a lot of relationships of human beings are involved. The nature of a partnership is particular to each specific case, where culture of the country or continent plays an important role. Even the culture of the different companies involved has an influence on partnerships. With the topic of risk management, it is similar; even though risks can be classified in a general way, every country can be subject to more severe consequences of a certain risk, or there can be more chance of a particular risk to fire.

In addition, the case study considers solely one tier above and one tier below the focal firm. More findings could be obtained by studying more tiers. The concept of supply chain risk management (SCRM) was explained in the literature review and one of its the goals is to have a global perspective of the supply chain in order to identify the vulnerable risks where supply chain risks could be present. Therefore, considering only two tiers doesn't allow to capture all the risks in a construction supply chain. This is also relevant in the issue of transferring of risk, since in this research it was possible to detect if a risk was transferred from the client, through the focal firm, to the supplier, but not further. It is not possible to know if the risk transferred stopped in that tier or if it continued.

The units of study include only a very low percentage of the focal firm's suppliers and clients. More units of study would have resulted in more concrete findings. The focal firm is not constantly giving jobs to only a few suppliers. The situation changes every few years. It could take considerable amount of time for a supplier to get a job after one has been finished. The analysed units of study were chosen according to the actual situation of the focal firm, however, that doesn't mean that the selected companies are the most important in any sense for the focal firm. The will to participate and availability of the selected firms were important factors to select them.

Also relevant is the number of suppliers and the number of clients selected; only two client units of study were included in the research, and by having two it was possible to realise that the findings contrasted from one another. There is a possibility that adding more clients to the list would've shown contrasting results across the client units. The reason for the low number of client cases is the low frequency of projects with the same client. A seller doesn't choose its buyer; the opposite occurs and that's why there were many suppliers to choose from when selecting the units.

An important limitation about the part of risks of this research is that risks weren't quantified, neither in terms of likelihood nor probability, which are crucial steps of risk management as explained in the literature review. The reason behind this is the lack of systematic management of the risks within the focal firm. During the survey (assessment of drivers and facilitators), some respondents had a difficulty of choosing an answered, which was a number the represented a probability. Doing the same for supply chain risks would've been even more complicated, and more since risks were mentioned in a general matter. If the research was about one project quantifying risks would've been feasible. Also, one same risk can vary considerably across suppliers in terms of likelihood and consequences.

Part IV
Conclusions & recommendations

Chapter 7. Conclusions and recommendations

The goal of this chapter is to explain in a summarised way why the research was performed, its objective, how was the objective reached, and what the results and findings were. The last two sections are focused on giving recommendations: Section 7.5 is dedicated to researchers who are interested in exploring the same topic and Section 7.6 is dedicated to the company that made this research possible, which has the most important role in the case study.

7.1 Why this research?

A research gap was found when addressing the literature on small-to-medium-sized enterprises (SMEs) in the construction industry. Subcontractors and suppliers are mainly SMEs and form the largest percentage of firms in comparison to large enterprises (LEs) in the industry. Countless parties are mainly concerned with maximising their profit, reason why, in many occasions, subcontractors and suppliers are selected by the main contractor on the basis of lowest price rather than best value. To have a safer feeling about the decision, main contractors include harsh terms in contracts with subcontractors and suppliers, e.g., risk transfer. Risk transfer is a well-known risk treatment strategy in project risk management that has the purpose of allocating a risk to the party most capable of handling it. Unfortunately, it is a common issue affecting SMEs in this sector, since, frequently, risks are transferred on the foundation of commercial and negotiation power from to stronger parties to the weaker ones, even if the risks are too big for the weaker parties to handle.

Forming and maintaining relationships were principles of supply chain management (SCM) are followed could help reduce the problem for SMEs, since part of the goals of SCM is to increase coordination and integration of the processes and parties involved. In SCM, there are different types of relationships ranging from arm's length, through different types of partnerships, to vertical integration. Supply chain partnerships are a common subject in literature and it can be often found that risk sharing is a component of this type of relationship. However, there is no literature addressing specifically the level of risk sharing or risk allocation within a supply chain partnership, which is the research gap this study intended to fill.

7.2 Objective of the research

This research focused on finding the behaviour of risk sharing within supply chain partnerships in the construction industry from the perspective of an SME. A case study with embedded units of study was selected as research methodology, where the *main case* is a specialist subcontractor in a construction supply chain in The Netherlands. As it was explained in Chapter 3, Sub-section 3.2.3, the *main case* was referred to as the focal firm, since the construction supply chain analysed was viewed from the point of view of the specialist subcontractor. Tier-1 suppliers and clients of the focal firm were selected to be part of the embedded units of study. The units of study were dyads, that is, each a relationship between the focal firm and the selected suppliers and clients.

In total, the research included seven complete embedded units of analysis: five units with suppliers and two units with clients.

7.3 How was the research made?

Interviews with employees of the focal firm and representatives of the selected suppliers and clients allowed to learn about their main drivers and facilitators, the power regimes, and the supply chain risks of the relationships. All results were presented in Chapter 4.

The theory on partnerships by Lambert *et al*. (1996) was the main theory used for obtaining the drivers and facilitators results, since it focuses in determining when a partnership is appropriate for an organisation via an assessment of drivers and facilitators, which was included in the interviews within the focal firm. In the interviews with the representatives of the suppliers and clients, it was also possible to learn about their main drivers. The listed drivers are for at least one of the following two reasons: first, for the firms in the dyad to want to form partnerships or maintain an existing one, and second, to keep the other in their supply chain.

Additionally, it was possible to learn about the power position of each firm with respect to the focal firm, based on the power regime analysis of Cox (2004). Finally, the interviews also helped to learn about the main positive and negative supply chain risks located in the studied links of the supply chain were the relationships are located, and whether the risks are shared or transferred from one party to another.

7.4 Results and findings

The research was a first attempt to build theory about SMEs regarding the behaviour of the concept of risk sharing within supply chain partnerships. The two concepts are too broad to make a direct comparison. Instead, the concepts were broken into smaller parts: risk sharing was broken into the different types of risks and the categories, while supply chain partnership was broken into the drivers, facilitators, and the power regime. The analysed drivers were: asset and cost efficiency, customer service, marketing advantage, and profit stability and growth. The analysed facilitators were: corporate compatibility, management philosophy and techniques, mutuality, and symmetry. The studied power regimes were: buyer dominance, supplier dominance, interdependence, and independence.

With all the information obtained from the data sources, a cross-unit analysis was made, in which all the units of study were compared. The outcome of the cross-unit analysis was a direct comparison across the units of study with respect to the drivers, facilitators, power regime analysis, distribution of allocated risks, and shared risks. Similarities and contrasts along the results were used to write theory-building propositions. The following are the 12 theory-building propositions defined based on the findings of this research:

1. Collaboration among supply chain members results in mutual advantage, independent on the difference in size of the two firms, meaning SMEs and LEs can both benefit from a relationship with collaboration.

The intention to collaborate and become better together is present in most units of study. In Chapter 4, Sub-sections 4.1.2, 4.1.3 and 4.1.4 describe the importance of collaboration between an LE and SME. In units of study

SM1, SM2, GL1 (Sections 4.3 to 4.5) there is collaboration at early stages of projects towards finding design solutions and also for problem solving during execution. In units of study GS and ST1 (Sections 4.6 and 4.7) there is potential for more collaboration during early stages, since there could be cost savings, reduction of time consuming loops and reduce the risk of technical failure.

In Chapter 2, it was mentioned that Loosemore and Lim (2015) believe that notions of collaboration among supply chain members should replace the traditional competition, since it can result in mutual advantage (Sub-section 2.10.3 under "suggestions to solve the problem").

2. LEs don't ignore the possibility of forming partnerships with SMEs if the SME offers a product or service that will help the LE increase the customer service level and its marketing advantage.

One of the relationships is a partnership with a main contractor, which is a large company (LE). The unit of study is described in Chapter 4, Section 4.1. The findings contradict what Saad *et al.* (2002) said with respect to partnering in construction: that most partnering is focused on developing collaboration in upstream relationships between LEs with less involvement of smaller organisations (Chapter 1).

Due to the focal firm's technical expertise, it can be in the interest of LEs to partner with the firm as it is described in Sub-section 4.1.2, where the main drivers of the main contractor are explained; it is clear that the focal firm has become an asset of the LE. Furthermore, the firms can exploit market opportunities together by starting collaboration in the tendering phase, since it can improve the chances of winning a tender.

Moreover, Hong and Jeong (2006) stated that SMEs with a strong negotiating position and with internal competencies that give them value creation capabilities allows them to be dominant members in business. This can be related to the focal firm, since its capabilities give it a dominant position in the supply chain.

3. An LE who is interested in forming or maintaining a partnership with an SME will be willing to share risks with that SME.

The interest of an LE in sharing risks the focal firm shows that it is concerned in keeping the focal firm as a close partner (Sub-section 4.1.5). Certain risks are currently allocated to one party, e.g., sub-subcontractor, but the main contractor is willing to share it if it could become more involved in the decisions with regards to sub-subcontractor selection. Also programme performance is currently allocated, even if the main contractor would be willing to share it, but that requires a change in the mind-set of a whole supply chain and maybe the whole industry, and not just of the two parties in the partnership. As Vrijhoef (1998) said, there is a tendency for self-interest due to the unique and temporary nature of construction projects and short-term individual objectives, which can make problem solving a difficult task (see Sub-section 2.5.1).

4. Unique projects in terms of engineering and aesthetics have an influence on developing the marketing advantage driver for suppliers for maintaining a relationship with a specialist subcontractor that is also an SME.

Supplier units of study showed the importance that marketing advantage represents to suppliers of the focal firm. Sections 4.3 to 4.7 present the main drivers of the interviewed suppliers, from which five mentioned it as the first main driver and the other two as the second main driver (see Table 5.3 in Chapter 5). An increased

marketing advantage by means of a close relationship encompasses the opportunity for a new market entry, joint advertising, a reduced price advantage, expanded geographical coverage, access to technology and even innovation potential (Lambert *et al*., 1996). Due to the focal firm's prestige and types of projects, it is in the interest of other SMEs to keep a close relationship, since doing so can offer more market opportunities.

SM1 and SM2 both believe that collaborating with the focal firm allows both parties to achieve greater strength in the market than individually. A close relationship offers the opportunity to come up with design solutions together. SM1 is also interested in the expanded geographical coverage that it has when working with the focal firm (Sub-section 4.3.2). SM2 believes that when joining with the focal firm, both can win special projects in the market, since they complement each other (Sub-section 4.4.2).

GL1 trusts that maintaining a close relationship with the focal firm is important due to its added value, that is, the uniqueness of the projects and the high degree of engineering. Working with such a firm and understanding its quality standards can offer GL1 more prestige and opportunities in the market (Sub-section 4.5.2).

GS is flexible towards adapting its system to irregular geometrical shapes and values the focal firm as a customer due to its projects with a high-level of sophistication. Similarly to GL1, GS sees this as a market opportunity and as innovation potential due to the technical challenges (Sub-section 4.6.2).

Finally, ST1 mentioned the opportunity of joint advertising, but it was meant in a more individual way rather than jointly. This can be justified with the more traditional nature of the relationship (Sub-sections 4.7.2 and 4.7.3).

5. The use of delay penalties in contracts by a buyer or the acceptance of delay penalties in contracts by a seller is not related to the presence or not of a partnership nor to the size and power of the firms involved.

In Chapter 4, when comparing Sub-section 5 of Sections 4.1 to 4.7, it is possible to make a classification of which parties use/don't use or accept/don't accept delay penalties in their contracts. Edkins (2009) believes in two routes towards risk management, one is the use of contracts and the other is management of the relationship (SCM approach) . The former refers to the use contracts as a formal way of providing incentives and penalties to establish expectations and responsibilities, while the latter refers following a SCM philosophy (Sub-section 2.10.2).

The focal firm and MC include delay penalties in their contracts with subcontractors and suppliers. The focal firm does it when its client gives the it penalties, so it transfers the penalties to the suppliers when possible. MC implements them as a way to motivate subcontractors and suppliers to perform as agreed (Sub-section 4.1.6). GL1 and ST1 accept delay penalties after the necessary negotiations are made. GL1 believes that by accepting them it shows that it can be trusted that they can deliver according to what was agreed in the contracts and because it is a firm that is willing to learn and grow in the market (Sub-section 4.5.6).

On the other hand GL2, as well as many other glass multinational companies, doesn't accept them since they have so much demand that they can set their own boundaries and in the case they do accept them, they increase

the price of their products considerably (Sub-section 4.8.1). ST1 accepts them since it understands that if the focal firm applies them because the penalties originate from the client, but it also believes that they could damage the relationship, since parties need each other in the end.(Sub-section 4.7.6).

SU doesn't implement delay penalties to its supplier, since the firm wants to break the barriers of traditional construction supply chains (Sub-section 4.2.6). SU believes in openness and information sharing with all the supply chain members, which are characteristics of partnerships as mentioned by Yu, Yan and Cheng (2011) (See Section 2.4). SM1 and SM2 don't accept delay penalties: SM1 doesn't, because it believes it brings in a very high risk, since external causes could cause delays (Sub-section 4.3.6); and SM2 considers that penalties are not a component of partnerships (Sub-section 4.4.6), and as ST1, SM2 is aware that it needs its suppliers, so implementing penalties wouldn't benefit the relationship. The philosophy of SU and SM2 is relevant to the second risk management route that Edkins (2009) describes, not only because of the exclusion of the delay penalties, but also the firms choose to have few suppliers and partnerships if it results in benefits for the company.

With respect to the power regimes: MC, GL1 and ST1 implement or accept delay penalties, but the units fall within the power regimes of interdependence, buyer dominance, and independence, respectively; on the contrary, SU, SM1, SM2 and GS don't implement them or accept them, and the units fall within the power regimes of supplier dominance, buyer dominance, and interdependence. When comparing the analysis with the power regimes, with the size of the firms and with the type of relationship, it is evident that the risk management route chosen is an independent decision that depends rather on the previously mentioned circumstances. This finding contradicts literature, where it was found that SMEs suffer from unfair transferring of risks due to main contractor's self-interest in maximising profit (Akintan and Morledge, 2017). Nonetheless, it is crucial to point out the type and magnitude of projects the different supply chains deal with, reason why the results could vary significantly, which could also be influenced by how traditional the practices of a supply chain are.

6. If two SMEs have similar management philosophy and techniques, there will be a presence of shared risks, both positive and negative.

Units SM1 and SM2 where the only two units that scored high in management philosophy and techniques (See Table 5.2 in Chapter 5). The two units obtained the highest percentages of shared opportunities and both are within the highest four percentages of shared negative risks (See Figure 5.2 in Chapter 5). On the other hand, units with the lowest scores in management philosophy and techniques were obtained for MC, GL1 and GS and ST1 (See Table 5.2). Figure 5.2 shows that these four units obtained the lowest percentages of shared opportunities. It also shows that GL1 and ST1 obtained the lowest percentages for shared negative risks.

The conclusion was made only for SMEs, since MC obtained the highest percentage of negative shared risks, but scored low for management philosophy and techniques. The latter can be explained by the fact that MC is an LE with a very different organisational structure, which cannot be compared to that of the focal firm. The high

percentage of shared negative risks can be justified with the high score obtained in all the drivers and with the highest possible score in mutuality, in addition to the reason behind proposition 3.

In literature, SCM is referred to as a management philosophy that requires a multifirm cooperative effort that includes activities such as integrated behaviour, sharing information, sharing risks and rewards, that can result in lower costs, increased customer satisfaction and greater competitive advantage (Chapter 2 Sub-section 2.1.2). Certainly, similar philosophies can involve SCM aspects such as these ones; in this case, the focus is on risk sharing in order to obtain positive outcomes.

7. Mutuality, specifically two-sided thinking and action in a dyad, is directly proportional to the equal distribution of allocated negative risks within the dyad.

As previously mentioned, unit MC obtained the highest possible score in the mutuality facilitator and the score was considerably above average (See Table 5.2 in Chapter 5). Furthermore, in Table 5.4 it can be perceived that in unit MC, 23% of the negative risks are allocated to MC and 15% to the focal firm, representing the most equal distribution of allocated negative risks.

Moreover, in unit ST1, 57% of the negative risks are allocated to ST1 and 43% to the focal firm, representing the second most equal distribution of the seven units of study and obtained a high score in mutuality also. SM1 and GL1 obtained, as well, high scores in mutuality, very similar to ST1 (Table 5.2). Unit SM1 has a distribution of 33% to SM1 and 50% to the focal firm, so also relatively an equal distribution. Yet, oppositely to the other thee units, GL1's distribution is not equitable, but can be justified with the fact that GL1 is a relatively new supplier for the focal firm and is working very hard to satisfy the high standards and become a trustworthy supplier, while SM1 and ST1 have been working many years for the focal firm.

In Chapter 2, Sub-section 2.10.3, it was explained that risk management in the construction industry mentions frequently a risk treatment called *risk transfer,* which refers to transferring a specific risk to a party; a topic that is highly addressed in this study. Also, it was mentioned that the distribution of rewards is unequal due to the competition of the supply chain members towards the greatest proportion of the client's value-stream, and for that reason, contracts are in many occasions awarded based on lowest costs rather than best value. These statements are aimed at the unfairness present in the construction industry, nonetheless, the presence of closer relationships where there is mutuality was not taken into account in this study of Loosemore and Lim (2015), which certainly has a an impact on the way risks are distributed, as this proposition explains.

8. The will of a buyer and a seller to build a close relationship where there is no buyer dominance can be associated to the sharing of risks of the financial category.

Supply chain risks of the financial category were found within the two client units of study, MC and SU. In each case there is a shared financial risk: the focal firm shares with MC the risk of bankruptcy of subcontractors, and with SU shares the risk of profit loss (see Table 5.5 in Chapter 5). It coincides that neither unit of study is located

in the buyer dominance box of the power regime analysis: unit MC is located in the interdependence box, while unit SU is located in the supplier dominance box (see Figure 5.1 in Chapter 5).

Peculiarly, financial supply chain risks were not mentioned in the supplier units of study. However, when looking at the supplier units, unit SM2 and GS are both cases of interdependence, that is, the buyer neither the supplier are dominant, and in both, there is a certain level of sharing of financial risks. SM2 is a firm that believes in collaboration, reason why instead of blaming a party for delays, for example, it tries to find a solution that can benefit both parties, even if delays represent financial loss (Sub-section 4.4.5). Financial risks were also not mentioned in unit GS, since for the service it offers this doesn't apply, however, GS would be willing to share sovereign risks, which can also be related to financial consequences (Chapter 4 Table 4.12).

Unit SM1 is in the buyer dominance box (Chapter 4 Sub-section 4.3.4). SM1 considers that the importance of a long-term relationship is larger than only making one project together, even if it is not always a win-win situation. However, the focal firm, in some occasions, makes supplier decisions based on price, in order to reduce overall costs for projects, which can leave SM1 out. In this unit of study, the seller is willing to take more risks than the buyer (Sub-section 4.3.3), because there is buyer dominance. Unit GL1 is also located in the buyer dominance box (Sub-section 4.5.4) and in this unit of study, there is no sharing of negative risks at all; the majority of the negative risks are allocated to the seller (Table 5.4). GL1 handles supply risks on its own, even if it can have result on profit loss (Sub-section 4.5.3).

Financial risks include fluctuation in foreign exchange, delays in payments, and inflation, among others (Ehsan *et al.*, 2010). Profit loss was categorised in this manner due to the description of the financial category of Araújo *et al.* (2014), which considers cash flow problems, such as product pricing (Appendix 2.D). No literature was found addressing specifically the sharing of financial risks, yet, another topic of study could be the measuring of the financial consequences of sharing a risk for both parties involved, without focusing in a specific risk category.

9. Early involvement of two firms can reduce the risk of wrong estimation of work and result in a cost-effective design and in finding technical project solutions jointly.

Flexibility, technical project solutions, and early involvement were all opportunities grouped into 'joint- and early stage-solution thinking' in Table 5.5 (Chapter 5). With early involvement of two firms, an early discussion about the technical aspects can take place and were quality requirements are made clear. Also, the knowledge of an expert supplier can result in an optimised design in terms of cost and functionality. Early involvement can also reduce certain risks such as wrong estimation of work and high product price.

MC wants to further exploit the opportunity of early involvement, since it trusts that having the focal firm's input during the tender phase could increase the chance of winning a tender. Additionally, writing the derogation schedule is also a positive consequence of early involvement, since it allows for the focal firm to point out the specifications that can't be technically achieved (Chapter 4 Table 4.2). Similarly, SM2 believes that early

involvement with the focal firm can give both a higher chance of winning a tender; the reputation of both firms can be attractive to architects due to the way both companies complement each other (Sub-section 4.4.1)

SM1 is aware that early involvement and being flexible can result in making both parties stronger, reason why the firm puts an effort in making the design more efficient to reduce the overall costs, which would benefit both parties (Sub-section 4.3.1). Likewise, GL1 used to deliver standard products to its customers, but changed the strategy to a more flexible way of working, where products are tailor-made to the customer's exact needs. GL1 is determined in helping its customers with technical project solutions as well. The objective of this new approach is to be able to expand internationally and satisfy the high market demands. The new market strategy is highly compatible with the focal firm's needs (Sub-section 4.5.3). The focal firm sees large opportunities of working with GL1 due to its high flexibility and desire of continuous improvement, since multinational glass suppliers (such as GL2) are less flexible due to the high demand in the market (Sub-section 4.8.1).

In addition, GS delivers a standard system, which has been tested an approved. Implementing the system is challenging to the focal firm, since the structures are unique. GS offers assistance and makes an exception to the standard system when possible. Both firm are willing to have an early involvement, such as during the engineering phase, to eliminate time-consuming loops and reduce the risk of technical failures (Sub-section 4.6.5). Similarly, ST1 is a flexible firm willing to collaborate at an early stage to achieve optimal solutions. Little collaboration in the recent years hasn't allowed this to happen, however, ST1 is open to have input in the design in order to optimise it, which can make it more simple and even with a lower cost (Sub-section 4.7.3).

Finally, in unit SU this opportunity was not listed, however, it is a possibility in the future. Certainly, there is room for more early collaboration. The case was that SU is a new firm that doesn't have the knowledge in engineering that the focal firm has, making it very difficult for SU to be involved during the engineering phase. Nevertheless, SU is willing to train its personnel to be able to provide more input for the engineering design, which could result in more collaboration in the future (Sub-section 4.2.5).

In Chapter 2, Sub-section 2.1.2, the outcomes of the implementation of SCM were given, these include: lower supply chain costs, increased customer value and satisfaction, higher overall performance and a greater competitive advantage. Early involvement is directly linked to SCM practices, since working together from early stages of a project involves collaboration, coordination, information sharing, and reduction of costs with the goal of achieving an optimal product for the end customer (Mentzer *et al.*, 2001).

10. Lack of IT compatibility is a threat that can be turned into an opportunity to be exploited by the parties in a dyad.

In three of the units of study (SM1, SM2 and ST1), lack of IT compatibility is a relevant supply chain risk, but it was found that if mitigated, this threat can certainly become an opportunity (see Table 5.5 in Chapter 5). Becoming IT-compatible can result in more collaboration opportunities, more accurate specifications and better quality outcomes. An example of this can be unit SM1: a few years ago, the SM1 decided to incorporate 3D modelling into its business, in order to be able to receive the focal firm's drawings in that format. It was an

investment that resulted in positive consequences for both firms, such as better communication (Chapter 4 Sub-section 4.3.5).

On the other hand, in units SM2 and ST1, the lack of IT compatibility is a threat (Table 5.5), since it results in significant time-consumption when having to change the format of drawings. The change of format can cause unexpected delays, affecting both parties, as in unit SM2 (Table 4.8), or can be considered as an extra cost for the buyer, as in unit ST1 (Table 4.14).

In Chapter 2, Sub-section 2.8.3, opportunity management was introduced, as it is common that there is a predominant view of risks being exclusively negative. Hillson (2001) emphasises on the beneficial effect that managing the positive risks could bring and, for that reason, he states four risk treatment strategies that are applicable to positive risks, or opportunities, and these are: exploit, share, enhance, and ignore (Table 2.8). When companies look for opportunities to exploit together, the relationship can be ameliorated for the long-term and can result in more market opportunities. Surprisingly, most of the risks obtained during the data collection were negative, meaning that there is very limited thought given to the upside of risks.

11. Risks causing the product to differ from the client's requirements, preparation for transportation risks, and supplier's supplier risks are normally allocated to the supplier.

Inaccurate forecast of profiles, meaning of quality, insufficient quality, mistakes in drawings, technical feasibility of design, and manufacturing/issues in factory are all risks grouped as 'product as required'. This group of risks is always allocated to the supplier (FF by MC, SM1, SM2, GL1, GS, and ST1) except for insufficient quality, which is a shared risk with MC, since MC demands mock-ups and samples which need to be approved. The risks of packaging and loading for transportation and supplier/sub-subcontractor risks are also allocated to the supplier; since it's the suppliers responsibility that their own suppliers comply and that they load the products well on the truck so they don't get damaged during the ride.

The findings can't be linked to the drivers nor the facilitators, and also not to the power regimes. The explanation behind this could be the supplier's responsibility for the work it agrees to deliver. Within this group of risks is the existence of human errors and incidents that are outside one's control. Even if allocated, flexibility by part of the buyer could reduce the negative effects on the responsible party, but this wasn't the case of any unit of study. The units of study showed that if a mistake is made by the supplier, the supplier is the one responsible to correct it. In Chapter 2, Sub-section 2.4.3, flexibility is listed as a critical success factor during the maintenance phase of a partnership, nonetheless, flexibility was found in a very low level in the case study. The focal firm is flexible when the supplier is not going to deliver on time if communicated with sufficient anticipation. For quality, the focal firm is less flexible, however, to prevent surprises, it makes visits to the suppliers' factories to supervise quality and detect faults in time.

12. Firms that are interdependent to one another can be associated to a higher number of shared negative risks. The size of the firms is not relevant.

The more sharing of negative risks can be associated to interdependence of two firms, as in units MC and SM2 (see Figure 5.2 in Chapter 5). Units MC and SM2 have the largest percentage of shared negative risks. Unit GS is also an interdependence case, but got a low score for negative shared risks, which can be explained with the type of service that GS offers; GS offers a system and its half-fabricates, and not a complete end-product (see Figure 5.3 in Chapter 5).

In this research, a relation was found between interdependence and negative risk sharing. Interdependence could be an important factor for two firms to become partners, since two firms that depend on one another can have a very good motive to share risks, but also to share more information, have more effective communication, and improve cooperation, which can increase customer satisfaction, improve design and quality, reduce costs, and result in fewer schedule overruns and fewer defects. (Beach *et al*., 2005) as mentioned in Sub-section 2.6.3. of Chapter 2.

Loosemore and Lim (2015) argued that significant power differences between parties is a reason why the value-stream of the client is not extracted fairly through the supply chain. With the results obtained, it is not possible to corroborate this finding, however, the unit of study with the most unfair distribution of allocated risks was a case of buyer dominance.

With the help of the 12 listed propositions, the research question could be answered. Explaining the behaviour of risk sharing in supply chain partnerships is not easy. Defining what exactly a partnership is turned out to be more complicated than expected. Some parties consider to have a partnership because they have collaborated in several projects or for a long-time, or maybe because they have a long-term vision. However, it is possible to say that most relationships fit to the definition of a partnership by Lambert *et al*. (1996), which was presented in Chapter 1, Section 1.2.

Initially, it was intended to measure the level of partnership of the units of study by using the assessment of drivers and facilitators of the partnership model, nonetheless, the level of the components of a partnership as described by Lambert *et al*. (See Appendix 2.B.2) did not match the results of the level of partnership obtained from the assessments. The assessments gave solely a good idea about the potential for more collaboration in the future. For that reason, rather than partnerships, the interactions were referred to as relationships, since the exact partnership level is not certain. Fortunately, an actual level of risk sharing was found in most units of study, which is a crucial component of a partnership.

On the other hand, risk sharing is also a complex term, since even if risks are shared, it does not mean that both parties will put an equal effort in mitigating it, or that the consequences won't be affect one more party than the other. For this reason, risk sharing can also be seen as a way of risk transferring. An equitable win-win situation when sharing a risk is very unlikely, reason why supply chain members should consider looking at group risks, rather than individual risks, since, the chance for cooperation is reduced when individual risks are

managed. Due to the complexity of answering this research question, recommendations for future research are described in the following section.

7.5 Recommendations for future research

In Section 6.4 (Chapter 6), the limitations of the study were presented. From the limitations and the previously explained propositions, some suggestions for future research on this topic can be derived:

- Include in the research a supply chain that is specialised in other areas of the construction industry, for example, infrastructure or real estate. Infrastructure can be interesting due to the large amounts of money and the number of stakeholders involved. Real estate can also give interesting findings due to the more repetitive nature of certain types of buildings, where there is a higher chance of having the same supply chain for different projects.

- Study more than one tier above and below the focal company. Having a bigger perspective of a supply chain can provide more understanding of why certain risks are present, or if there are more risks that were not considered, yet could cause serious consequences.

- Choose firms where there is a certain level of systematic risk management. Risk registers and other archives can help gain a better perspective of the weight a certain risk can have in a project and know exactly how it was treated. Creating a list of risks based on documents can be the basis for a new line of questioning for the interviews. Creating a survey for the topic of supply chain risks can help in obtaining more comparable results across the units of study.

- Include in the study clients and suppliers ranging from arm's length relationships to very high levels of partnership. The results can offer a better point of comparison with theory. Also, treat each relationship as an individual case study, so the points of views of both parties are presented in an equal manner.

- Sharing risks doesn't necessarily equal a win-win situation for the firms involved, reason why it would be interesting to measure the extent to which risks are shared, that is, determine how equal is the (financial) effort of the firms when pursuing to mitigate a negative risk or exploit an opportunity. The consequences of a shared risk could also affect each firm differently in the case that it fires, which would also be very interesting to explore.

- Focus on a group perspective of risks, rather than individual risks. A group perspective will help the two firms have a view of the risks that affect both parties and the treatment strategies that can be chosen in a way that both are benefited in an equal manner, rather than one receiving more benefits than the other. This is recommended given the common circumstance where risk sharing or information sharing can result in more benefits for one party than the other, which would demotivate the less benefited party to collaborate.

7.6 Recommendations for the focal firm

The focal firm has proven to be a respected company in the industry. Suppliers are willing to keep a good relationship, while clients are willing to involve the firm in future projects, since it has demonstrated that it is capable of delivering high-quality results and to work in a collaborative manner with the rest of the supply chain members of the different projects. The focal firm is a fast-growing company that is willing to improve in different aspects of the organisation. Based on this research, a few recommendations can be given to the company.

First, there is potential in improving the way in which the company manages the risks. This can be done by following a systematic procedure, especially for complex projects. Using simple tools, such as a risk register, can help in monitoring the risks and having a plan for in the case they fire. They can also serve as a basis for new projects, since they can be a way of knowledge transfer.

The supply chain approach for performing risk management is not very well known in the construction industry, since the industry is project-based; many other processes would have to take place in order to start using a supply chain approach in a general manner. For that reason, project risk management (PRM) would likely be more useful for a company as the focal firm. As it was mentioned in the literature review (Section 2.8), the PRM process has six general steps, which are:

1. Establish context
2. Identify risks
3. Analyse risks
4. Evaluate risks
5. Treat risks
6. Monitor and review

A risk discussion before selling a project could have a significant impact in the reduction of losses during the execution, that is, a discussion during the establishing of the context and risk identification phase. In the discussion, technical aspects can be consulted with people of the production and installation departments to learn if what is being sold is feasible for the offered price. Having input of more team members at an initial stage can help the sales engineers to be more aware about the complexity of the project and, if necessary, establish a risk premium that is proportional to the amount of risk. It's important to become aware of risks in the technical and execution areas, but also important to be aware of the sources of risk. Common sources of risk in the construction industry come from changes in project scope, design error or omissions, subcontractors, new technologies, unfamiliarity with local conditions, and even due to uncertainty about relationships between project participants (Ehsan *et al.*, 2010).

There are different ways of responding to risk. Accepting the risk is a common one, but if many project leaders are taking big risks at the same time, it would be wise for them to have an idea of which risks are being taken in other projects. Else, other risk responses could be chosen, such as avoiding the risk by not doing a certain part of a project or changing the scope; monitoring the risk and having a back-up plan for the moment it fires; and

risk mitigating, which would be to implement actions that would reduce the chance of the risk from happening or that would reduce its impact.

Another risk response strategy is to transfer the risk, which was addressed in this research. Risk transfer can be an option when the supplier or subcontractor is completely sure that they can handle it, and agrees to do it. The focal firm is flexible and supportive with its suppliers when mistakes are made; it is already in a good path of collaboration during the execution of a project, but it might as well consider to include expert suppliers from an earlier stage, at least when these suppliers are responsible for a critical part of a project. Certain risks and costs can be eliminated if there is a proper dialogue at an early stage of a project, preferably before the sale of a project. Openness with suppliers can contribute to increasing trust and can maybe lead to more information sharing.

Deciding to whether the focal firm should partner or not with certain suppliers or subcontractors is certainly difficult to say. This research was focused on risk sharing within supply chain partnerships, but that is not the only aspect to consider. In many occasions, a partnership is confused with other simpler types of relationship just because there are notions of collaboration and interdependence. The focal firm should know that having a partner means that the two firms will be working towards the same goal, with improved communication, early involvement, a learning culture, integrated teams and processes, and dispute resolution planning. The outcomes of partnership include increased trust, mutual rewards and benefits, mutual learning, best value, improved service and a higher level of dependency (based on Beach *et al*., 2005).

It was already mentioned a number of times that creating a partnership requires for both companies to have drivers to pursue it, as well as for both to make an effort to make it possible. From this research, it can be said that partnering has more chances of working when there is interdependency. When two parties are interdependent, it means they need one another to a certain extent. There were three interdependence cases in this research: MC, SM2 and GS. It is clear that the focal firm is an important asset for MC, and MC has become a very important client for the focal firm, reason why there has been communication about the future of the relationship.

On the other hand, there areas of improvement with SM2, and forming a closer partnership is not the only solution; agreeing on a closer collaboration and longer-term objectives could be of great benefit for both, without necessarily focusing on all elements of a partnership. The same goes for GS; the focal firm could save itself from many problems by involving GS in earlier stages and GS is actually willing to help in this way, so there is a possibility for a closer relationship, but maybe a partnership is not the best decision. It has to be agreed with these parties which processes can be done jointly in order to achieve better results.

The rest of the suppliers certainly appreciate to have the focal firm as a customer; each has its own drivers independent of the power situation. The focal firm could use the motivation of the suppliers for better project outcomes, which already happens with some of them. Since suppliers are experts of very specific materials or products, listening to their opinion on certain designs or use of materials could result in cost savings and optimisation, but this can only be achieved when they are invited to participate at an early stage. Also, having

multiple suppliers for a certain product or service has its advantages, but attention has to be put to selecting suppliers based on cost. Selection on the basis of lowest cost can increase risk in other areas of the project, such as planning and quality.

Another recommendation is to have joint view (or group perspective) of supply chain risks with supply chain members. This research addressed supply chain risks from individual points of view. Interviews were not done with both parties of the dyads together, but rather separately. It would be very interesting to look at risk from a group perspective, that is, jointly identifying the risks in the supply chain link, look how it affects each party and the project, and how they could be treated. Such a discussion can create transparency, were information is shared that immediately reduces certain risk for the other party. This recommendation is important given the fact that, sometimes, even if there is intention to share a risk, one of the parties could be more affected or benefited than the other. The objective of a joint view of the risks is that the firm see each other as a group rather than independent, which could result in a better distribution of the benefits.

A final recommendation is to look at the positive side of risks: opportunities. Negative risks are predominant in the outcomes of this research. It can be assumed that supply chain members look mainly into the possibilities of what can go wrong during projects, due to the damage that the consequences can cause. The upside of risk can be thought of by companies that are very likely to work together in the future, whether there is a partnership or not. Looking at the opportunities that could be exploited together could be the next step towards a closer relationship, which can result in more competitive advantage for the parties involved.

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Appendices

Appendix 2.A: The power matrix: the attributes of buyer and supplier power – With characteristics

Adapted with permission from *Supply chain management: a guide to best practice*, by A. Cox, P. Ireland, C. Lonsdale, J. Sanderson, and G. Watson, 2004, London: Financial Times Prentice Hall.

Attributes to buyer power relative to supplier	**Low**	**High**
High	**Buyer dominance (>)** ○ Few buyers/many suppliers ○ Buyer has high % share of total market for supplier ○ Supplier is highly dependent on buyer for revenue ○ Supplier's switching costs are high ○ Buyer's switching costs are low ○ Buyer's account is attractive to supplier ○ Supplier's offering is a standardised commodity ○ Buyer's search costs are low ○ Supplier has no information asymmetry advantages over buyer	**Interdependence (=)** ○ Few buyers/few suppliers ○ Buyer has relatively high % share of total market for supplier ○ Supplier is highly dependent on buyer for revenue ○ Supplier's switching costs are high ○ Buyer's switching costs are high ○ Buyer's account is attractive to supplier ○ Supplier's offering is relatively unique ○ Buyer's search costs are relatively high ○ Supplier has moderate information asymmetry advantages over buyer
Low	**Independence (0)** ○ Many buyers/many suppliers ○ Buyer has relatively low % share of total market for supplier ○ Supplier has little dependence on buyer for revenue ○ Supplier's switching costs are low ○ Buyer's switching costs are low ○ Buyer's account is not particularly attractive to supplier ○ Supplier's offering is a standardised commodity ○ Buyer's search costs are relatively low ○ Supplier has very limited information asymmetry advantages over buyer	**Supplier dominance (<)** ○ Many buyers/few suppliers ○ Buyer has low % share of total market for supplier ○ Supplier has no dependence on buyer for revenue ○ Supplier's switching costs are low ○ Buyer's switching costs are high ○ Buyer's account is not particularly attractive to supplier ○ Supplier's offering is relatively unique ○ Buyer's search costs are very high ○ Supplier has substantial information asymmetry advantages over buyer

Attributes to supplier power relative to buyer

Appendix 2.B.1: The Partnership Model – The assessment of drivers and facilitators (& Interview Part I)

Adapted from "Developing and Implementing Supply Chain Partnerships", by D.M. Lambert, M.A. Emmelhainz, and J.T. Gardner, 1996, *The International Journal of Logistics Management*, 7(2), p. 6, 9 & 10.

Assessment of drivers

The first step was to list the drivers i.e., compelling the reasons to partner. The drivers set the expectations of outcomes of the partnerships. A driver is a strategic factor that results in competitive advantage and that helps in determining the appropriate level of a business relationship to make it industry-specific. The number in the parenthesis determines the number of points obtained from each question.

1. Asset/cost efficiencies					
What is the probability that the relationship will substantially reduce channel costs or improve asset utilisation? – Product cost savings – Distribution cost savings, handling costs savings – Packaging cost savings, information and handling cost savings – Managerial efficiencies – Assets to the relationship					
Probability	No Chance 0% ☐(1)	25% ☐(2)	50% ☐(3)	75% ☐(4)	Certain 100% ☐(5)
If you rated efficiencies in the shaded area and if the advantage is either a sustainable competitive advantage or it allows your firm to match benchmark standards in your industry, choose 'yes'.	Yes ☐(1)		No ☐(0)		

2. Customer service					
What is the probability that the relationship will substantially improve the customer service level? – Improved on-time delivery – Better tracking of movement – Accurate specifications – Process improvements					
Probability	No Chance 0% ☐(1)	25% ☐(2)	50% ☐(3)	75% ☐(4)	Certain 100% ☐(5)
If you rated efficiencies in the shaded area and if the advantage is either a sustainable competitive advantage or it allows your firm to match benchmark standards in your industry, choose 'yes'.	Yes ☐(1)		No ☐(0)		

3. Marketing advantage					
What is the probability that the relationship will lead to substantial marketing advantages? – New market entry – Promotion (joint advertising, sales promotion) – Price (Reduced price advantage) – Place (Expanded geographic coverage) – Access to technology – Innovation potential					
Probability	No Chance 0% ☐(1)	25% ☐(2)	50% ☐(3)	75% ☐(4)	Certain 100% ☐(5)
If you rated efficiencies in the shaded area and if the advantage is either a sustainable competitive advantage or it allows your firm to match benchmark standards in your industry, choose 'yes'.	Yes ☐(1)		No ☐(0)		

4. Profit stability/growth					
What is the probability that the relationship will result in profit growth or reduced variability profit? – Growth – Sales volume – Assurance of supply					
Probability	No Chance 0% ☐(1)	25% ☐(2)	50% ☐(3)	75% ☐(4)	Certain 100% ☐(5)
If you rated efficiencies in the shaded area and if the advantage is either a sustainable competitive advantage or it allows your firm to match benchmark standards in your industry, choose 'yes'.	Yes ☐(1)		No ☐(0)		

Total sum:

Assessment of facilitators

The second step in the Partnership Model was to assess the facilitators, which are supportive environmental factors that enhance the partnership to grow or to be maintained.

The number in the parenthesis determines the number of points obtained from each question.

1. Corporate compatibility					
What is the probability that the two companies will mesh smoothly in terms of… (a) Culture – Both place value in keeping commitments – Constancy of purpose – Employees viewed as long-term assets – External stakeholders considered important (b) Business – Strategic plans and objectives consistent – Commitment to partnership ideas – Willingness to change					
Probability	No Chance 0% □(1)	25% □(2)	50% □(3)	75% □(4)	Certain 100% □(5)

2. Management philosophy and techniques					
What is the probability that the management philosophy and techniques of the two companies will match smoothly? – Organisational structure – Commitment to continuous improvement – Degree of top management support – Types of motivation used – Importance of teamwork – Degree of employee empowerment					
Probability	No Chance 0% □(1)	25% □(2)	50% □(3)	75% □(4)	Certain 100% □(5)

3. Mutuality					
What is the probability that both parties have the skills and predisposition needed for mutual relationship building? Management skilled at: – Two-sided thinking and action – Taking the perspective of the other company – Expressing goals and sharing expectations – Taking a longer-term view – Mutual respect Management willing to: – Share financial information – Integrate systems					
Probability	No Chance 0% □(1)	25% □(2)	50% □(3)	75% □(4)	Certain 100% □(5)

4. Symmetry					
What is the probability that the parties are similar on the following important factors that will affect the success of the relationship? – Relative market share – Financial strength – Productivity – Brand image reputation – Technological sophistication					
Probability	No Chance 0% □(1)	25% □(2)	50% □(3)	75% □(4)	Certain 100% □(5)

Additional factors		
5. Do you have shared competitors which will tend to unite your efforts?	Yes □(1)	No □(0)
6. Are the key players in the two parties in close physical proximity to each other?	Yes □(1)	No □(0)
7. Is there a willingness to deal exclusively with your partner?	Yes □(1)	No □(0)
8. Do both parties have prior experience with successful partnerships?	Yes □(1)	No □(0)
9. Do both parties share a high value end user?	Yes □(1)	No □(0)

Total sum:

Type of partnership based on the assessment

		Driver points		
		8-11 points	12-15 points	16-25 points
Facilitator points	8-11 points	Arm's length	Type I	Type II
	12-15 points	Type I	Type II	Type III
	16-25 points	Type II	Type III	Type III

Appendix 2.B.2: The Partnership Model – The components

Adapted from "Developing and Implementing Supply Chain Partnerships", by D.M. Lambert, M.A. Emmelhainz, and J.T. Gardner, 1996, *The International Journal of Logistics Management*, 7(2), p. 12.

Components are all the joint activities and processes that build and sustain the partnership, in case that it was decided to partner. The component levels can range from low to high. In a Type I partnership the level of the components is mainly low. For a Type II, there is a predominance of medium level, and finally in a Type II partnership, most components have a high-level implementation (Lambert *et al*, 1996).

		Low	Medium	High
Planning	Style	On ad-hoc basis	Regularly scheduled	Systematic: Both scheduled and ad-hoc
	Level	Focus on projects or tasks	Focus is on process	Focus is on relationship
	Content	Sharing existing plans	Performed jointly, eliminating conflicts in strategies	Performed jointly and in multiple levels, including top management; objective to mesh strategies; each party participates in other's business planning
Joint operating controls	Measurement	Performance measures are developed independently and results are shared	Measures are jointly developed and shared' focused on individual firm's performance	Measures jointly developed and shared; focused on relationship and joint performance
	Ability to make changes	Party may suggest changes to other's system	Parties may make changes to other's system after getting approval	Parties may make changes to other's system without getting approval
Communications	Non-routine	Very limited, usually just critical issues at the task or project level	Conducted more regularly, done at multiple levels; generally open and honest	Planned as a part of the relationship; occurs at all levels; sharing of both praise and criticism; parties speak the same language
	Day-to-day: Organisation	Conducted on ad-hoc basis, between individuals	Limited number of scheduled communications; some routinisation	Systematised method of communication; may be manual or electronic; communication systems are linked
	Day-to-day: Balance	Primarily one-way	Two-way but unbalanced	Balanced two-way communications flow
	Day-to-day: Electronic	Use of individual system	Joint-modification of individual systems	Joint-development of customised electronic communications
Risk/reward sharing	Less tolerance	Very low tolerance for loss	Some tolerance for short-term loss	High tolerance for short-term loss
	Gain commitment	Limited willingness to help the other gain	Willingness to help the other gain	Desire to help other party gain
	Commitment to fairness	Fairness is evaluated by transaction	Fairness is tracked year to year	Fairness is measured over life of relationship

	Low	Medium	High	
Trust and commitment	Trust	Trust is limited to belief that each partner will perform honestly and ethically	Partner is given more trust than others, viewed as "most favoured" supplier	There is implicit, total trust; trust does not have to be earned
	Commitment to each other's success	Commitment of each party is to specific transaction of project; trust must be constantly "re-earned"	Commitment is to a longer-term relationship	Commitment is to partner's long-term success; commitment prevails across functions and levels in both organisations
Contract style	Timeframe	Covers a short time frame	Covers a longer time frame	Contracts are very general in nature and are evergreen, or alternatively the entire relationship is on a handshake basis
	Coverage	Contracts are specific in nature	Contracts are more general in nature	Contract does not specify duties or responsibilities; rather, it only outlines the basic philosophy guiding the relationship
Scope	Share	Activity of partnership represents a very small share of business for each partner	Activity represents a modes share of business for at least one partner	Activity covered by relationship represents significant business to both parties
	Value-added	Relationship covers only of or a few-added value steps (functions)	Multiple functions, units are involved for at least one partner	Multiple functions and units are involved; partnership extends to all levels in both organisations
	Critical activities	Only activities which are relatively unimportant for partner's success	Activities that are important for each partner's success are included	Activities that are critical for each partner's success are included
Investment	Financial	There is low or no investment between the two parties	May jointly own low value assets	High value assets may be jointly owned
	Technology	No joint development of products/technology	There is some joint design effort and there may be some joint R&D planning	There is significant joint development; regular and significant joint R&D activity
	People	Limited personnel exchange	Extensive exchange of personnel	Participation on other's party board

Appendix 2.C: When are partnerships appropriate?

Adapted from *World class supply management: the key to supply chain management* (7th ed.), by D.N. Burt, S.L. Starling, and D.W. Dobler, 2003, New York: Mcgraw-Hill Education.

This appendix is part of the second approach for determining whether a partnership is appropriate (Section 2.4.2).

Part 1: General questions

How does a supply management executive determine whether a relationship should be transactional, collaborative, or a strategic alliance? Several key questions should be asked to determine the "strategic" elements of a relationship:

1.1 Are there many relatively undifferentiated suppliers providing what amounts to interchangeable commodities? If so, a collaborative alliance or relationship would not be appropriate: Try a transactional relationship instead.

1.2 Does the potential supplier possess economic power which it is willing to employ over its customers? A transactional or very carefully developed and managed collaborative relationship is usually appropriate.

1.3 If there is recognition by both parties of the potential benefits of an alliance, but adequate qualified human resources are not available at one or both firms, a collaborative relationship is usually appropriate.

1.4 A collaborative relationship frequently is an appropriate first step on the road to a strategic alliance.

1.5 Is one supplier head and shoulders above the rest in terms of the value it provides, including price, innovation, ability to adapt to changing situations, capacity to work with your team, task joint risks, and so on? If so, an alliance may be in order, assuming that the supplier is willing to enter into an interdependent, trusting relationship.

1.6 Are some suppliers "strategic" to your business? In other words, do they have a major impact on your competitive advantage in the marketplace? Are you highly reliant on them to provide a unique product, technology, or service? If so, an alliance may be vital.

1.7 Would your company benefit greatly if the supplier were more "integrally connected" with your company, perhaps with their engineers working side by side with yours, or collocating their manufacturing facilities adjacent or within yours? If yes, consider an alliance.

1.8 Do your customers require high degrees of flexibility and speed of responsiveness, causing you to demand the same performance from your suppliers? This is a classic alliance driver.

Part 2: Supplier point of view

Suppliers are attracted to customers who have a reputation for working collaboratively with suppliers who experience a problem to identify and correct the root cause of the problem. Suppliers want "good" customers. Several issues affect a customer firm's rating as a "good" customer including:

2.1 Does the customer have a reputation for timely payment? Cash flow is a major concern of all suppliers.

2.2 Is the customer secretive? Suppliers prefer customers who are open and approachable.

2.3 Are the customer's supply management personnel responsive? Suppliers prefer customers that are available.

2.4 Are the customers known as professionals? World-class suppliers conduct themselves professionally, and expect to be treated professionally.

Part 3: Questions before final decision

While strategic supplier alliances receive a great deal of media coverage and discussion within the supply management community, are they for everyone? Will the benefits of an alliance outweigh the effort, risk, and resources required? For those supply management professionals and organizations that are investigating the possibility of strategic supplier alliances, it can be helpful to ponder the following questions:

3.1 Is there a danger that the supplier may act in an opportunistic manner over time?

3.2 Do electronic systems at the purchasing and supplier organizations allow for optimum communication and sharing of information?

3.3 Is the potential strategic alliance supplier well equipped, in terms of knowledge, expertise, and resources, to stay current in the industry?

3.4 Are both the purchasing and supplier organizations willing to keep attention focused on the joint customer, in order to establish supply chain objectives and goals?

3.5 Are there other suppliers in the marketplace, perhaps now more accessible because of e-procurement, who are worth investigating before committing to a strategic alliance?

3.6 Has the supply manager been thoroughly trained in managing an alliance relationship? Is the purchasing organization proud to be aligned and associated with the supplier organization, as they present a joint marketing front for the links further downstream in the supply chain?

3.7 Is the purchasing organization comfortable with the level of risk associated with reducing the supply base?

3.8 Are both supplier and buyer aligned in what their ultimate customer considers to be valuable?

3.9 If there is substantial risk for the supplier to develop new technologies, sub-systems, products, processes, or service support, is the buying firm willing to share or reduce the risks?

3.10 Are both supplier and buyer aligned in their respective visions to be able to make long term commitments to each other?

3.11 If an alliance is in order, are there sufficient operational points of interaction where the supplier can engage with the buying firm, such as joint development programs, just in time inventory, electronic communication, or colocation of service personnel?

Appendix 2.D: Supply Chain Risk Classification

Adapted from "Supply chain risk classification: discussion and proposal," by D., Araújo, T. Kamel and M. Alexandre, 2014, *International Journal of Production Research*, 53(22), p. 6885.

The classification of supply chain risks created by Araújo, Kamel and Alexandre (2014) was used the classify the risks that were gathered during the data collection of the research. The classification was introduced in Chapter 2, Sub-section 2.9.3. The following table offers a more detail description of each risk category.

Process	Risk	Description
Plan	Strategic	Characterised by any event affecting the business strategy, such as a lack of strategic planning (both organisational and SC-dependent) and the absence of a systematic perspective
	Inertia	Defined by the instability to remain in a competitive market, usually caused by failure of the organisation and/or chain to follow the market changes (e.g. technology, design, function, etc.)
	Informational	Results from failure in the information system due to deficient data feed systems or electronic systems or the inability to receive, transfer and access information
	Capacity	Caused by effective production over- or underutilisation capacity, lack of flexibility to respond to changes in demand or even the inability of some links (SC members) to plan, schedule and control production and inventory management
	Demand	Occurs when there is poor demand forecasting (in terms of quantity and mix), seasonality, long lead times, short product life cycles, small customer bases or information distortion due to promotions and incentives. May result in the bullwhip effect
Source	Supply	Stems from inefficiencies in the supply chain process (e.g. an increase in the price of some inputs, suppliers' lack of responsiveness, unavailability of inputs in terms of quantity and/or quality) and problems in internal product flow
	Financial	Arises from cash flow problems (product pricing, delinquencies by debtors, non-payment) and changes in the financial market (taxes, exchange rates, licences, etc.)
	Relational	Stems from the relationship among supply chain links (members), such as members' lack of visibility, opportunism, trust in information transfer, sub-par cooperation and interaction among members and outsourcing (e.g. a supplier supplying the chain and its competitors or a supplier redesigning parts and creating its own product)
Make	Operational	Results from situations preventing the focal company from performing its production activities, which may be related to problems with production systems, internal policies, procedures, processes and people
	Disruption	Results from discontinuity in the materials flow in the production process (following suspension in activities that add value to the customer), for example, arising from the reliance on a single source of suppliers and labour strikes
Delivery	Customer	Focuses on situation that modify customer choice, reducing the number of applications, e.g. product obsolescence, product delivery, customer service (before, during and after the order request) and confidence loss in the product or brand
Return	Legal	Begins with the inability of the organisation and/or chain to comply with legal restrictions or further exposure to litigation
Others	Environmental	Stems from events outside the chain, e.g. natural disasters and uncertainties in governmental (legislation, regulatory), economic, technological and social policies
	Culture	Defined by the difference in business culture among the links (members) or the chain or differences in the culture, language, people in the countries in which they are located

Appendix 2.E: The SCOR Model

Adapted from "The SCOR Model for Supply Chain Strategic Decisions – SCM" by S. Hudson, 2004. Retrieved April 07, 2017, from https://scm.ncsu.edu/scm-articles/article/the-scor-model-for-supply-chain-strategic-decisions

The SCOR model was created by the Supply Chain Council (http://www.supply-chain.org) and is a management instrument used to address, improve, and communicate SCM decisions within a firm and with suppliers and customers of that firm. The model describes the business processes required to satisfy a final customer's demands. It is focused on five areas of the supply chain, which are: plan, source, make, deliver and return. It is a process that repeats across the different members of a supply chain, from the suppliers' suppliers to the customers' customers.

1. Plan

The first step includes demand and supply planning and management, which include balancing resources with requirements, determining communication along the entire chain, and determining business rules to improve and measure supply chain efficiency. These business rules cover inventory, transportation, assets, and regulatory compliance, among others.

2. Source

The second step defines sourcing infrastructure and material acquisition. It describes how to manage inventory, the supplier network, supplier agreements, and supplier performance; and discusses how to handle supplier payments and when to receive, verify, and transfer product.

3. Make

The third step is focused on manufacturing and production. Is the manufacturing process make-to-order, make-to-stock, or engineer-to-order? The make step includes, production activities, packaging, staging product, and releasing. It also includes managing the production network, equipment and facilities, and transportation.

4. Deliver

Delivery focuses on order management, warehousing, and transportation. It also comprises receiving orders from customers and invoicing them once product has been received, in addition to management of finished inventories, assets, transportation, product life cycles, and importing and exporting requirements.

5. Return

The final step is where firms handle the return of containers, packaging, or defective products. The return encompasses the management of business rules, return inventory, assets, transportation, and regulatory requirements.

Appendix 3.A: Tests to establish quality of empirical research

Yin (2013) describes tests that are commonly used to establish the quality of the research. The ones applicable for this research are construct validity, external validity and reliability.

1. Construct validity

This test consists of identifying the correct operational measures for the concepts being studied.

1.A Multiple sources of evidence

Different sources of evidence were used to obtain information for the case study,

INTERVIEWS AND SURVEYS: The research was about dyads and every *embedded unit of study* included at least one interview with each side of the dyad. Most of the interviews took place inside the focal firm, which was the *main case*. Within the focal firm, two to three interviews were done with employees. With the supplier or client of the dyad, one interview was realised with somebody that could represent the firm and that had experience working with the focal firm.

For each *embedded unit of study,* the interviewees of the focal firm were selected to be from different departments of the company. Moreover, not only heads of department were interviewed, since every employee plays an important role when dealing with a specific supplier or client for a specific project.

DOCUMENTS: The focal firm has digital files that contain evaluations for certain projects or for certain suppliers, with respect to the performance. Evaluation documents are not only filled in by employees of the focal firm, but also by the client or supplier. This process helps in identifying what went wrong and why. Theis type of documents were also used to build the case study.

1.B Chain of evidence

In the research methodology chapter (Chapter 5), the research design is explained the steps to be followed for the research. The following are the detailed steps to arrive to the conclusion and recommendations of the research.

1. Literature review
2. Identification a research gap
3. Development of research methodology
4. Selection of case study
5. Selection of embedded units of study
6. Interviews and surveys within the focal firm and analysis of evaluation documents
7. Documentation of transcripts and results
8. Interviews with clients and suppliers of the focal firm
9. Documentation of transcripts and results
10. Cross-unit analysis
11. Discussion, conclusion and recommendations

1.C Key informants review draft of case study report

Two employees of the focal firm will be asked to review the draft of the report to assure that the information here provided is true and that it doesn't harm any of the involved parties in any way. It is also important that the key informants approve the report in term of privacy and confidentiality of the respective parties.

2. External validity

This test has the purpose of defining the domain in which findings can be generalised. For this project *replication logic* can be used, since the research deals with multiple units of study. In the cross-unit analysis (Chapter 8), it was possible to compare all the units of studies by using word and number tables. Different table were used to "play" with the results obtained and find similarities across the cases.

- If results were obtained in two or three units of study, then the results were considered to be valid, since (literal replication)
- If results obtained didn't follow a literal replication logic, the reason behind it was found (theoretical replication). The reason could be for reasons behind the particular unit of study or due to the nature of the firms being studied. Another possibility was that contrasting characteristics of certain units resulted in contrasting results.

3. Reliability

The reliability test is about demonstrating that data collection procedures can be repeated obtaining the same results. The book *Enqueteren en gestructureerd interviewen* by Baarda, Goede and Kalmijn (2000) provides important tips to prepare for interviews. All interviews were structured, that is, following a strict line of questioning, including close-ended and open-ended questions. In general, it was very important to ask the questions solidly and without making suggestions for an answer, unless a respondent asked for a specific example or a more clearer explanation. The respondents were interviewed inside the company, in a quiet room with the least distractions possible, and without a strict time limit. For the open-ended questions, it was important to keep the respondent focused on answering the question.

Furthermore, as it was explained in the research methodology, the survey that was included in the interviews within the focal firm was not an own creation of the researcher; it is an assessment that was created in 1996 by Lambert *et al.* (1996), with the purpose of helping global leading companies in determining whether forming a partnership in their supply chain was a good option to increase their performance. The complete model, which was called "The Partnership Model" and which includes the assessment, has been used since then by well-known successful companies worldwide.[10]

[10] More information on The Partnership Model can be found in http://thepartnershipmodel.com/the-partnership-model/

Appendix 3.B: Interview Part II, Risks and risk management (about clients)

The following questions were asked to employees of the focal firm for units of study that concerned clients.

1. I mentioned that I am interested in learning whether risks are being shared between the two companies, or if they are being transferred from one company to another. Can you tell me, how are risks managed between the two companies?

2. Risks can be both positive and negative. Positive risks are known as opportunities. Can you name some opportunities of having *Company X* as a partner and how does the focal firm exploit these opportunities?

3. What are the most important negative risks present when working with *Company X*? You can also mention risks that are present due to having a partnership with this company.

The following are examples mentioned, in case the respondent had difficulties answering.

- Lack of strategic planning
- Bankruptcy
- Communication or information problems (receive, transfer or access info)
- Cash flow problems
- Relationship problems (Eg., opportunism or trust issues with information transfer)
- Disruptions on site, such as in building process or material flow
- Design
- Legal problems
- Environmental. Eg., weather
- Corporate cultural differences
- Approvals
- Costs of holding inventories
- Problems with other suppliers

4. How are the risks you mentioned managed?

5. How do you think that joint risk management within partners would affect project performance?
If respondent says that risks are already managed jointly, ask the results of the process and what can be done better.

6. What is your opinion on how risks are currently managed in the focal firm, in general. This question helps me in getting an overview on how risks are handled within the company.

Appendix 3.C: Interview Part II, Risks and risk management (about suppliers)

The following questions were asked to employees of the focal firm for units of study that concerned suppliers.

1. I mentioned that I am interested in learning whether risks are being shared between the two companies, or if they are being transferred from one company to another. Can you tell me, how are risks managed between the two companies?

2. Risks can be both positive and negative. Positive risks are known as opportunities. Can you name some opportunities of having *Company X* as a partner and how does the focal firm exploit these opportunities?

3. What are the most important negative risks present when working with *Company X*? You can also mention risks that are present due to having a partnership with this company.

The following are examples mentioned, in case the respondent had difficulties answering.

- Lack of strategic planning
- Bankruptcy
- Supplier going out of the market/bankruptcy
- Insufficient capacity
- Price increase of product
- Low quality/wrong quantity
- Relationship problems
- Operational problems
- Disruption in supply
- Transportation risks: late deliveries, higher transportation costs,
- Lack of compatibility in IT
- Communication difficulties

4. How are the risks you mentioned managed?

5. How do you think that joint risk management within partners would affect project performance?
If respondent says that risks are already managed jointly, ask the results of the process and what can be done better.

6. What is your opinion on how risks are currently managed in the focal firm, in general. This question helps me in getting an overview on how risks are handled within the company.

Appendix 3.D: Interview to representatives of supply chain firms

For each unit of study, at least one interview was done with a representative of the corresponding company.

Introduction to project

1. What is your role or job position within *Company X*?

Part I: The relationship
2. Can you describe the relationship there is currently between the focal firm and *Company X*?

3. What the drivers for *Company X* to have and maintain this type of relationship?
Examples of drivers are asset/cost efficiencies, customer service, marketing advantage, profit stability/growth.

4. What are the factors that allow this relationship to grow or be maintained?
Examples of this factors are corporate compatibility, management philosophy, two-sided thinking, expressing goals, symmetry.

Part II: Threats and opportunities
5a. What are the main opportunities that *Company X* can exploit by having the focal firm as a partner?

5b. How does *Company X* exploit these opportunities?

6a. What are the main negative supply risks of working in projects with the focal firm and/or having the focal firm as a partner?
Examples of supply chain risks can be found in the annex, which can help the interviewee.

6b. How are these risks managed by *Company X*?

Part III: Joint risk management
7. What is your opinion about the way risks are currently managed by the two companies?
For example, transferring and/or sharing of the risks.

8. How could *Company X* and the focal firm manage the risk(s) jointly, if it's not done already?
Discuss about the already mentioned risks and the focal firm's risks learned from the interviews.

9. Would *Company X* be willing to share risks with The focal firm?

Annex

Adapted from "Assessing and managing risks using the Supply Chain Risk Management Process (SCRMP)", by R. Tummala and T. Schoenherr, 2011, *Supply Chain Management: An International Journal*, 16(6), p. 475.

Risk category	Risk triggers
Demand risks	○ Order fulfilment errors ○ Inaccurate forecasts due to longer lead times, product variety, swing demands, seasonality, short life cycles, and small customer base ○ Information distortion due to sales promotions and incentives, lack of SC visibility, and exaggeration of demand during product shortage
Delay risks	○ Excessive handling due to border crossings or change in transportation mode ○ Port capacity and congestion ○ Custom clearances at ports ○ Transportation breakdowns
Disruption risks	○ Natural disasters ○ Terrorism and wars ○ Labour disputes ○ Single source of supply ○ Capacity and responsiveness of alternate suppliers
Inventory risks	○ Costs of holding inventories ○ Demand and supply uncertainty ○ Rate of product obsolescence ○ Supplier fulfilment
Manufacturing (process) breakdown risks	○ Poor quality (ANSI or other compliance standards) ○ Lower process yields ○ Higher product cost ○ Design changes
Physical plant (capacity) risks	○ Lack of capacity flexibility ○ Cost of capacity
Supply (procurement) risks	○ Quality of service, including responsiveness and delivery performance ○ Supplier fulfilment errors ○ Selection of wrong partners ○ High capacity utilization supply source ○ Inflexibility of supply source ○ Poor quality or process yield at supply source ○ Supplier bankruptcy ○ Rate of exchange ○ Percentage of a key component or raw material procured from a single source
System risks	○ Information infrastructure breakdowns ○ Lack of effective system integration or extensive ○ system networking ○ Lack of compatibility in IT platforms among SC ○ Partners
Sovereign risks	○ Regional instability ○ Communication difficulties ○ Government regulations ○ Loss of control ○ Intellectual property breaches
Transportation risks	○ Paperwork and scheduling ○ risks Port strikes ○ Delay at ports due to port capacity ○ Late deliveries ○ Higher costs of transportation ○ Depends on transportation mode chosen

Appendix 4.A: Supply chain risk catalogue

The following table lists the supply chain risks mentioned in Chapter 4 for each unit of study. The goal is to describe each risk for the better understanding of the reader. The plus sign (+) next a risk title refers to a positive risk (opportunities). A plus/minus sign (+/-) means that the risk can be both positive and negative, depending on the unit of study. No sign next to the risk title means that the risk is negative.

Risks are categorised based on Araújo *et al*. introduced in Chapter 2, Sub-section 2.9.3 and further explained in Appendix 2.D. Furthermore, risks are categorised from the perspective of the focal firm, since that is how the SCOR model works (Appendix 2.E).

Risk Title	Risk category	Description
Bankruptcy of client	Plan: Strategic	In this moment, If SU goes bankrupt, it wouldn't represent a substantial loss for the focal firm, since the firms haven't made an agreement on the next collaboration. The lost investment would be the extra hours spent on making a more efficient engineering design for the structure. However, it is a risk to have in mind if the firms consider to make a long-term agreement involving multiple projects.
Bankruptcy of subcontractors	Source: Financial	It is always a risk for a subcontractor to go bankrupt. This could represent major losses during a project due to the difficulty in replacing him. It is in the interest of a main contractor to have financially stable subcontractors, especially one with a crucial role in the project. In this case is also relevant because there is interest to involve the subcontractor in more projects in the future.
Change in engineering design	Delivery: Customer	If the final client wants to make a change in the "final" engineering design, then it is the focal firm's responsibility to make these changes. The problem is that it will affect the original planning. Nevertheless, the focal firm can rely on the main contractor for support in this kind of situations.
Change of supplier	Delivery: Customer	If SU decided to change of supplier to replace the focal firm, then all the work would have to be redone by the new supplier in regards to engineering design. It would represent a loss for SU, but also for the focal firm due to the investment it has already put in the design.
Contractual process (+)	Source: Relational	The main contractor and the focal firm can have a smooth contractual process, since the two parties have already achieved a certain level of trust. The parties are not always looking at the contract which results in an environment of collaboration.
Derogation Schedule	Return: Legal	Before agreeing on the performance specifications demanded by the final end user, the focal firm goes through the specifications to point out those that can't be realised as demanded, reason why a derogation schedule is realised.
First quotation different from final design	Plan: Strategic	It is a risk for the supplier that after the first quotation is given, the design is modified in a way that it doesn't match the quotation anymore. The focal firm is also responsible for informing about changes, but if it is not, then the loss is for the supplier.
Exchange rate	Source: Financial	The main contactor pays to the subcontractor in Euros, so there is a risk in the exchange rate fluctuations.
Flexibility (+)	Plan: Inertia	Suppliers that are flexible and the focal firm can come up with product designs that fit exactly with what the final client needs.
High product price	Source: Financial	Working with this supplier has its advantages, but also the disadvantage of a higher cost in comparison to its competitors. The high price could affect the profit of both the supplier and the focal firm, since the focal firm will likely negotiate the prices, making it a risk for the supplier.

Risk Title	Risk category	Description
Installation	Make: Operational	The focal firm is responsible for installing on site the half products provided by GS. If something goes wrong, it is the focal firm's responsibility. Sometimes GS assists the focal firm, but doesn't take responsibility.
Insufficient quality	Source: Supply	If insufficient quality is delivered by a supplier, then the supplier is responsible to do the rework. Sometimes, the focal firm is flexible, but most of the times those elements need to be replaced.
IT compatibility (+/-)	Source: Supply	The risk is positive when two firms use the same IT programme, since they can be more efficient when working together (+). Using different IT programmes has caused serious delays in the past given the fact that the focal firm sends the drawings in one format and the supplier has to redraw in order to send the drawings to their machines. Also, a supplier can decide to charge the extra hours that redrawing takes, which have to be paid by the focal firm (-).
Inaccurate forecast of project specific profiles	Source: Supply	It is the suppliers responsibility to estimate the profiles required by the focal firm for a specific project.
Information for engineering design	Plan: Informational	Formally, it is the main contractor's task to provide the necessary information on time in order for the focal firm to perform its work on time. However, informally, the focal firm is in contact with the necessary parties to demand specific information. Not receiving the required information has cause schedule overruns.
Issues in factory	Source: Supply	If a supplier has an issue in factory it can affect the delivery of a product.
Manufacturing issues	Source: Supply & Make: Operational	With GS, GS only delivers half elements so the focal firm who is responsible for further manufacturing. In other cases, the supplier is responsible for the correct manufacturing of the product where there is a risk of having human errors.
Market entry (+)	Plan: Inertia	Two firms working together can introduce the dyad to new markets, since the companies complement each other with their work, that is, they are stronger together.
Meaning of quality (+/-)	Source: Supply	Many years of working have allowed the firms to have same understanding of quality, which reduces the risk of insufficient quality for the focal firm and gives the supplier more opportunities for getting jobs (+). Some suppliers are concerned about the quality standards of the focal firm, which are high, and not realising a product according to those means that they need to redo work under their own expenses (-).
Mistake in drawings	Source: Supply	If a supplier makes a mistake in a drawing and the focal firm doesn't notice it, and therefore, elements are produced as in the drawing, it is an issue that the supplier has to solve. It can result in delays.
Payments	Source: Financial	Not receiving payments on time is always a risk for a subcontractor or a supplier. There are many reasons why payments could not be effectuated and this is not always in hands of the buyer.
Profit loss	Source: Financial	If the project prices are higher than expected by the customer, this can lead to negotiation for reducing the price. Trying to find a middle point means that nobody wins, since the seller loses and the customer is still paying a high amount. This can be a consequence of a wrong estimation of work or lack of communication at an early stage.
Programme performance from focal firm side	Make: Operational	The focal firm is responsible for completing the work in the specified amount of time. Also, when using GS' product, the focal firm is responsible for the manufacturing and installation, since GS is only supplying the materials and has already standard delivery times.

Risk Title	Risk category	Description
Programme performance from main contractor's side	Source: Supply	The main contractor could have an influence on the subcontractors' performance.
Programme performance from supplier's side (+/-)	Source: Supply	The focal firm relies on SM1 when it has an urgent order and SM1 is aware of this, reason why the focal firm becomes a priority in this cases (+). There is always a risk for a supplier not delivering on the date/time agreed upon (-).
Relationship problems	Source: Relational	Asking for prices and not giving the job in multiple occasions has caused some tension in the past with the supplier, which can damage the relationship and have consequences for future collaboration.
Sovereign risks	Others: Environmental	An example is Brexit, in the case of the main contractor. The consequences of Brexit are unclear and it's not possible to know which party will be affected the most.
Sub-subcontractors/ suppliers	Source: Supply	With MC, what is currently done is that the main contractor approves a list of subcontractors and suppliers that the focal firm will hire for a specific project, nonetheless, the results are still responsibility of the focal firm. In the contracts with SU, the focal firm is responsible for the design and building of the structure, and therefore, responsible for its subcontractors/suppliers.
Technical feasibility of design	Make: Operational	The focal firm is responsible for making the design technically feasible for the main contractor. In the case of GS, GS is responsible for the technical feasibility of the application of the system when giving a warranty, even if it's an exception of the system.
Technical mis-understanding	Make: Operational	It is the focal firm's responsibility to understand the technical specifications, for example, given the product GS sells, the instructions have to be accurately followed in order to be subject to warranty.
Technical solutions (+)	Plan: Inertia	The knowledge and expertise of two parties can help in achieving a technical solution according to the end client's needs.
Transportation (During ride and arrival)	Source: Supply	The party in charge of the transportation is responsible for the product to be picked up and delivered to its destination when agreed upon.
Transportation (Packaging and loading)	Source: Supply	The supplier must prepare its product well for transportation, in order to prevent it from getting damaged during the ride.
Unclear responsibility of an issue	Source: Relational	An issue at the building site where no one wants to accept responsibility can prevent the subcontractors to continue with their work, which could lead to financial losses due to delays in programme.
Underestimated amount of work	Plan: Demand	A planning is done according to the estimated amount of work, but if done incorrectly, it can be a source of delays.
Underestimated technical complexity during sales phase	Plan: Demand	Selling a project without accurately estimating the technical complexity can result in very high risk and the prices might be much higher than expected, which can result in reduced the profit or losses.
Wasted quality	Plan: Demand	Wasted quality is a concern since it creates unnecessary costs and, if not detected, the parties involved have to pay the extra costs without knowing. Wasted quality involves a high quality where not visible/necessary or spending extra time in non-essential issues.