Master Thesis

Trust building in logistics cooperations

A conceptual model for the design of a trust-building control tower strategy in multi-company cooperations in logistics

- Where there is unity, there is success -

Christian Meissner, 4291921

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Supervisors

Prof. dr. ir. L.A. Tavasszy
Dr. J.H.R. van Duin
Dr. M. de Bruijne

H. Kampinga
L. Rommens

TU Delft Delft University of Technology

KPMG

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Abstract

High inefficiencies in transport networks due to low utilization of transport modes, incurring unnecessary costs and burdens on the environment, are motivating companies to increasingly cooperate in logistics with companies from the same or another value chain. Although multi-company cooperations are likely to create benefits for the cooperating companies, more than half of all cooperations in logistics fail. Trust has been identified as a central success factor for the start and preservation of a cooperation. A conceptual model has been developed that is based on multi-actor risk management and enables decision makers to regain the ability to act in the otherwise complex and multifaceted subject of trust building. The model aims at building up trust by mitigating perceived risks of partners in a cooperation. The suitability for practical use of the presented model is proven on the basis of a case study in the Dutch building industry which resulted into recommendations for certain risk counter strategies .

Keywords: Multi-company cooperation, Logistics, Trust, Multi-actor risk management, Control tower

Content

Part 1: Introduction and motivation

1.1 Research background

1.1.1 Development in logistics

Logistics can be defined in many ways. Realistically, no true definition of logistics exists because industries, companies and products differ. However, some authors have tried to formulate definitions of logistics which apply to most industries. Rushton et al. (2006) provide such a comprehensive definition of logistics by describing logistics as "the efficient transfer of goods from the source of supply through the place of manufacture to the point of consumption in a cost-effective way whilst providing an acceptable service to the customer". This definition suggests that logistics occurs at multiple points in the value chain of a product. The value chain of product most often consists of a number of different companies. Logistics is needed to manage the flow of goods, information and money between the different companies involved. This perspective on logistics is considered as intercompany logistics (Chopra & Meindl, 2012). Furthermore, logistics is also needed inside a company. Generally, three different organisational functions can be distinguished within a company which are sourcing, production and distribution. Sometimes additional function are distinguished for example packaging (Rushton, et al., 2006). Logistics manages the flow of goods and information within and between each organisational function. This perspective of logistics is called intracompany logistics (Chopra & Meindl, 2012).

From a historical point of view, company's focus on logistics has changed over time from a intracompany-centric towards a intercompany-centric perspective (see Figure 1).

Beginning with the 1970s, companies focused on the optimisation of the isolated organisational functions sourcing, production and distribution (Baumgarten, 2008). In regard to production, the concept of Kanban was deployed to manage and control production processes among different production stages (Giordano & Schiraldi, 2013). In regard to distribution, lager retail chains developed their own distribution networks by implementing regional or local distribution depots to supply their stores (Rushton, et al., 2006).

In the 1980s, the need for internal integrated logistics systems were recognized. The focus of logistics shifted from a purely functional perspective to an overarching functional perspective. Due to the advances in information technology, companies began to integrate organisational functions with each other. As an example, the concept of Just-in-Time was developed to align internal procurement and production processes (Giordano & Schiraldi, 2013).

In the beginning of 1990s, logistics evolved into the total integration of all functions in a company. The functional integration into process chains aimed at the optimisation of material and information flows inside a company and laid the foundation for a more holistic view on logistics beyond company's boundaries.

In the middle of 1990s, logistics was developed further to encompass not only the functions within an organisation's own boundaries but also those functions outside which contribute to the final product or service. To that time, an intercompany perspective on logistics took over from an intracompany perspective which was dominant in the previous decades (Rushton, et al., 2006).

Nowadays, logistics integrates different value chains in a global setting. Thereby each value chain consists again of a number of companies. This holistic view on logistics has introduced the discipline of

supply chain management. Supply chain management is characterized by simultaneous consideration of many conflicting interests and objectives in logistics networks (Crandall, et al., 2009).
Due to the broader view on logistics, companies are aware that the optimisation of logistics activities is not an individual endeavour but can only be achieved in cooperation with other parties.
Today, companies are confronted with inefficiencies in transport networks and an increased concern at environmental hazards (Pomponi, et al., 2015). In order to address these issues, companies increasingly step into logistics cooperations with companies from the same or another value chain. Such multi-company cooperations aim at generating mutual benefits to its participants which could materialize for example in reduced transportation costs and a competitive advantage (Pomponi, et al., 2015). The subsequent section further describes the concept of multi-company cooperation in logistics and highlights logistics activities which are suitable for a cooperation.

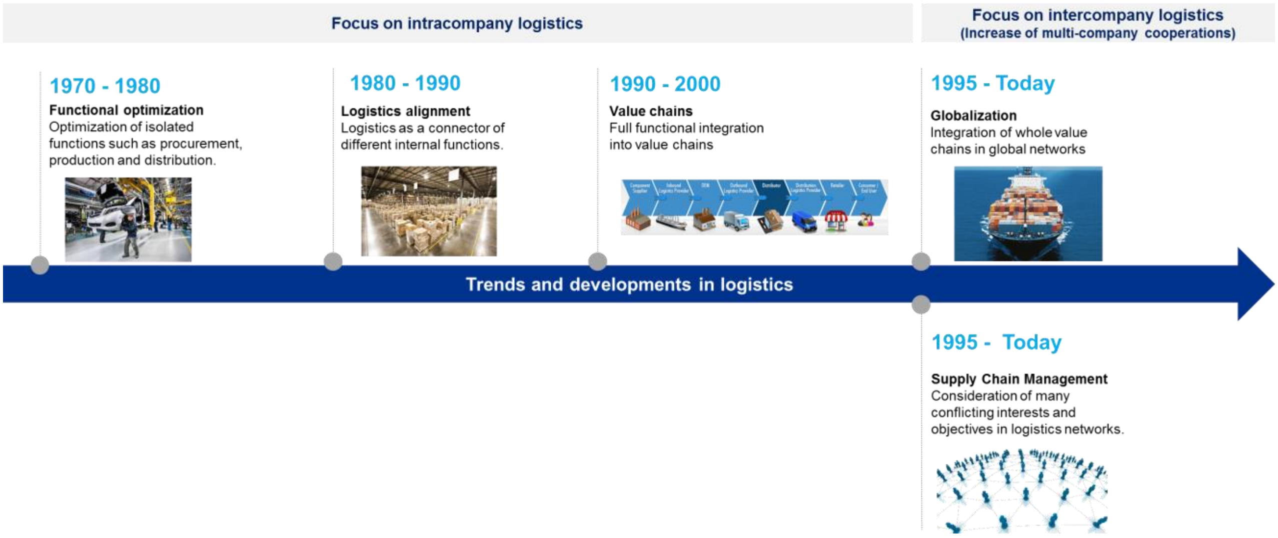


Figure 1: Overview of trends and developments in logistics from 1970 until today

1.1.2 Multi-company cooperation in logistics

Once companies have optimised their logistics activities internally, the next step is to collaborate with other companies. Often companies reach a glass ceiling when they keep optimising within the boundaries of their firm and soon reach the limits for additional efficiency gains. For that reason, an increasing number of companies are looking at cooperations (Lindert, 2013).
The nature of a multi-company cooperation represents a continuum between markets and hierarchies. Thereby, cooperations are mutual beneficial for every partner when coordination via markets (price) and hierarchies (authority) are both inefficient (Das & Teng, 1998).
The goals of a multi-company cooperation in logistics are to increase efficiency in networks and reduce transportation costs (Defryn, et al., 2013). In more detail, partners in a cooperation aim at increasing productivity, for instance by heightening utilisation of vehicles, reducing empty runs, and cutting costs of non-core activities (Cruijssen & Dullaert, 2005). Moreover, sustainability has grasped more attention by companies which can be recognized in Corporate Social Responsibility (CSR) activities. Therefore, multi-company cooperations also strive to achieve goals of green-logistics-initiatives such as the reduction of CO_2 emissions (Sanchez-Rodrigues, 2006).

In order to achieve the goals mentioned above, companies step in cooperations to exploit synergy effects between them. Companies in the same value chain often have similarities in their processes and customer characteristics. As a consequence, these companies have a relatively high potential to exploit synergy effects by cooperating with each other (Oswald, 2010) (Leitner, et al., 2011). Synergy effects can be realized when companies consolidate logistics activities, which they used to perform internally. The whole idea of synergy effects is that companies operate more efficiently and effectively when doing similar activities together (Lindert, 2013).

Companies which solely focus on individual transport planning and optimise their logistics independently from other companies face limited potential for synergy effects as described earlier. However companies which decide to optimize their logistics activities beyond their own borders and consider to cooperate with other companies open up substantially higher potential for synergy effects. *Purchasing cooperation* offers a medium potential for synergy effects. This kind of cooperation aims at joint tendering of transport services. An higher potential for synergy effects can be reached by a *transport cooperation* which allows cross-company transport bundling. The highest potential for synergy effects is represented by *lateral supply chain cooperation* which facilitates coordination between logistics and production (Leitner, et al., 2011).

Figure 2 shows the correlation between potential of synergy effects and the level of integration of processes. The more synergy effects companies aim to achieve the more they must integrate their internal activities with activities of other companies in a cooperation.

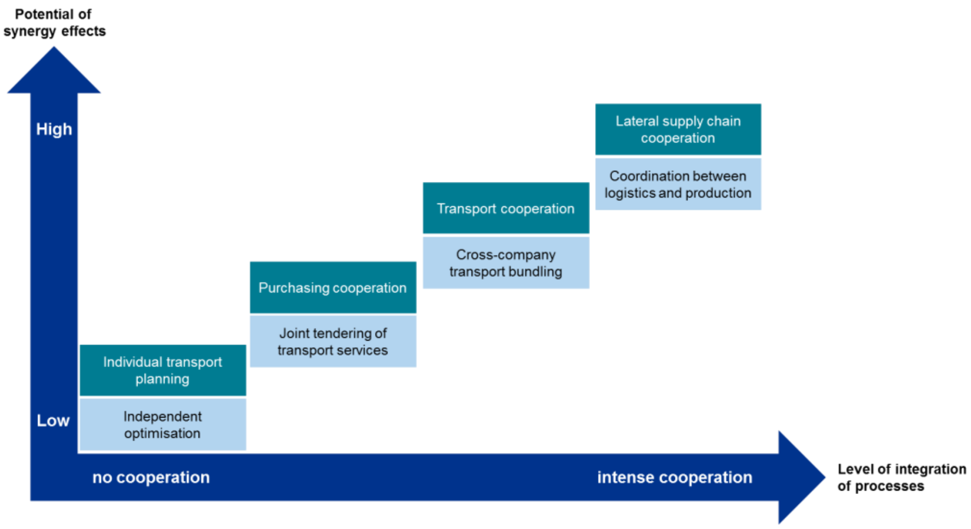


Figure 2: Correlation between synergy effects and level of integration (Leitner, et al., 2011)

An elaborate description about the various existing cooperation forms such as joint venture and alliance is made in Part 2 (Theory and concepts).

Irrespectively of the cooperation form or the logistics activity which is in the centre of a cooperation, the past experiences have shown that many multi-company cooperations are susceptible to failure. A positive business case has not proved to be a recipe for a cooperation to flourish. High failure rates of multi-company cooperation, which are at more than 50%, suggests that cooperations are more likely to fail than to succeed. In fact, success of an multi-company cooperation is rather an exception than a rule (Park & Ungson, 2001). The following section aims to provide reasons for why cooperations are often subject to failure.

1.2 Research problem

Multi-company cooperation represents a dilemma for the participating companies. The nature of a cooperation expects all parties to restrain from their normal economic behaviour to act according to their own interests. All parties are expected to align their behaviour with the goals of the cooperation in order to reach a collective optimum (Teece, 1992). Some researchers have stated that multi-company cooperation are by nature self-destructive and unstable since companies will eventually act opportunistic to optimize their individual outcome on the cost of the collective optimum (Inkpen & Beamish, 1997) (Kogut, 1989). Due to this dilemma, companies in a cooperation face the imminent risk that their partners in a cooperation do not restrain from their individual interest and sacrifice the common optimum of the cooperation for their own goals.
Different risk coping mechanisms exist to avoid or at least minimize the imminent risk of opportunistic behaviour. Barney & Hansen (1994) state that social and economic governance mechanisms must be introduced to cope with opportunistic behaviour in cooperations. The authors emphasize the importance of social and economic governance mechanisms to develop trust in a cooperation. Johnson & Howard (2014) define trust itself as a safeguarding mechanism against opportunistic behaviour. As a consequence, trust in multi-company cooperation is both, the result of successfully deployed social and economic risk coping mechanisms against opportunistic behaviour and a risk coping mechanism against opportunistic behaviour itself. In this way, trust is regarded as an essential ingredient of a successful cooperation between companies (Johnsen & Howard, 2014). A lack of trust between companies in a cooperation is emphasized by a number of authors as one main reason for a cooperation to fail (Das & Teng, 1998) (Vangen & Huxham, 2003) (Peng & Shenkar, 1997). For that reason, trust is key for a cooperation to be successful.

The following section introduces the concept of trust in multi-company cooperation. A more elaborated description of the concept of trust and trust building methods can be found in Part 2 (Theory and concepts).

1.3 Research question

1.3.1 Trust in multi-company cooperations

A variety of definitions of trust exist in the literature which define trust from different perspectives. Thereby, definitions of trust are formulated from either a social, psychological or managerial perspective (Laeequddin, et al., 2012). The comparison of the available definitions of trust manifests four similar characteristics of trust across all definitions: vulnerable position, positive expectation of the future, reduction of complexity and time dependency.

First, vulnerable position means that trust can only develop when a party faces a situation of potential damage. Coleman (1991) compares trust with placing a bet and thereby emphasises the risk character of trust. When trusting, the bet of the one who trusts is the potential damage he or she receives in case of a breach of trust. In this way, trust is considered as a goodwill that someone brings in a cooperation.

Second, a positive expectation of the future is another characteristic of trust. In many trust building concepts, trust is characterized by a positive expectation of the future whereas the one who trusts must accept a certain degree of uncertainty. The one who is trusted has basically to possibilities: To reward given trust or to disappoint. Trustworthiness is expressed by refraining from opportunistic behaviour. A positive expectation of the future is also considered by Rousseau et. al (1998) as an important element of trust. The authors therefore define trust as goodwill which is given to another party.

A third characteristic of trust is the reduction of complexity. Trust leads to the acceptance of possible risks without comprehensive calculations of risk probabilities and impacts. Furthermore, trust reduces the necessity for control which eases the daily work in a cooperation.

A fourth characteristic of trust is time dependency. A trust relationship is a self-reinforcing phenomenon which develops over time between the one who gives and the one who receives trust (Inkpen & Beamish, 1997). Throughout a cooperation, experiences made by the one who trusts is the basis of his willingness to trust in the future (Luhmann, 2000). In the beginning of a cooperation, the potential damage of the one who trust is relatively low. In the course of the cooperation, the potential damage constantly increases when trust is not exploited. The time factor is therefore an important characteristic of trust since trust does not emerge instantly but develops over time and with positive feedback loops.

A number of trust building models exist which describe the process of trust building over time. A detailed descriptions of the five most referred trust building models is made in Part 2: Theory and concepts.

Some authors in the trust literatur propose the involvement of a neutral third party to support the trust building process in a cooperation. In logistics cooperations, a neutral party makes it easier for other partners to join without having all agreements to be renegotiated (Lindert, 2013). Burt & Knez (1995) point out that “trust is significantly amplified by third parties”. A third party takes the role as a middleman and functions as a facilitator for trust building between all partners in a cooperation (Hertz & Alfredsson, 2003). Even further, in some instances it would not even be possible to develop trust among partners without the involvement of a third party. For instance when trust is low at the beginning of a cooperation, governance should be brokered by a third party. Thereby, the rule of thumb exist the lower the trust is in a cooperation, the stricter and more formal must be the third party governance (de Ferrante, 2015).

A third party can help to overcome concerns of partners e.g. regarding data security and profit allocation, thereby facilitating the trust building process. Important characteristics of third parties are trustworthy image, expertise, experience and technological know-how to facilitate the implementation and operation of a cooperation (Verstrepen, 2015).

In regard to logistics cooperations, a relatively new concept is currently attracting the interest of practitioners and researchers that is called Cross-Chain Control Tower. A Cross-Chain Control Tower is an independent third party which takes over several tasks in a logistics cooperation, ranging from strategy to operation. The following section introduces the concept of Cross-Chain Control Towers.

1.3.2 Cross-Chain Control Tower

Cross-Chain Control Tower is a relatively new appearance in the supply chain and logistics literature. For the matter of simplicity, the term Control Tower will be used in the proceeding sections. In the literature can be also found synonyms which represent the same concept such as supply chain orchestrator (SCO) or cross-chain-collaboration-centre (4Cs). The idea of a Control Tower is the "coordination of logistics activities for various shippers and logistics service providers" (Janssen, et al., 2015). For that reason, the frequently used term of Control Tower perfectly highlights the idea of a neutral party responsible to plan, optimize and coordinate logistics streams as it is done by an air traffic control tower at an airport. Laarhoven (2008) defines Control Tower as "a centre from which several supply/demand chains are controlled by means of modern technology, advanced software and top professionals". Thereby, a control tower manages physical, financial and information flows between partners in a cooperation.

Part 2 (Theories and concepts) compromises a separate section about the concept of Control Towers including key processes, value proposition, organisational form and information architecture of Control Towers. The following section combines the areas of trust and control towers in order to derive the formulation of the research question.

1.3.3 Formulation of research question

The research is designed to meet the objectives described above. The focus is on the incorporation of risk perception on trust development in multi-company cooperation in logistics. The main research question is:

''How to design a trust-building control tower strategy
for multi-company cooperations in logistics?''

The main research question is systematically addressed through four sub-questions.

1. What is a plausible conceptual framework for managing trust building in a multi-company cooperation in logistics?
2. What are perceived risks of companies which are involved in logistics cooperations?
3. How to develop risk profiles of partners in a cooperation with respect to perceived risks?
4. How can a Control Tower support building and sustaining of trust in a logistics cooperation?

The conceptual framework presented in Part 3 is based on theoretical research from Part 2 and is used to make sense of the findings of the other sub-questions. The framework proposes a relation between trust and risk perception and provides insights to why the relation is plausible.

The ShareShip cooperation is used as a case study for data gathering in sub-question 2 and 3. The research method for answering these two sub-questions is the Q-method which is described in Part 4. The results, discussions and corresponding recommendations are made in Part 5. Additionally, to ensure sophistication in the understanding of the implementation of a trust-building control-tower strategy, the process design on how to implement a trust-building strategy is described in Part 5.

In Part 6 will be a discussion about the lessons learned beyond the case-specific context of ShareShip. This is followed by a discussion of the main research question. The report concludes with a reflection on the research process and recommendations for further research.

1.4 Research objective and deliverables

Some knowledge gaps are discerned from the introduction above. Irrespectively of the number of advantages which multi-company cooperation in logistics offer for its partners, more than half of all cooperations in logistics have failed in the past (Park & Ungson, 2001). Next to hierarchy and market, cooperation represents a third organisational form which is located between hierarchy and markets. While coordination mechanisms in hierarchy and markets are authority and price respectively, the coordination mechanism in multi-company cooperation is trust. For that reason, mutual trust between companies is a key requirement for a cooperation to flourish.

This research has its focus on the development and sustainment of trust in multi-company cooperation. The research objective is to understand and describe the process of developing and sustaining trust in the background of perceived risks of partners in a cooperation. Perceived risks of partners in a cooperation represent barriers in the trust development process (Laeequddin, et al., 2012). The primary deliverable is a set of recommendations to practitioners in the area of logistics who are involved in setting up multi-company cooperation in their line of work. The recommendations are about the mitigation and avoidance of perceived risks in multi-company cooperations with the involvement of a control tower. Practitioners affiliated to the development of logistics cooperation can see these recommendations as an additional input for their work. The designed conceptual framework is another important deliverable bridging multiple research areas about trust building, logistics cooperation and risk management.

1.5 Research methodology

The research methodology is built along a five-step approach. In the first step, literature search focusses on existing trust-building methods, cooperation's life cycle, multi-actor risk management and the concept of Control Towers in logistics. Based on findings from literature search, a conceptual model is designed which aims at supporting the trust-building process in logistics cooperations. Subsequently, the conceptual model is tested on an empirical case within the Dutch building industry including expert interviews and application of the Q-method. The evaluation of empirical research eventually results in recommendations for risk counter strategies to be implemented in the underlying case of ShareShip and also derives general recommendation for the design of trust-building strategies for other logistics cooperations. Thereby, the research aims to enrich the existing literature on trust-building in multi-company cooperations.

Figure 3 shows an overview of the applied research methodology and visualises key outcome of each step.

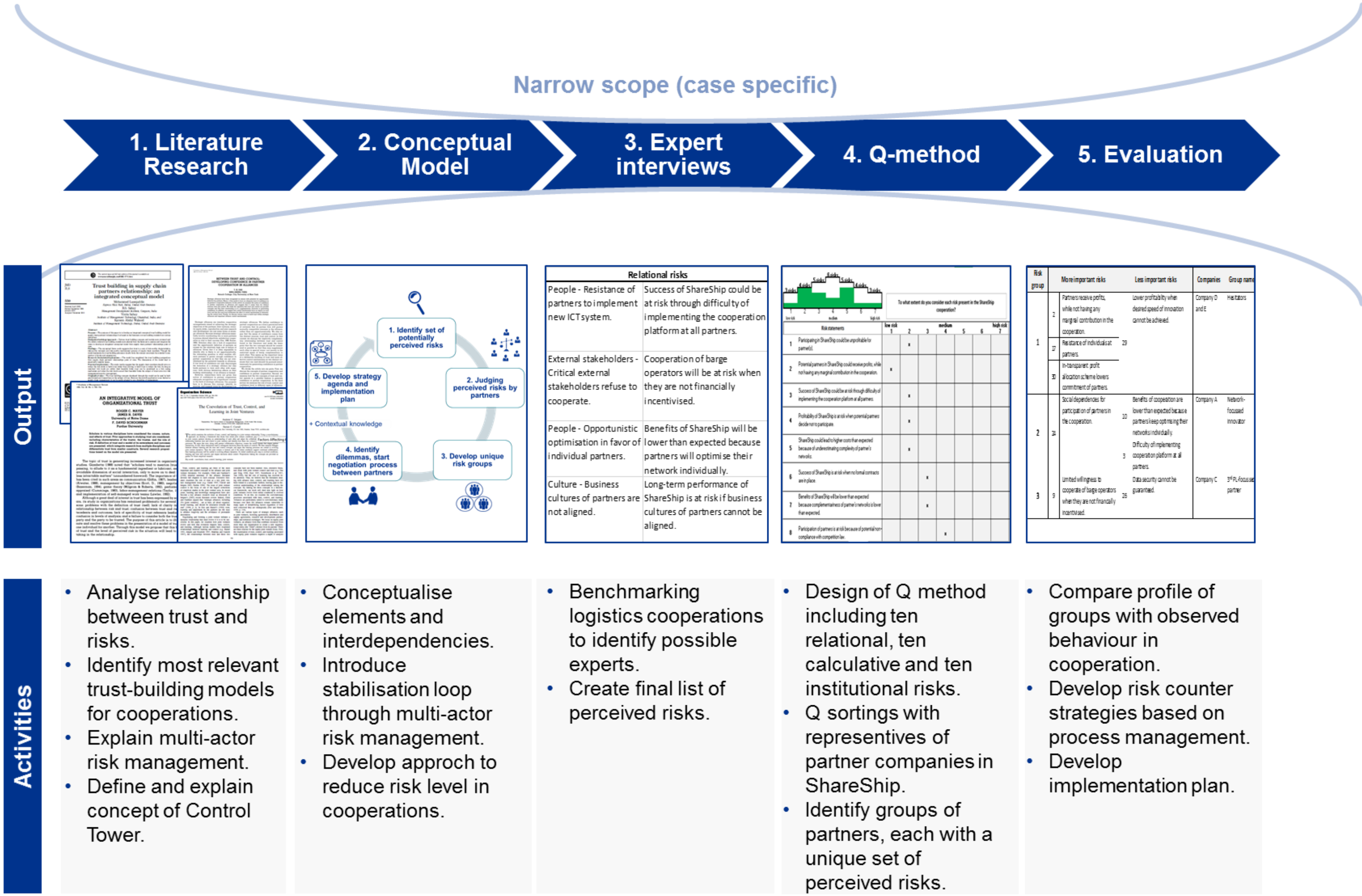


Figure 3: Research methodology

Figure 4 shows how the research methodology can be found back in the structure of this thesis. Results of literature research are presented in part 2 of the thesis. The conceptual model is introduced in part 3 and expert interviews and Q-method is part of the empirical research of part 4. Eventually, part 5 of the thesis presents results from the evaluation of empirical research.

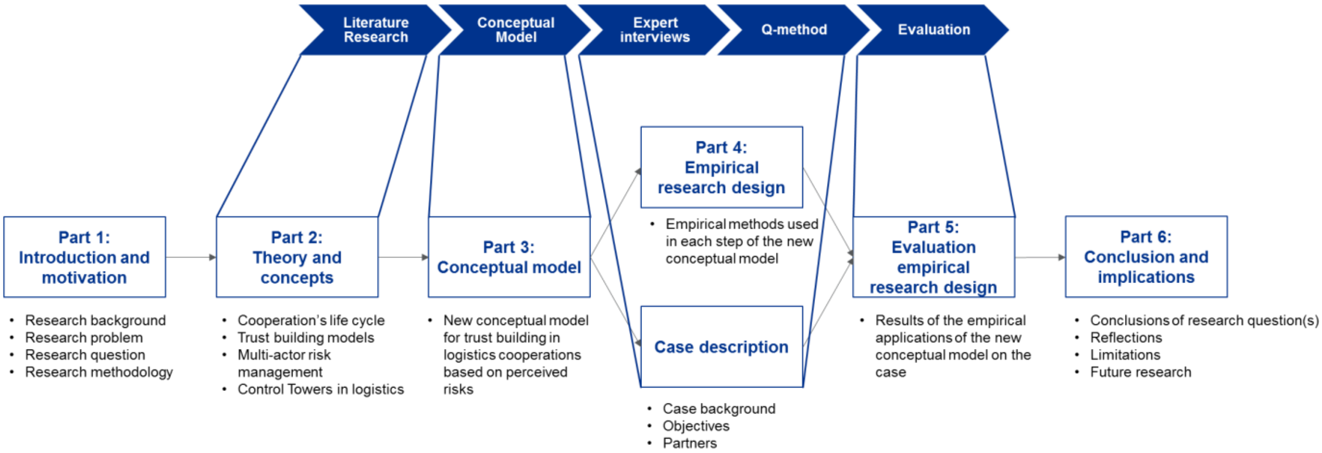


Figure 4: Research methodology embedded in the thesis structure

1.6 Summary

Companies, striving for optimising their logistics network, will inevitably depend on cooperating with other companies in the value chain. Thereby, trust between cooperating partners is a key success factor for a cooperation to flourish. This research has the objective to explore the field of trust building in cooperations and come up with a new conceptual model which can be practically applied and integrate the relatively new concept of Control Towers into the trust building process. In a subsequent step, the model is tested on a case in the Dutch building industry. Results of this case study approach strive to enrich the existing literature about trust building in logistics cooperations.

Part 2: Theory and concepts

Part 1 of this thesis concluded with a research methodology which comprises literature research as the first step. For that purpose, the cooperation's life cycle, existing trust building models, multi-actor risk management and the concept of Control Towers will be analysed in detail. The combination of insights from these areas is supposed to offer the required input for the development of a new conceptual model for trust building in cooperations. This part concludes with a causal diagram that describes the process of trust building based on the risk perception of partners in a cooperation.

2.1 Multi-company cooperations in logistics

2.1.1 Cooperation forms

Multi-company cooperations can be divided into intra-company cooperations on the one hand which solely takes place within the borders of a company and multi-company cooperations on the other hand which requires the involvement of different companies. While focussing on multi-company cooperations, it can be distinguished between Joint Ventures, Strategic Alliances, Networks and Project-based cooperations. These different cooperation forms are explained in detail in the following.

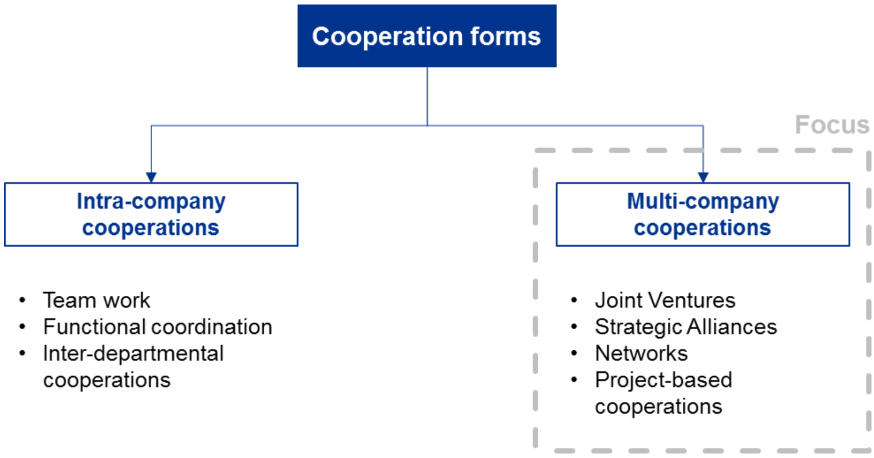


Figure 5: Different forms of cooperations

Joint Ventures

A Joint Venture is the foundation of a new company by two or more parent companies. Existing or new functions and tasks from the parent companies are placed in a separate entity. Joint Ventures are suitable for cooperations between companies from different levels in the same value chain (vertical cooperation), between competitors (horizontal cooperations) and between companies from other industries (Complementary-Joint-Venture). Additionally, outsourced activities in Joint Ventures can originate from all areas in the parent companies (Link, 2001).

Joint Ventures can be distinguished according partner's contribution which may be equity capital, know-how, intellectual property or whole business units which are into as separate entity. In this regard, Joint Ventures can either be majority led and parity led whereas Joint Ventures have a higher chance of success when partners evenly split up financial ownership (Bleeke & Ernst, 1991). Besides the foundation of a new organisation, parent companies stay legally and economically independent.

Strategic Alliances

A strategic alliance is the coupling of value-adding activities of several companies into a net of competences aiming at achieving significant competitive advantages (Bronder, 1992). In contrast to a Joint Venture, strategic alliances serve mainly the achievement of strategic goals whereas Joint Ventures strive to achieve operational improvements. Therefore, the differentiation of both cooperation forms is primary made through a higher strategic relevance (Bleicher, 1992). Typically, a strategic alliance is subject to some functional areas or a business unit.

Three different types of strategic alliances exist: Co-Option, Co-Specialisation and Learning and Internationalization alliance (Doz & Hamel, 1998). The objective of a Co-Option is to reach a critical mass in existing markets. Pre-requisites are matching strategic goals of cooperating partners. A shared Co-Specialisation is a strategic alliance that aims to open up new markets or opportunities in existing markets by for example new technologies. Pre-requisite is compatibility of existing strategies of partners. Especially high-risk projects and high-expensive projects as for example in the pharmaceutical industry can be realised with a Co-Specialisation alliance. Finally, Learning and Internationalization alliances serve the development or usage of new competences to close an existing gap. Pre-requisite is a sufficient distinction of partner's strategies regarding target markets and needed competences. The gain of new competences must be realised for all partners.

Networks

Networks define the cooperation between larger number of companies than in the case within other cooperation forms. Often, ten or more companies are involved in a network. The differentiation of network types is made by management type (polycentric or focal) and stability (stable or unstable). Polycentric networks are managed by different organisations whereas focal networks are centrally managed. Stable organisations remain in the same constellation for a longer time whereas unstable change constellations often or resolve completely. Four different network types exist which are Strategic Networks, Project Networks, Integrated Network and Virtual Network (Hess, 1998). Strategic Networks are strategically led by one or more companies. The leading companies are in most cases the end producers or retailers (e.g. in the car industry). Strategic networks are stable and are characterised by a focal management type. In Project Networks, one company takes over the dominant position of a project leader. An example is an general contractor in the building industry. Project networks are instable due to their project character and have a focal management type. In contrast to the previous network types, integrated networks have a polycentric management type in which each partner has the same weight and may decide over long-term developments. This network type is also considered as stable. Lastly, virtual network is the second network type that is managed polycentric, thus each partner has an even stake. In contrast to integrated networks, virtual networks are rather instable as the connection of competences between partners is problem related and is re-configurations takes place when problems change. Virtual networks still allow competition among partners. Openness and flexibility in such networks is often achieved through usage of modern IT (Link, 2001).

Project-based cooperations

Project-based cooperations have many touching points to the other cooperation forms and often functions as a preliminary stage for another cooperation form such as a Joint Venture. As partners become familiar with each other in the course of a project, they might find themselves in a position of continuing the cooperation with each other beyond the scope of the project. A project can have a strategic and/or operational focus and its direction can be either vertical, horizontal or complementary. Due to its broad applicability to various situations of companies striving to work together, project cooperations are a good starting point for a long-term cooperation in the future (Hess, 1998).

Table 1: Summary of characteristics of cooperation forms (Link, 2001)

Characteristic	Joint Venture	Strategic Alliance	Networks	Project-based cooperation
Connection	Rigid	Rigid, often formalised	Dynamic, flexible	Flexible
Formal instruments	Legal entity	Contract	Often informal	Informal or contract
Orientation	Strategic and operational	Strategic	Operational	Strategic and operational
Time horizon	In principle unlimited	Long-term but temporary	From short-term to unlimited. But often re-configurations	Temporary for the duration of project
Focus	Narrow and strong focussed on task and goal	Broad but limited to business unit	Broad but often re-configurations	Narrow and focussed on task and goal
Number of partners	Typically less than 5	Typically less than 5	Often more than 10	Typically less than 5

2.1.2 Cooperation's life cycle

Multi-company cooperation in logistics is a dynamic and sometimes chaotic endeavour. The apparent chaos comes from the characteristics of multi-company networks as e.g. mutual interdependency, absence of hierarchy and high variety of goals and expectations which are not always correlated to each other. Power positions of partners may change, new partners can join the cooperation and others may withdraw (de Bruijn & ten Heuvelhof, 2008). Multi-company cooperations are always subject to change and every cooperation follows its own individual path. Therefore, a universally valid life cycle for all multi-company cooperations is difficult to derive.

Nonetheless, previous and existing multi-company cooperations show recurring patterns of which each are unique for certain time periods in a cooperation. Verstrepen et al. (2009) describes a cooperation's life cycle which consists of the four phases Strategic positioning, Design, Implementation and Moderation (see Figure 6). Additionally, the authors introduce a stage-gate approach to the life cycle that is commonly known in project management. Thereby, each phase is separated to its successor by gates which must be overcome in order to proceed with the next cooperation phase. At the gates, quality checks take place and a go/no-go decision is made whether the quality of the cooperation phase fulfils the requirements to continue to the next phase. The authors also build in an evolution and growth cycle in which change management is applied to continuously update the cooperation design.

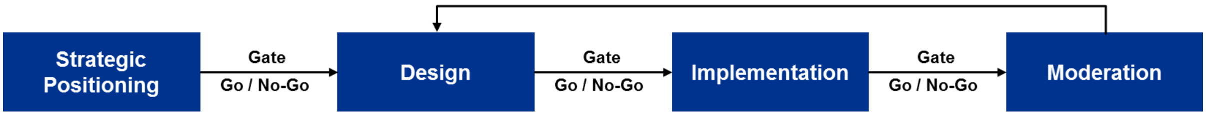


Figure 6: Cooperation's life cycle from Verstrepen et al. (2009)

However, the cooperation life cycle from Verstrepen et al. (2009) still misses out some important elements. First of all, the life cycle does not take into account the determination of a cooperation. When a change management does not achieve the desired outcome, cooperation partners might choose to refrain staying and the cooperation comes to an end. For that reason, Harland (2002) developed a cooperation life cycle which consists of the four phases of Initiation, Implementation, Operation and Determination (see Figure 7). In the Initiation phase, two or more companies express their intentions and take the decision of working together in the future. This decision is accompanied with agreements in respect to confidentiality and rules about data ownership (Biermasz & Louws, 2014). The Implementation phase is split up into two parts. A partner selection is conducted in which the final composition of companies in the cooperation is determined. A leading principle thereby is to find companies which are complementary to each other in order realize synergy effects. The second part is the configuration of the cooperation setup. Thereby, decisions have to be made about e.g. the object of the cooperation, cost allocation mechanisms, entry/exit clauses, target service levels, control mechanisms, collaborative KPIs, organisational structures and others (Biermasz & Louws, 2014). In the third phase, the Operation phase, partners start with their cooperating activities such as transport bundling or joint production. When a cooperation has reached the determination phase, partners stop cooperating and withdraw from the cooperation.

Another downside of the life cycle from Verstrepen et al. (2009) is that cooperation phases are connected with a go/no-go gates and only one evolution loop exists. However in practice, more evolution loops can exist which make it possible to return to previous cooperation phases. The life cycle from Harland (2002) contains three evolution loops which are shortly explained in the following (see Figure 7). The first evolution loop goes from the configuration phase back to the partner selection phase in order to make a re-adaptation of the partner composition possible and achieve higher synergy effects. A second evolution loop exists within the operation phase and makes a continuous review of the implemented cooperation setting including control mechanisms possible. A third evolution loop connects the determination with the implementation phase and can be considered as the emergency break, the last possibility to update the cooperation setting before the termination of a cooperation occurs.

These evolution loops are also called stabilisation loops because they aim at a balance between trust and risk level in a cooperation. More explanation about the interdependence between trust and risk is made in the following section.

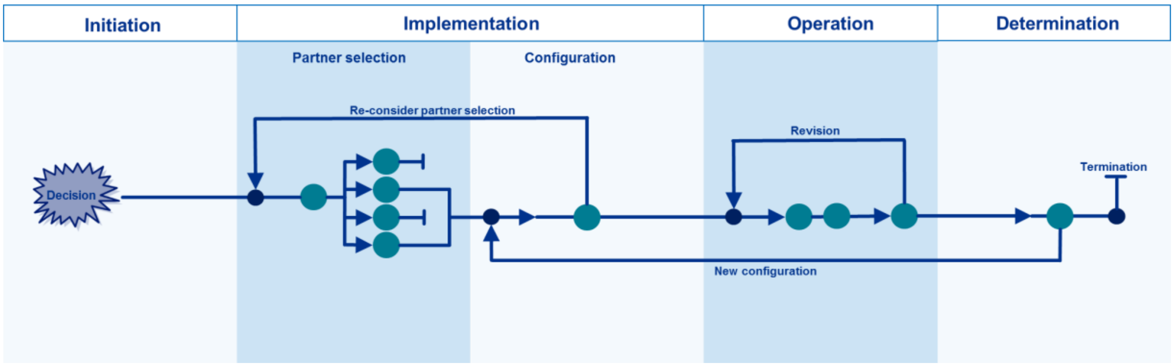


Figure 7: Cooperation's life cycle (Harland, 2002)

2.2 Trust in multi-company cooperations

2.2.1 The concept of trust

The concept of trust has gained more attention in latest management publications and by now has a substantial role in modern economy. Some authors even consider trust as a central economic factor which among others determines the wealth and economic strength of a society (Adler, 2001) (Fukuyama, 1995). Trust can be considered as "goodwill and reliability of and between partners of a cooperation" (Cummings & Bromiley, 1996). A comprehensive definition of trust is the "positive expectations about another's motives with respect to oneself in situations entailing risk'' (Boon & Holmes, 1991). A more psychological approach of defining trust is the "confidence in another's goodwill or faith in the partner's moral integrity" (Ring & van de Ven, 1994).

Trust has a number of positive effects in a cooperation. First, trust lowers transaction costs between cooperating parties due to a decreased need of negotiations and control (Gulati, 1995). This advantage is also supported by Larson (1992) who points out that trust reduces the extent of formal contracts. Second, trust leads to a desirable behaviour of cooperating parties which aim to optimize common goals instead of individual goals (Madhok, 1995). Third, trust eases the way to resolve disputes in a cooperation because partners recognize the overall value of the cooperation and do not want to sacrifice the existing level of trust in favour for some quick but small wins. Therefore, partners are more considerate in times of conflicts. In contrast, partners who do not trust each other are more susceptible opportunistic behaviour (Ring & van de Ven, 1994).

When analysing trust between humans or organisations it becomes obvious that a trust relation requires the involvement of at least two parties, a trustor and a trustee. "A trustor is the one who puts himself in a valuable position whereas a trustee is the party in whom the trust is placed" (Laeequddin, et al., 2012).

Modern trust research distinguishes between two general streams of trust concepts. The first stream considers trust as embedded in the trustor and thereby depended on their feelings, emotions and personality. The second stream look at trust embedded in trustees. Thereby, a trustee does not necessarily to be a person. Instead it can also be a brand, calculation method, technology or an institutional system (Laeequddin, et al., 2012).

Trust can only exist in an environment of uncertainty and risk (Luhmann, 2000). Risk occurs when a trustor puts himself in a vulnerable position, thus making himself vulnerable towards a trustee. For example, a company provides sensitive information about costs levels to its cooperation partners and run the risk of partners exploiting information to achieve a better competitive position. The latter example is especially realistic in horizontal cooperation in which partners compete with similar product/market mix.

In conclusion, trust develops between a trustor and a trustee in a situation entailing risk. In multi-company cooperations, trust is a key success factor because it functions as a risk coping mechanism. However, the underlying process of trust development remains a black box to that point. In order to open this black box and to identify the key elements in the trust building process, the following section describes the five most referred trust building models in the literature.

2.2.2 Trust building models

A number of different trust building models have been developed throughout the last two decades. The following selection of trust building concepts presents the most referred ones in trust literature and thus are assumed to lie a profound fundament for the preceding steps in this research. Furthermore, the selection of trust building models is based on its relevance to this topic. The trust building model of Das and Teng (1998) focuses on the interplay between trust and control which is relevant for the governance model of a cooperation. The trust building models of Rousseau et al. (1998) and Lewicki & Bunker (1995) differentiates between categories of trust which helps to manage each category apart from each other. The model of Inkpen and Curall (2004) presents key elements for trust development which are unique for the phase before and after the implementation of a cooperation. Finally, Mayer et al. (1998) describe on what trustworthiness of trustee and willingness to trust of trustor depends on.

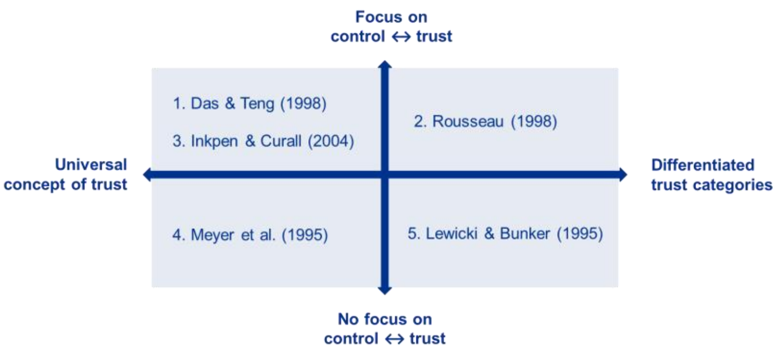


Figure 8: Classification of trust building models

Overall, selected trust building models can be categorised according to the following two dimensions: Focus on trust and control vs. No focus on trust and control and Universal concept of trust vs. Differentiated trust categories (see Figure 8). Some trust building models differentiate between types of trust whereas others use trust as a general concept between cooperation partners. As control and trust seem to influence each other in a cooperation, some trust building models explicitly elaborate on the interdependence between control. All selected trust building models are described in detail in the following sections.

Interplay between control and trust by Das & Teng (1998)

The authors distinguish between trust, which is based on experience and hope, and control. In their model, control is a regulating process that makes a cooperation more predictive. Together, trust and control levels forming partner's confidence in the cooperation. Confidence is a distinguished concept to trust as it defines the expectations of motives whereas trust defines the perception of certainty about cooperative behaviour. As cooperation are subject to opportunistic behaviour, the significance of confidence in other's behaviour is obvious.

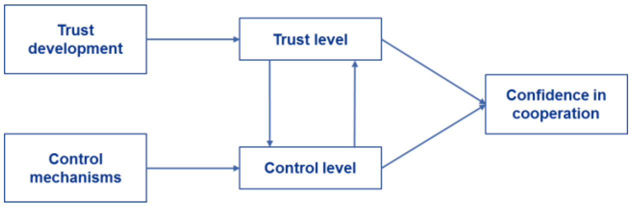


Figure 9: Trust building model Das & Teng (1998)

Commitment in a cooperation, for instance a Joint Venture or a contract, is only an instrument of control. Formal and inappropriate control mechanisms reduce trust whereas social and appropriate control mechanisms increase trust. Thereby, the danger of reinforcing loops exists when inappropriate control mechanisms increase mistrust which in turn leads to the introduction of more inappropriate control mechanisms. In cooperations with mistrust, parties often face difficulties to agree upon common control mechanisms.

Factors which influence the choice of a cooperation form (e.g. Joint Venture or Limited Liability Company) are the existing trust level on the one hand and the required control level on the other hand. Based on existing trust level and required control level, a cooperation must be chosen which is appropriate to the current situation.

Trust categories by Rousseau et al. (1998)

The trust building model from Rousseau et al. (1998) differentiates between institutional trust, which is common in organisations, and personal trust. Personal trust can be split up in calculative and relational trust. Whereas institutional trust remains constant over time, calculative trust is higher in the beginning of a cooperation and decreases on cost of relational trust when the cooperations proceeds.

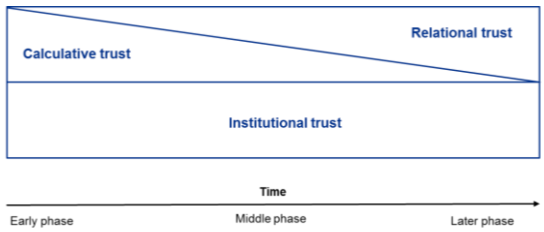


Figure 10: Trust building model Rousseau et al. (1998)

The authors see a tendency towards relational trust due to the decentralization of enterprises and the development of flexible work places which in turn leads to a resolution of company borders. The consequence is a replacement of institutional trust with relational trust.

The coevolution of trust by Inkpen & Curall (2004)

Inkpen and Curall (2004) investigate the phases before and after the implementation of a cooperation in order to better understand the processes in each phase. Similar to Das & Teng (1998), the authors state that partners must balance the trade-off between trust and control. As illustrated in Figure 11, trust creates the initial conditions which determine partner's interactions. These interactions in the initiation phase influence decisions about the nature of control for the future. At the moment a cooperation is implemented, learning processes are central and learning and trust will coevolve. Thereby, two different learning processes are distinguished: Learning *from* a cooperation partner (e.g. knowledge acquisition) and Learning about a cooperation partner.

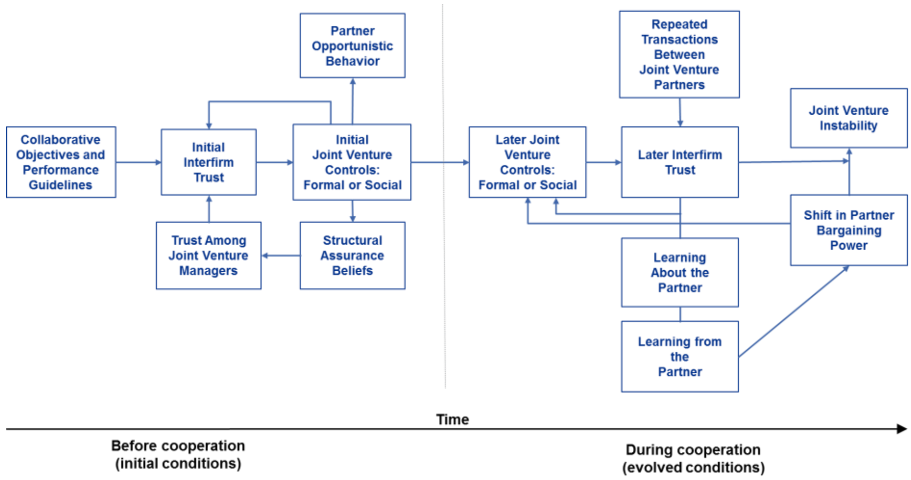


Figure 11: Trust building model Inkpen & Curall (2004)

As a result, learning plays a critical role cooperations because its shapes partner's interactions and influences decisions about control mechanisms. For that reason, the authors have emphasized the importance of time since learning is irretrievable connected to time.

Trust as risk taking by Mayer et al. (1995)

One of the most referred trust building models is the one from Mayer et al. (1998). The authors differentiate between trustworthiness of trustee and trustor's propensity towards trust. The relevant factors for trustworthiness of a trustee are ability, benevolence and integrity. Ability is the influence and knowledge in a certain area (e.g. technical knowledge). Benevolence means the expectation that initially given trust will not be exploited. Therefore, benevolence is also considered as goodwill. Integrity means the compliance with common institutions such as norms and values. These three factors can influence each other but are dependent from each other.

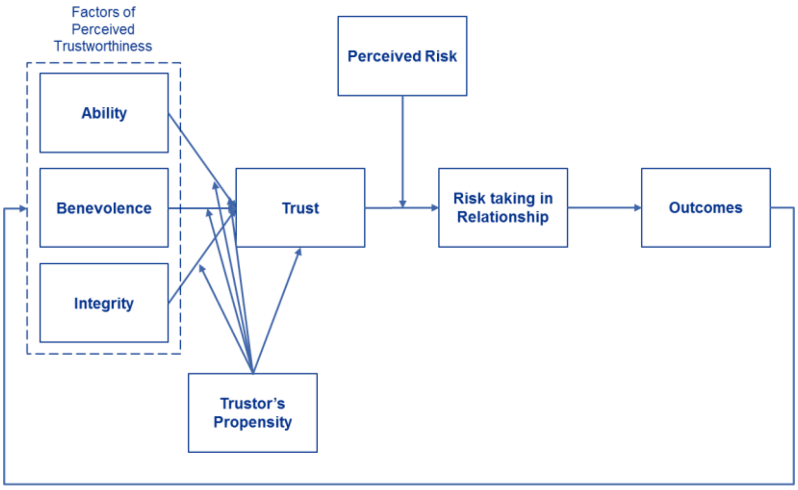


Figure 12: Trust building model Mayer et al. (1995)

Behaviour of a trustor is based on his trust propensity to trust. Since a direct connection exist between risk and trust (see 2.6), propensity to trust can be translated into trustor's willingness to take risk. This willingness to take risk depends on the characteristic, cultural background and experiences of the trustor. When a trustor decides to take risk in a cooperation by trusting another partner, the other partner can either act opportunistically or value the trusting behaviour of the trustor and act according to common goals of the cooperation. In this case, the trustee would refrain from opportunistic behaviour and in turn trustworthiness of trustee and propensity to trust of trustor increase which allows for more risk taking in the following transactions. As a consequence, trust is the result of the characteristics and behaviours from both trustor and trustee.

Trust in stages by Lewicki & Bunker (1995)

Lewicki & Bunker (1995) differentiate three stages in trust development: Calculus-Based Trust, Knowledge-Based Trust and Identification-Based Trust. Calculus-Based Trust emerge from pure cost/benefit comparison whereas Knowledge-Based Trust emerge in a getting-to-know process and continuous transactions. Identification-Based Trust emerges in the very long term of a cooperation when partner's intentions and goals are completely aligned with each other and a collective identity and shared values exist.

Figure 13: Trust building model Lewicki & Bunker (1995)

All three stages are sequentially connected with each other and trust develops gradually when partners move to the subsequent stage. However, not every cooperation moves through every stage. Some cooperations stop at stage 2 (Calculus-Based Trust) when only arm-length transactions are required.

Many cooperations stop at stage 3 (Knowledge-Based Trust) and only a few cooperations reach stage 3 (Identification-Based Trust).

Comparison of trust building models

Table 2: Comparison of trust building models

Trust-building model	Trust develops through …	Model differentiates between	Trust is …	Uniqueness of model
Das & Teng	Risks, Power & Communication	Trust & Confidence	Opposite pole to control	Interdependency of trust and control
Rousseau et al.	Behaviour	Calculative, Relational & Institutional trust	Positive expectation of the future	Differentiation of three distinct trust categories
Inkpen & Curall	Security belief, Control & Experiences. Evolutionary process between learning and control	Personal vs. organisational trust	Part of the cooperation process	Distinguishing between pre and post cooperation phase
Mayer et al.	Ability, Benevolence & Integrity of trustee. Propensity to trust of trustor	Trust, Risk taking behaviour and Outcome	A facilitator for risk taking in a cooperation	Differentiation between trust factors and trust outcome
Lewicki & Bunker	Learning, Positive experience & Necessity to build trust	Calculus-based, Knowledge-based, Identification-based trust	A concept that changes character and texture as a cooperation develops	Some cooperation stay at calculus trust, many at knowledge trust and only a few achieve identification trust

Conclusion Trust building models

The selected trust building models from literature suggest a differentiation of trust into three categories of relational trust, calculative trust and institutional trust. Relational trust is defined by Rousseau et al. (1998) as reliability and dependability which result from previous interactions between trustor and trustee. Interactions lead to the development of interpersonal care and concern about the personality of other partners. Therefore, Coleman (1990) calls this category identity-based trust.

Second category of trust is called calculative trust. Rousseau et al. (1998) describe calculative trust as trust which is based on rational choice such as economic exchange. An example is the profit allocation scheme in a cooperation. The emergence of calculative trust requires credible and verified information about other cooperation partners for instance certifications or confirmations by third parties. Calculative trust is especially important for the success of a cooperation when relational trust is still low which is often the case at the beginning of the cooperation (Rousseau, et al., 1998).

Third category of trust is called institutional trust. This type of trust functions as a support for the development of the other two types of trust the for example in form of control mechanisms (Rousseau, et al., 1998). Inkpen & Curall (2004) also introduce control mechanisms in their model which they split up into social and formal control mechanisms.

Besides the different categories of trust, trust building models also suggest that trust is subject to time and repeated interaction between partners. For example, Rousseau et al. (1998) and Lewicki & Bunker (1995) argue that relational trust is based on repeated and long-term interactions over time. As a consequence, the authors consider relational trust as more important in a later stage of a cooperation whereas calculative trust is more important at beginning of the cooperation.

2.2.3 Connection between trust and risk

"Trust is the willingness to assume risk" (Laeequddin, et al., 2012). Provided that cooperating partners have full information about partner's reliability and can be certain that no risks exist in a cooperation, then trust would be pointless. In other words, there is no need to trust when no risks exist. Luhmann (1979) and Dasgupta (1988) consider total security as the opposite of trust which is always connected with uncertainty and risks . The higher the uncertainties are in a cooperation the higher are the risks which companies face in a cooperation.

Laeequddin et al. (2012) describe trust as a risk coping mechanism. According to their approach, trust among partners is a tool to manage risks in cooperation. The authors differentiate between two risk coping mechanisms; trust and risk management. According to their perspective risk management begins when trust ends. As a consequence, the less trust is present in a cooperation the more risk management must be applied to compensate for the lack of trust.

The focus is thereby on risks which are perceived by cooperating partners. These risks must not necessarily represent existing risks. For instance, a company could judge another partner as not reliable and therefore risky to trust although no evidences exists from previous cooperation about the unreliability of the respective partner. Nonetheless, perceived risks are important in multi-company cooperation to consider because cooperating with other companies is a voluntarily endeavour and will only be undertaken when the perceived risk level of a company is not higher than the risk bearing capacity of the company.

Other authors also argue that trust can be considered as a risk coping mechanism. Panayides and Lun (2009) for example argue that trust in cooperations creates an environment in which companies exceed the minimum requirements of a business relationship in order to increase the probability of higher benefits but in the light of an increased risk level.

In practice, multi-company cooperations contain a facet of uncertainties and risks for its partners. Trust functions as a risk coping mechanism and let partners show the willingness to accept certain risks in a cooperation. However in case when the level of risks exceeds the level of trust in a cooperation, another risk coping mechanism must come to play that compensate for the surplus of risks. The second risk coping mechanism is multi-actor risk management. The following sections will elaborate further on this mechanism.

2.3 Multi-actor risk management

The previous section concluded with a direct relationship between trust and risks. Thereby, trust can be considered as a risk coping mechanism. In case the level of trust in a cooperation is not sufficient to cope with the level of perceived risks, another risk coping mechanism becomes necessary which is multi-actor risk management. In the first step, the difference between traditional risk management and multi-actor risk management is described.

2.3.1 Difference between traditional and multi-actor risk management

Multi-actor risk management is a sub-category of risk management that becomes applicable in a multi-actor network as it is the case in a cooperation. In traditional risk management, single risks are consolidated into an overall risk, representative for an entire project. Most often this is done by the multiplication of the probability of each risk with the potential damage of each risk (Risk=Probability X Potential damage). The overall risk is the accumulation of the result of all risks. In contrast to traditional risk management, multi-actor risk management or collaborative risk management does accumulate risks. Instead, an extensive set of possible risks is developed in a first step. Subsequently, risks are assessed by partners regarding their importance. An accumulation of risks is consciously avoided because it could lead to reduced possibilities of applying risk mitigation strategies based on risk sharing. Multi-actor risk management takes into account moderate risks may turn out to be a critical risks to only single partners. An accumulation of those risks would increase the perceived risk level for all partners at the same time which is not a realistic representation of the risk perception on partner’s level. A better approach is to consider each partner’s risk perception separately and search for compromises and deals which can be realised among partners. This approach promotes understanding for the needs of other partner and at the same time facilitates the creation of a risk-conscious cooperation culture (Link, 2001). Before describing the concept of risk mitigation including risk counter strategies in multi-actor risk management, the following section presents different categories of risks which can be found in cooperations.

2.3.2 Categories of risks in cooperations

As a direct connection exists between trust and risks, the categorisation of risks in multi-company cooperations is derived from the three trust categories introduced in the previous section. Therefore, risks will be distinguished in the course of the this thesis between relational, calculative and institutional risks. The reason to categorise risks the same way as trust is to make it manageable in the context of trust building.

Relational risks are all risks regarding the reliability and integrity of other cooperation partners. These risks mostly emerge through negative experiences with partners or through a negative image that a partner has in the market. Additionally, partners may also perceive relational risks because of a lack of knowledge over other partners. Examples for relational risks are an opportunistic behaviour of internal partners and resistance of external stakeholders to cooperate with cooperation partners.

Calculative risks are based on rational choice and credible information such as economic exchange. Risks which belong to this category often deal with complex mathematical calculations which fall into the field of cooperative game theory. Examples for calculative risks are unfair profit allocation scheme or higher coordination costs than initially expected.

Institutions are by definition systems of social rules which structure behaviour and social interactions (Koppenjan & Groenewegen, 2005). In institutional economics, institutions are considered as modes of governance such as contracts, rules, regulations, law and organisational structures. Therefore, institutional risks include all risks which originates from the institutional setting of the cooperation including legal, governance model and other arrangements between partners. Examples for institutional risks are low data security and non-compliance with competition law.

As risk categories match with identified categories of trust, it is necessary to emphasize that risks from one risk category must not necessarily be compensated by trust from the same category. For instance, a calculative risk can be compensated by institutional trust or institutional risk counter strategies. Figure 14 illustrates the concept of risk coping mechanisms for perceived risks in cooperations.

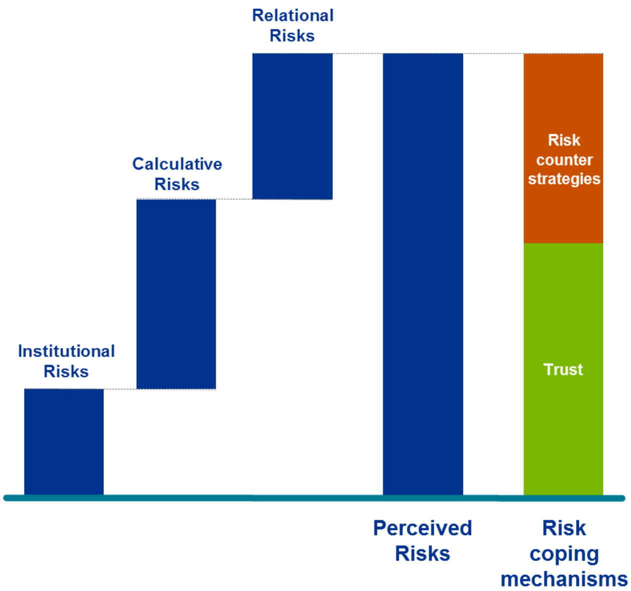


Figure 14: Total risk level in a cooperation is an accumulation of institutional, calculative and relational risks

2.3.3 Risk mitigation in multi-actor risk management

Process design

In the literature, risk management and related risk management strategies often take a perspective of a single person or company. For that reason, risk counter strategies are often aligned with tools which one actor can influence and manage. In this regard, risk mitigation in the supply chain literature distinguishes between into risk avoidance (e.g. remove specific products or markets), risk control (e.g. vertical integration) and increase flexibility (e.g. postponement and multiple sourcing) (Jüttner, et al., 2003). These risk counter strategies can be implemented by single companies and do not require to take into account risk perceptions of other companies in the supply chain.

In a cooperation, however, another initial situation is present that does not allow the alignment on only a single company. Provided one company is the initiator of a new cooperation, this company depends on other companies to implement the cooperation and the other companies may not necessarily be convinced by the arguments of the initiator. Even further, they might think their own ideas are not sufficiently represented in the suggested setting of the new cooperation. As a consequence, commitment of other companies is at risks. They will only support the cooperation when they are involved in the implementation of the cooperation and when their own ideas are sufficiently taken into account (de Bruijn, et al., 2010). De Bruijn et al. describe in their book process management why project management approaches fail in complex situations like the one of a cooperation. The authors argue for a process design approach that involves every partner. Following this idea, multi-actor risk management should also be based on a process that is managed by a process manager and eventually results in agreements between partners on the risk strategies to apply in the cooperation.

Figure 15 shows the process design for multi-actor risk management which is adapted from De Bruijn et al. (2010). In a first step, information about partners are gathered regarding their individual risk perception. This can be done for example through interviews or surveys. Subsequently, core values of each partner are derived based on the individual judgement of risks. Core values are subjects which are of special importance to partners and are protected by them. Therefore, core values should be uncovered because they require protection in the subsequent steps. The protection of core values ease the participation of partners (de Bruijn, et al., 2010). A partner indicates a core value when he assesses one risks as relatively serious compared to other risks. In a second step, dilemmas need to be identified between partners. A dilemma is defined as opposing risk perceptions of one or more partners which can hardly be mitigated simultaneously due to a negative correlation. For example, a partner perceives the risk of data leakage to other partners whereas another partner perceives the risk of information silos and request information transparency between partners. Third step is to make dilemmas in a cooperation visible to partners in order to create awareness of opposing risks and thereby open up negotiations among partners. Negotiations are supposed to lead to compromises and package deals between partners. For example, two dilemmas which involve the same partners can be coupled in order to achieve a package deal. Important to consider in this step are the core values of partners. Compromises and deals should not force partners to give up on their core values. The last step is to derive and implement concrete strategies based on the compromises and deals made.

By following this process design, risk counter strategies are selected on the basis of individual risk perceptions of partners which are assumed to be closer to the complexity of a multi-actor networks. The following section provides a collection of possible risk counter strategies which can be selected from in the last step of the process design.

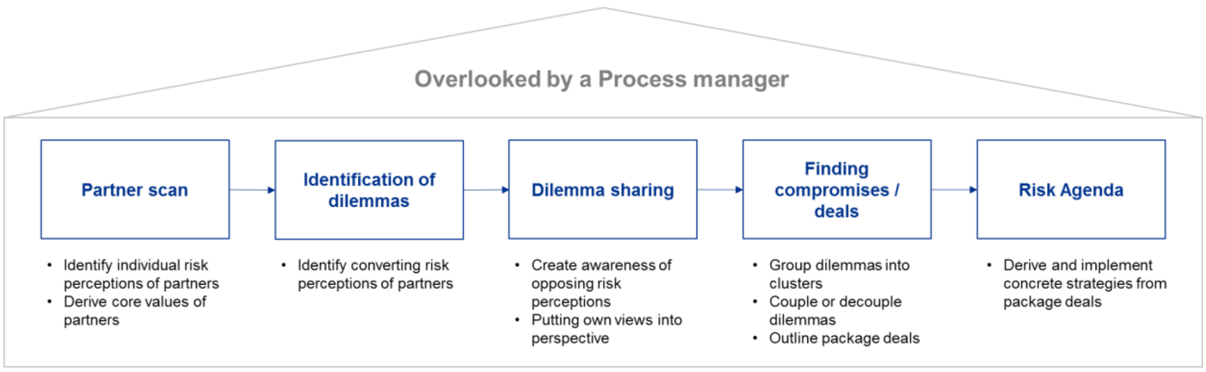


Figure 15: Process design for multi-actor risk management in cooperations adapted from (de Bruijn, et al., 2010)

Risk counter strategies

In accordance to the identified risk categories, risk counter strategies are also divided into relational, calculative and institutional risk counter strategies. As multi-actor risks management is a continuous process through the entire life cycle of a cooperation, risk counter strategies are assigned to specific phases of the cooperation's life cycle. The collection of risk counter strategies does not claim completeness of all existing strategies. Instead, the list serves as a first collection of risk counter strategies which are identified throughout the literature research and from which risk managers and partners in a cooperation can choose from (see Table 3).

Table 3: Possible risk counter strategies in each cooperation phase

	Initiation	Implementation	Operation	Determination
Potential risk counter strategies for relational risks	• Clearly define cooperation goals	• Select partners based on capability, strategic goals, and value potential • Isolate social from content related conflicts	• Achieve fixed agreements on communication processes between partners	• Introduce independent mediator for social conflicts

		• Introduce voting rights for each partner		
Potential risk counter strategies for calculative risks	• Develop an attractive business case	• Allocate investment costs among all partners	• Ensure transparent profit allocation • Apply "fair" profit allocation (e.g.) cooperative game theory	• Ensure transparent profit allocation
Potential risk counter strategies for institutional risks	• Make use of a non-disclosure agreement	• Protect intellectual property of partners • Create legal backup with contractual agreements between partners	• Implement collaborative KPIs • Implement clear guidelines and policies in terms of financial control and accounting transparency • Protect intellectual property of partners	• Implement sanctions and penalty system

2.3.4 Benchmarking on the effectiveness of risk counter strategies

A recent study with 136 companies in Germany has investigated risk counter strategies companies perceive as most effective in cooperations. On the first position is the definition of clear goals between partners. This finding resonates with other researches which came to the conclusion that conflicts in a cooperation are often the result of unaligned expectations and goals. Other effective risk counter measures are fixed agreements of communication, such as regular meetings, and detailed project and work plans for a fully monitoring (Bundesverband Deutscher Unternehmensberater e.V., 2010).

In practice, risk management and the introduction of risk counter strategies can be politically sensitive topic because not every partner may agree to proposed counter strategies. In order to prevent additional conflicts, a third party provider is considered a more suitable to conduct the task of risk management than one of the partners involved. In principal, a third party provider in a cooperation functions as a broker for network organisation, information sharing and asset management. Additionally, a trend emerged that a third party also manages risks in a cooperation which has given rise to the term of risk orchestrator (Zacharia, et al., 2011). In a previous section, the concept of a Control Tower was introduced as a certain type of third party provider (see 1.3.2 Cross-Chain Control Tower). In the course of this research, such a Control Tower will be responsible for the risk management in a cooperation.

2.4 Control Tower in logistics cooperations

As introduced in Part 1, a neutral third party supports the trust building process in a cooperation. In regard to logistics cooperations, a relatively new concept attracts the interest of practitioners and researchers that is called a Cross-Chain Control Tower. This section aims to offer a comprehensive description about the various aspects of a Control Tower including the role in a cooperation, business model and information architecture. It concludes with providing a benchmark of existing Control Tower to demonstrate the different possible forms of a Control Tower.

2.4.1 Role of a Control Tower

A neutral Control Tower is not very different to a fourth-party logistics provider. A fourth-party logistics provider integrates own resources and technologies with the ones of complementary logistics service providers in order to offer customers comprehensive supply chain solutions. Fourth-party logistics provider functions a as single contact person for customers and other logistic-partner companies in place. Additionally, customers outsource the majority or all logistics activities to fourth-party logistics providers (Skjoett-Larsen, 2000).

A number of fourth-party logistics providers have developed their own Control Towers such as DHL, Kuehne + Nagel and DB Schenker. However, a grey area still exists about whether they are well equipped to perform the task of a Control Tower which is hundred percent congruent with the traditional tasks of a fourth-party logistics provider (Lindert, 2013).

A Control Tower in a logistics cooperation is supposed to be a combination between an information technology and consultancy provider which fulfils the following four tasks: Network Architect, Network Judge, Network Developer and Charismatic Leader. As a Network Architect, a Control Tower selects complementary companies to make up the business network and supports the formulation of objectives in the cooperation. The role as a Network Judge ensures output of the cooperation is the promised one. In other words, the Control Tower judges whether pre-determined objectives were achieved. Thereby, the Control Tower sets, monitors and adapts performance standards for the member companies in the cooperation. The network developing task consists of building up a network’s physical and non-physical assets, including knowledge acquisition, knowledge transfer across member firms and the creation of a strong brand image. The last role of a Charismatic Leader is about creating and managing a rich texture of interactions in the network, taking a long-term view on the relationship and expect partner companies to do likewise (de Ferrante, 2015).

Referring to the four roles which a Control Tower is supposed to take in a cooperation, some experts disagree the solution that a Control Tower is set up by an existing fourth-party logistics provider. Bas van Bree (2015) who is program manager for Cross-Chain-Control Towers at Dinalog imagines a Control Tower to be a combination of a IT provider and a consultancy firm. The IT provider offers the connectivity and transparency on operational level and runs optimisation software for the transport planning. The consultancy firm brings partners together and facilitates the emergence of a new cooperation.

2.4.2 Business model of a control tower

Various alternatives exist to present a business model. The Business Canvas Model offers a structured approach to cover nine key elements of a business model that are value proposition, key activities, key resources, key partners, customers segments, customer relationships, channels, revenue stream and cost structure. Each of the nine elements are explained in the light of a Control Tower.

Value propositions

From a broad perspective, a Control tower brings value to the cooperation by increasing its supply chain performance. From a detailed perspective, a Control Tower creates value by offering unique competences to exploit latent strategic and operational synergies, offering ICT data sharing, safeguarding and offering neutral collaboration-facilitation and transaction efficiency (Janssen, et al., 2015).

A cooperation aims at exploiting synergy effects between participating partners. In this regard, a Control Tower offers capabilities to realise operational synergy effect by reducing waste and increasing economies of scale. On the other hand, strategic synergy effects are realised by making use of economies of scope. Thereby, a Control Tower supports achieving a complementary fit between partners (Janssen, et al., 2015). An example for economies of scope is a Control Tower that leads the transition from a dedicated warehouse of one partner to a category warehouse of all partners (de Kok, 2015).

Sharing and safeguarding data between partners is still a main challenge in a cooperation. Thereby, managing the sharing process and safeguarding data from competing firms is essential not only to avoid a competitive disadvantage but also to ensure conformity to competition laws (Klein Woolthuis, et al., 2013). Control Towers bring in ICT infrastructure to a cooperation and manage the data sharing process between partners.

Finally, a Control Towers functions as a facilitator of a cooperation, bringing partners together and facilitate decision making about the design elements of a cooperation such as partner selection and profit allocation in the cooperation (Janssen, et al., 2015). Therefore, a Control Tower needs to be a trusted party by all partners in a cooperation. In the European project of CO3, Control Towers were consciously named trustee to emphasise the importance of their trustworthiness (Cruijssen, 2012).

Key activities

Control Towers fulfil four key activities to achieve its value proposition in a cooperation. These activities are operational network coordination, alliance management, administrative handling and project management and consultancy (Janssen, et al., 2015).

Operational network coordination comprises steering shipments in the partner’s network, taking care of operational objectives regarding correct destination, correct arrival time and correct quality. Also optimising the flow of shipments belongs to that task. One way to achieve higher efficiency in the partner network is to synchronize shipments of partners and to consolidate partner’s resources such as vessels, warehouses and other equipment (Skipper, et al., 2008).

Alliance management follows a step-wise approach that follows the cooperation life cycle (see 2.1.2 Cooperation's life cycle). Each phase in the cooperation's life has unique challenges regarding alliance management. As a neutral party, a Control Tower can support to reduce opportunistic behaviour and power plays between partners in each cooperation phase. In the beginning of a cooperation, a Control Tower supports in the partner selection and the development of suitable governance mechanisms (Lavie, 2007). In the operation phase, a Control Tower ensures an allocation of benefits and costs which is mutually accepted by partners (Vanovermeire & Sörensen, 2014). Additionally, safeguarding confidential data of partners is a task of a Control Tower throughout the operation phase (Klein Woolthuis, et al., 2013).

Administrative handling encloses support functions in a cooperation which a Control Tower takes over. Support functions include supply chain finance such as debt management and invoicing, but also legal assistance, public relations and sales support (Janssen, et al., 2015).

Strong project management skills are often needed in the beginning of a cooperation as the implementation can take up years and is similar to a project including different stakeholders, resources to be managed and an objective to be reached in budget (Janssen, et al., 2015). A Control Tower functions as a project manager by planning and coordinating project tasks and reviewing the quality achieved. Furthermore, a Control Tower also offers non-operational consultancy services, for example the analysis of synergy potential and selection of suitable transport modes in the cooperation (Schmid, et al., 2013).

Key resources

In order to be able to conduct key processes and achieve its value proposition, a Control Tower depends on different resources. Janssen et al. (2015) states five resources a Control Tower needs to fulfil its tasks: Operational capacity, ICT infrastructure and telematics, Client supply chain networks, Partner network and Personnel.

A Control Tower needs access to operational capacity such as vessels, warehouses and other equipment to execute operational tasks in the cooperation. Thereby, access to operational capacity can be assured by existing contracts of partners to logistics service providers (Ashenbaum, et al., 2009). However, access is not limited to existing contracts of partners. Instead, a Control Tower can also close private contracts with logistics service providers which may offer more flexibility to consolidate shipments and shift modes of transport (Janssen, et al., 2015).

A Control Tower is only able to coordinate partner's networks when applying information and communication technologies (Skipper, et al., 2008), "like interfaces between transport management systems (TMS), warehouse management systems (WMS), and enterprise resource planning (ERP) systems, with the goal of providing seamless data exchange in order to improve decision-making". Telematics, which offer real-time data of shipments, can be combined with big data technologies which comes up with predictive forecasting (Janssen, et al., 2015).
A Control Tower becomes more efficient when it has access not only to one supply chain network but several. In order to gain economies of scale and scope, a Control Tower looks at possibilities to consolidate and synchronize logistics activities across client's networks (multi-echelon). A higher

number of logistics networks which one Control Tower is managing goes hand in hand with more opportunities for synergy effects (Wind, et al., 2009).

A Control Tower takes over the role as a knowledge broker for a variety of inquiries which partners in the cooperation may have, for example advice regarding legal, financial, project management or human resources (Klein Woolthuis, et al., 2013). A partner network of specialised firms is therefore a key resource for a Control Tower. By establishing the role as a knowledge hub, a Control Tower reduces transaction costs and increases efficiency for partners in a cooperation (Janssen, et al., 2015).

Personnel of Control Towers are highly-skilled workers who need to excel in a complex multi-actor network. Needed competences of personnel varies from soft skills such as conflict resolution to hard skills such as using advanced ICT tools and analysing networks for optimisation potential (Janssen, et al., 2015).

Coordination of a Control Tower network

Literature does not provide a definite answer about who should be in the lead of a Control Tower network. Figure 16 shows three alternative coordination forms in a logistics cooperation (Provan & Kenis, 2007). The first alternative makes every member of a Control Tower Network responsible for the coordination of the cooperation activities. This alternative depends on relatively frequent and active interactions between all partners. In the second alternative, one partner is chosen to be in the lead of the cooperation. The leading partner is often a larger party or a party with specific resources and capabilities. The third alternative comprises a new entity in the cooperation such as a joint venture or private limited liability company. The new entity is called a network administrative organisation (NAO) and takes the position as a delegate of partners in the cooperation (Janssen, et al., 2015).

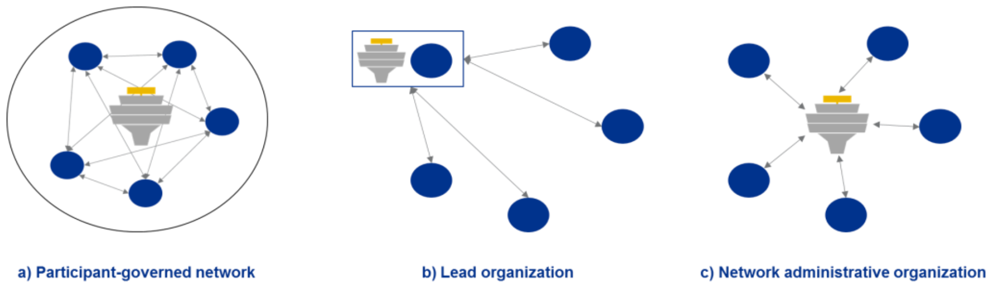


Figure 16: Coordination alternatives (Provan & Kenis, 2007)

Some authors consider it as unfavourable when only one partner of the cooperation is in charge because this could sacrifice the trust of other partners involved (Lindert, 2013). This would argue against alternative b) of a lead organisation. Instead, a neutral party can act as a referee and makes it easier for other companies to join the cooperation without the necessity to renegotiate all terms of the cooperation again.

Key partners

A partner network is necessary to realise its value proposition. In regard of a Control Tower, four key partners can be identified which are shippers, ICT providers, 3rd party logistics service provider and research institutions.

Shippers commit volumes to the cooperation and provide data (e.g. transport data) to the Control Tower. ICT providers complement the Control Tower's information architecture which facilitates operational network coordination and optimisation. As a Control Tower has an asset light business model, it depends on vehicles, facilities and other equipment from 3rd party logistics providers. Finally, a Control Tower deploys advanced technologies and algorithms to ensure continuous improvement of its partner network. In order to have access to state-of-the-art technologies, a Control Tower needs to cooperate with research institutions such as universities.

Customer segments

A Control Tower facilitates and manages cooperations between actors in the supply chain. Thereby, customers of a Control Tower are either shippers (e.g. producers and retailers) or 3rd party logistics service providers (e.g. barge operator or warehouse operator). Customers base may also consists of combination of shippers and 3rd party logistics service providers. Besides these two customer segments, a Control Tower could theoretically have other Control Towers as customers that only covers a limited geographical region or logistics field (e.g. rail logistics). By doing so, a consolidation process takes that results into different layers of Control Towers as it is the case with 1st, 2nd and 3rd party logistics service providers.

Customer relationships

Customer relationship of a Control Tower is based on community building. Creating a community allows for direct interaction among different partners. The collaboration platforms facilitates knowledge sharing and coordination between partners. Besides building a community platform, relationship to partners also include automated services such as monitoring of KPIs and invoicing.

Channels

A Control Tower deliver its value proposition to its partners through a collaboration platform and direct consultation. Partners have access to a collaboration platform, mostly facilitated by advanced ICT, which offers them services around network optimisation, communication and monitoring. In addition, Control Towers offer direct consultation to its partners. As a Control Tower is a combination of an IT company and a consultancy firm, the consultancy part of a Control Tower comprises services such as evaluation of logistics synergy potential (business case) and facilitation of process integration of partners.

Revenues and costs

Sources of revenues or reimbursement depends on the desired policy. In general, three different revenue streams can be identified for a Control Tower.

The first possibility to generate revenue is a periodic management fee for the services offered by the Control Tower. Thereby, a management fee is decoupled from the transactions and is payed regardless of the number of shipments that is managed by the Control Tower. An alternative reimbursement scheme is a fee per transaction, for example executed shipment or order. This alternative represents an incentive for the Control Tower to maximise orders and shipments through the cooperation. A rather complementary revenue stream to the already mentioned ones is revenue sharing. In order to stimulate efforts for costs savings and align objectives of partners with objectives of the Control Tower, the Control Tower could receive a share of realised saved costs as an additional compensation (Bhaskaran & Krishnan, 2009).

The greatest share of cost for a Control Tower is related to direct costs for the operation of the network. Direct costs are for example fees for the usage of vehicles or salaries of personnel. As a Control Tower is an asset-light business model, indirect costs take a small share compared to direct costs. Thereby, most indirect costs can be associated to the implementation of the cooperation and development and provision of IT systems and tools (Janssen, et al., 2015).

Network effects play an important role for the determination of prices. The larger the network and the more partners participate in the network, the more value a Control Tower can provide to its clients. Therefore, a successful pricing strategy must not focus on simply breaking even but on being competitive to gain a high number of partners until a critical mass is reached.

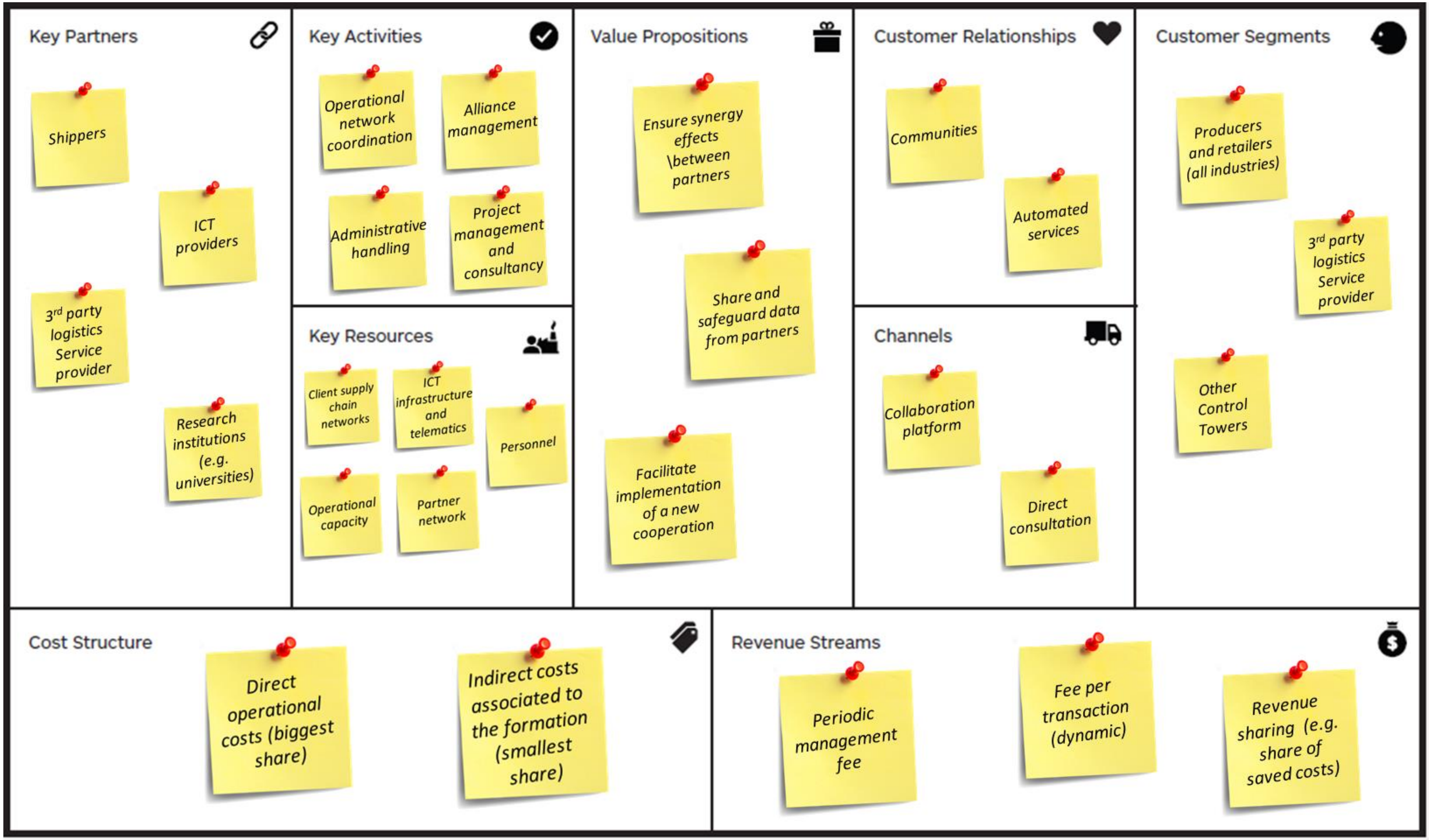


Figure 17: Business Canvas Model applied on a Control Tower

2.4.3 Information architecture

A Control Tower depends on an effective and efficient information architecture in order to enable collaboration among partners and a lack of appropriate ICT support is a major barrier for the feasibility of a Control Tower (Dalmolen, et al., 2015). Experts exist who imagine a Control Tower to be a combination between a ICT company and a consultancy firm (Verstrepen, 2015). This emphasizes the importance of advanced information and communication technology as a core element of a Control Tower. Although this section is not subject to a detailed description of each IT technology that should be deployed in a Control Tower, the introduction of key requirements of an information architecture represent the fundaments of subsequent selection of proper technologies. Dalmolen et al. (2015) have identified five key requirements for an information architecture in a Control Tower which are modularization of services and products; coordination and collaboration capability; quick connect capability; relationship management capability; and risk management capability.

A modularization of services and products allows targeted pricing on product and service level that also enables comparison between products and services offered by the same Control Tower and between different Control Towers (Hoogeweegen, et al., 1999). Furthermore, modularization simplifies coordination, integration and composition of different services and products (Tanriverdi, et al., 2007).

Coordination and collaboration between partners is key in a complex multi-actor network as it is the case with a logistics cooperation. Therefore, Control Towers must offer formal and informal coordination mechanisms which can also be found back the information architecture. In this regard, Dekker (2004) distinguishes between three types of control mechanisms which can also be implemented in the IT architecture of a Control Tower which are control of outcome (e.g. monitoring and reward schemes), behaviour control (e.g. behavioural rules) and social control (e.g. interaction, joint decision making and problem solving).

A Control Tower functions as a hub between partners on the one hand and a variety of service providers on the other hand. The needed mix of partners to conduct a transaction vary from transaction to transaction. Therefore, a Control Tower must be equipped with an IT tools which allow quick-connect and disconnect possibilities between partners and service providers (Dalmolen, et al., 2015).

Control Towers are managing agile networks and time is short to build long lasting relationship between partners. Technologies must be deployed that enable formal communications between partners, adaptation of processes and conflict resolution (Aziz & van Hillegersberg, 2010).

Multi-company cooperations comprises risks for participating parties which can also be mitigated with the use of IT tools which support risk counter strategies. Additionally, IT tool can also prevent misunderstanding among partners by introducing semantic standards (Folmer, et al., 2011)

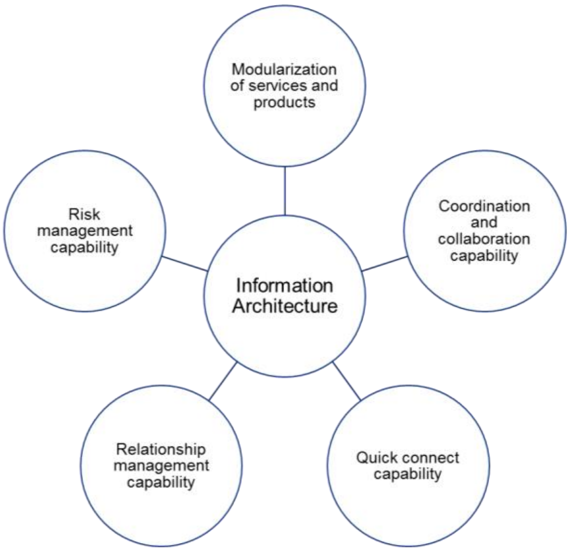


Figure 18: Key requirements of an information architecture of a Control Tower

2.4.4 Benchmarking of Control Tower cooperations

Benchmarking of existing Control Tower cooperations are supposed to give an insight into the very different variations of Control Towers in practice. For that purpose, the Canvas Business Model offers a practical guideline to summarize profiles of the following Control Tower cooperations: De verkeersonderneming, Operationeel Controle Centrum Rail (OCCR) and TransMission (see Table 4).

Table 4: Canvas Business Model applied on De verkeersondernemeing, OCCR and Dirkzwager (De verkeersonderneming, 2015) (Operationeel Controle Centrum Rail, 2015) (Tjalma, 2015)

	De verkeersonderneming	Operationeel Controle Centrum Rail (OCCR)	TransMission
Key Partners	• Municipality of Rotterdam • Rotterdam city region • Port of Rotterdam Authority • Ministry of Infrastructure and Environment • Confederation of Netherlands Industry and Employers • Logistical and industrial companies • Dutch Association for Transport and Logistics • Different municipalities • Different advisory firms	• Pro Rail • TNO • Rail transport providers (e.g. NS, Arriva, Veolia) • Train maintenance providers (e.g. NedTrain) • Track-construction providers (e.g. Strukton, VolkerRail, BAM Rail)	• Truck operators • Warehouse operators
Value proposition	20% reduction of car traffic in rush hours in Rotterdam-Den Haag area. Private-Public cooperation.	Bundle all parties which are involved in the Dutch rail transport to avoid disruptions and solve problems more efficient.	Cooperation expands geographical reach and service scope of participating truck operators in Benelux.
Key activities	• Provide readily-available travel information	• Execution of rail schedule	• Coordination of shipments

	• Collecting and implementing smart travel solutions with its partner	• Forecasting of possible disruptions • Conduct national impact assessment • Reduce impact of disruptions • Provide relevant weather reports for rail transport • Organising maintenance for tracks and party trains • Provide useful travel guidance to passengers	• Accountancy and allocation of revenues between partners • Sales activities • Track & Trace of shipments • Monitoring of collaborative KPIs
Key resources	• Real-time traffic information and traffic forecasting • Partner network with public and private organisations	• Control centre which consolidates all relevant information over the Dutch railroad infrastructure • Effective partner network with one direct contact person at each partner.	• Control centre which consolidates shipments information from participating truck operators • Own warehouses
Customer relationship	• Automated service of traffic information • Community building of public and private partners •	• Automated provision of train traffic information • Individual travel advise for groups of passengers or single train operators	• Automated generated information over shipments • Automatic and manual generated truck guidance
Channels	• Information panels and workshops • Developments of pilots with partners • Individual advisory	• ICT platform that passengers (e.g. App) and train operators can access • Direct communication to train operators or maintenance providers	• Collaboration platform (ICT) for all truck operators • Direct communication to truck operators • Online sales platform for shippers
Customer segments	• Private car users • Producers who organize own logistics • 3rd party logistics service provider	• Train operators • Train passengers • Rail infrastructure providers • Maintenance service providers	• Truck operators • Warehouse operators • Shippers
Revenue Streams	• Subsidies • Fees of companies which participate in pilots	• Partner pay a fixed fee per year per workplace	• Transaction fee • Periodical fee
Cost structures	• Personnel costs • Development and maintenance cost for IT infrastructure for traffic information • Additional costs (events, public relations, etc.)	• Personnel costs • Development and maintenance costs for Control Centre and IT infrastructure	• Personnel • Development and maintenance costs for Control Centre and IT infrastructure • Operational costs for own warehouses

2.5 Causal diagram: Relation between trust and risks

Based on the findings from the literature review, there is the need to better understand the interactions between perceived risks and trust building in multi-company cooperation. Therefore, a first causal diagram is developed to illustrate the relationships between perceived risks, trust, opportunistic behaviour and achievement of cooperation goals. The causal diagram serves as a preparation for the new conceptual model

2.5.1 Elements of causal diagram

Review of the trust literature has resulted in the identification of four elements which are substantial to understand the development of trust in multi-company cooperation.

The first element is perceived risk which represents trustor's belief about a negative outcome in a cooperation. Thereby, the focus is on the individual risk perception of each partner. Due to the fact that a cooperation lacks hierarchical control as it is the case within companies, it is important that risks which each partner perceive in a cooperation are taken seriously into account in order to maximize partner's commitment. The assessment of perceived risks in a cooperation involves weighing the likelihood of a negative outcome (Bierman, et al., 1969) (Coleman, 1990). Thereby, two factors influence the assessment of likelihood. The first factor is trustworthiness of partners and the second factor are external events which impact the cooperation from the outside (Mayer, et al., 1995). In principal, a partner determines the trustworthiness of another partner based on past experiences. Thereby, not only personal and direct experiences are significant but also indirect experiences which do not require a direct contact between partners can influence the trustworthiness of a partner (Mayer, et al., 1995). For example, a positive image that a partner radiates in the market would increase his trustworthiness. The second, external events, is the sum of all origins which can increase uncertainty in a cooperation for example the emergence of competing cooperations in the same market that could lead to diminishing return for both cooperations. Perceived risks are difficult to measure or quantify because they are subject to feelings of partners in a cooperation. Nonetheless, it is possible to uncover perceived risks for instance by conducting in-depth interviews or applying other psychological research methods.

The second element is trust level which is, in the scope of this research, the willingness to accept risks in a cooperation. In the beginning of a cooperation, the initial store of trust is goodwill which is the result of external reputation and personal relationship during the negotiation process (Arino & de a Torre, 1998). The level of trust is depends on the individual willingness of partners to accept risks in a cooperation that is called trustor's propensity to trust. Sitkin & Pablo (1992) define propensity to trust as "the tendency of a decision maker either to take or avoid risks". In practice, partners differ in their propensity to trust because risk bearing capacity depends on partner's personality type, cultural background and past experiences in other cooperations (Hofstede, 1980).

The third element is opportunistic behaviour which is behaviour that can generally be considered as deceitful or unethical. Williamson (2007) defined opportunistic behaviour as "self-interest seeking with guile". Examples in regard to cooperations are under-delivering on own promises, withholding or distorting information and forcing partners to provide additional services without compensation (Nand, et al., 2014).

Finally, the last element is the achievement of cooperation goals. Generally, each partner has a set of goals and expectations regarding its participation in the cooperation. Thereby, a variety of goals exist for stepping into a cooperation such as financial (e.g. cost reduction), operational (e.g. higher service level) or strategic goals (e.g. higher customer base). It is important to spend enough time for the identification of individual goals of partners in order to review whether they are achieved or not.

The four elements can be clustered into two group which are 'internal drivers' and 'observable outcomes'. The elements perceived risks and trust level belong to the group of internal drivers as they are both embedded in a cooperation and necessary for the trust-building process but they are not directly observable. Perceived risks and trust level are directly connected as trust level is determined by partner's willingness to accept risks. Consequently, in order to be able to determine the trust level in a cooperation it becomes necessary to identify perceived risks from partners first and subsequently determine which risks partners consider as risk-worthy and non risk-worthy.

The elements opportunistic behaviour and achievement of cooperation goals belong to the group of observable outcomes because both are visible for partners and can partly be measured, provided cooperation goals can be expressed quantitatively. The more opportunistically partners behave in a cooperation, the less likely it becomes that cooperation goals can be achieved.

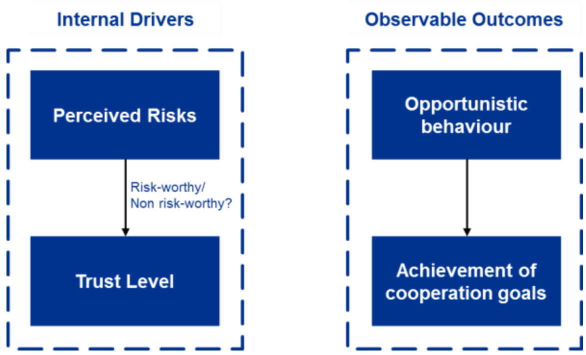


Figure 19: Four elements of the conceptual model

2.5.2 Interdependencies between Internal drivers and Observable outcomes

As described in the previous section, direct connections exists between elements of one group (Internal drivers and Observable outcomes). In addition to that, dependencies exist also between the two groups.

First of all, a connection exists between trust level and opportunistic behaviour. In organisational economics literature, trust has been conceptualized to reduce opportunistic behaviour (Bromiley & Cummings, 1995). For that reason the higher the trust level is, the less likely partners behave opportunistically.

A second connection exist between opportunistic behaviour and perceived risks. A factor that determines perceived risks in a cooperation is the risk worthiness of cooperation partners.

Opportunistic behaviour partners lowers their trustworthiness and thereby increases the risk perception in a cooperation. Furthermore, opportunistic behaviour decreases partner's propensity to trust that in turn shrinks the trust level in a cooperation.

In the contrary, a positive correlation exists between achievement of cooperation goals and risk worthiness of partners as well as achievement of cooperation goals and partner's propensity to trust. As a result, the more goals of partners are achieved in a cooperation, the higher the trust level and the lower the level of perceived risks becomes. An overview of the dependencies between the two groups of internal drivers and observable outcome is shown in Figure 20.

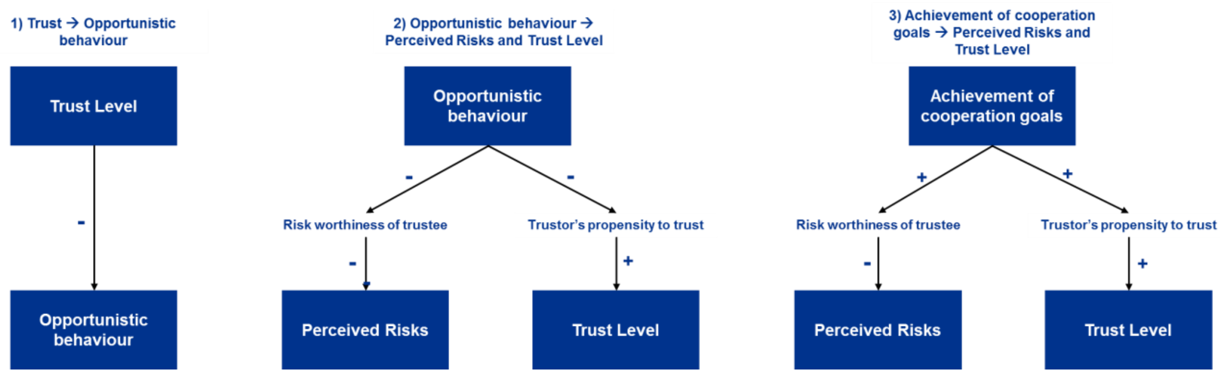


Figure 20: Dependencies between the two groups 'Internal drivers' and 'Observable outcomes'

An overview of all interdependencies between the four elements of the conceptual model including a short explanation is presented in Table 5.

Table 5: Overview of interdependencies of the four elements of the causal diagram

From / To	Perceived risks	Trust level	Opportunistic Behaviour	Achievement of cooperation goals
Perceived risks		Risks which are considered as risk-worthy increase trust level and vice versa.	n.a.	n.a.
Trust level	n.a.		Trust lowers opportunistic behaviour.	
Opportunistic Behaviour	Recognized opportunistic behaviour highers perceived risks through an decrease of risk-worthiness of trustee.	Recognized opportunistic behaviour lowers trust level through an decrease of trustor's propensity to trust.		Opportunistic behaviour reduces to achievement of cooperation goals .
Achievement of cooperation goals	Achievement of cooperation goals lowers perceived risks through an increase of risk-worthiness of trustee.	Achievement of cooperation goals highers trust level through an increase of trustor's propensity to trust.	n.a.	

A close look on the interdependencies of the four elements reveals that opportunistic behaviour can cause a chain reaction that hinders trust building in a cooperation. Opportunistic behaviour leads to an increase of risk perception and a decrease of trust level which in turn support more opportunistic behaviour to emerge. For that reason, the need for an additional mechanism exist which stabilizes the increase of perceived risks. Therefore, another element is added to the conceptual model that is a risk counter strategy and creates a feedback loop from opportunistic behaviour to perceived risks. The following sections describes this stabilisation mechanism.

2.5.3 Risk counter strategy as stabilisation mechanism

A number of risk counter strategies exist which are categorized into relational, calculative and institutional risk counter strategies in the scope of this research. Before risk counter strategies should be introduced, it is necessary to identify perceived risks of partners in a cooperation and to derive individual risk profiles out of it. A risk profile consists of the dominant risk(s) which a partner perceives in a cooperation and may differ to the risk profile of another partner. A method to draw partner's risk profiles is for example a factor analysis. In the course of a factor analysis, partners express their perception on risks in the underlying cooperation. Partners rank risks according to its seriousness. Based on the rankings, risk profiles can be drawn for each partner using a factor analysis.

In a second step, appropriate risk counter strategies can be derived for each partner based on the individual risk profiles. Before implementation, individual risk counter strategies must be compared with each other in respect to complementariness. For example, given that one partner perceives a risk of unfair profit allocation in the cooperation. A feasible risk counter strategy could be to introduce a fair but complex profit allocation scheme originating from game theory. However, another partner might complain about to little transparency in the cooperation. In this case, the introduction of a complex profit allocation scheme would amplify the partner's perception of lacking transparency. Therefore, individual risk counter strategies of partners must be aligned with each other before implementation. As the alignment contains a selection and weighting up process of different risk counter strategies, a third party in form of a Control Tower is suitable to fulfil this task in order to ensure neutrality and independence. Figure 21 shows the entire conceptual model including the risk counter strategies as a stabilisation mechanism for the trust building process.

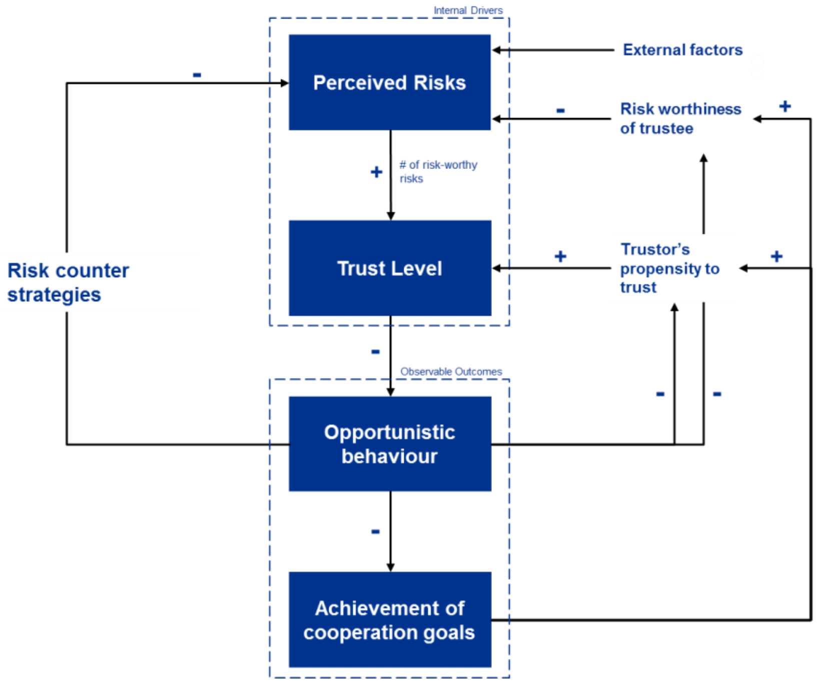


Figure 21: Causal diagram for trust-building based on perceived risks and risk management

The causal diagram consists of four main elements which are derived from the trust literature. As the analysis of the interdependencies between the four elements shows, a negative spiral can occur which leads more opportunistic behaviour which in turn leads to a decrease of trust and so on. For that reason, a stabilisation loop is proposed to implement in the conceptual model. The stabilisation loop becomes necessary when partners act opportunistically because the trust level in the cooperation is not high enough to cope with the level of perceived risks. In this case, risk counter strategies must be implemented in the cooperation in order to lower the level of perceived risks and thereby decrease opportunistic behaviour of partners. This process of identifying perceived risks and implementing risk counter strategies is a continuous process throughout every cooperation phase. Taking into account the cooperation's life cycle (see 2.1.2 Cooperation's life cycle), three types of stabilisation loops can be distinguished which are characteristically for single cooperation phases. A first stabilisation loop takes place in the implementation phase and is called 're-consideration of partner selection'. When potential partners in a cooperation consider other partners as too risky to work with, a strategy to reduce the level of perceived risks is to re-consider the partner composition in the cooperation. A second stabilisation loop exists in the operation phase and can be seen as a continuous revision of applied risk counter strategies based on the existing level of perceived risks. After a cooperation is implemented, perceived risks can still change over time through internal and external factors such as the exit of a partner or the emergence of a competing cooperation. Depending on the emergence of new risks, the introduction of new risk counter strategies might become necessary. A third stabilisation loop exist in the determination phase and is needed when no appropriate risk counter strategies were applied in the operation phase and therefore a serious imbalance between trust and risk exist which brought the cooperation on the edge of termination. At that moment, a new configuration of the cooperation setting is required to radically reduce perceived risks and avoid the cooperation to terminate. In practice, the identification of perceived risks and the development of appropriate risk counter strategies should be conducted by a Control Tower in order to ensure neutrality and independence towards all cooperation partners.

2.6 Conclusion

Literature research about trust building in cooperations has revealed an inseparable connection between trust and risk. The connection leads to the fact that trust is only an indicator for the willingness to accept risk(s) in a cooperation. A new conceptual model must be developed that aims at building up trust by mitigating perceived risks in a cooperation and thereby increasing the willingness to accept remaining risks.

Mitigation of risks in cooperations can best be achieved via multi-actor risk management. Multi-actor risk management is a relatively young appearance in the risk management literature and offers an approach for risk mitigation in complex multi-actor networks such as cooperations.

Furthermore, literature search about Control Towers has resulted in the definition of a Control Tower as a combination of an information technology and consultancy provider. Due to its neutral and independent position, a Control Tower is suitable for managing risks in a cooperation. Therefore, the following part of this thesis is going to develop a conceptual model that supports trust building in logistics cooperation by mitigating perceived risks of partners with the use of multi-actor risk management and the involvement of a Control Tower.

Part 3: Conceptual Model

Part 2 concluded with the necessity to reduce perceived risks of partners in order support trust building in a cooperation. Part 3 takes up this idea and develops a new conceptual model for trust building in logistics cooperations. The conceptual model consists of five steps and leads from the identification of perceived risks over the development of risk groups to the definition of specific risk counter strategies. Each of the five steps is described in detail. It concludes with an explanation about the role of a Control Tower in the conceptual model.

3.1 Five-steps of the conceptual model

The analysis of the existing trust building literature has come to the result that trust building is inseparable connected to the management of risks in a cooperation. The analysis also revealed hardly any trust building offers an approach to manage risks of partners in a cooperation by the application of multi-actor risk management which is a sub-category of risk management applicable in complex networks as it is in a multi-company cooperation. The new conceptual model makes use of the process design approach of multi-actor risk management as it is introduced in Part 2 of this thesis. The model consists of the following five steps: (1) Identify set of potentially perceived risks, (2) Judging perceived risks by partners, (3) Develop unique risk groups, (4) Identify dilemmas and start negotiation process between partners and (5) Develop strategy agenda and implementation plan.

(1) Identify set of potentially perceived risks

Each cooperation is unique with its background, objectives, partners and possible risks. Therefore, the first step of the conceptual model is to gather as many risks as possible which partners might perceive in a cooperation. This step results into a set of risks that represents wide range of relational, calculative and institutional risks.

(2) Judging perceived risks by partners

The second step aims to make individual perceptions on risks explicit. For that purpose, all identified risks from step one are judged by each partner according their seriousness. The result is a matrix of partners and risks showing which partner has given which grade to each risks.

(3) Develop unique risk groups

A risk group consists of partners which perceive the same or a very similar set of risks in a cooperation. With the help of the matrix from step two, partners with similar risk perceptions can be grouped together. The purpose of defining risk groups is to create more transparency about subjective views and perspectives of partners. Additionally, risk groups offer an indication of partners core values which become important during the negotiation about risk counter strategies.

(4) Identify dilemmas and start negotiation process between partners

In the process management literature, dilemmas are defined as opposing risk perceptions of one or more partners which can hardly be mitigated simultaneously due to a negative correlation (de Bruijn, et al., 2010). Therefore, dilemmas exists regarding different partners or also groups of partners. Step three has resulted into groups of partners which share a similar perception of risks in a cooperation. Based on these risk groups, dilemmas between groups can be identified and made visible to partners in the cooperation. Making dilemmas visible to partners promotes understanding for the needs of every partner and facilitates the creation of a risk-conscious cooperation culture (Link, 2001). The goal of this step is not to solve dilemmas yet but make dilemmas subject to a negotiation process between partners. The result of this step is to find compromises between partners

Transition element: Contextual knowledge

Contextual knowledge becomes necessary to make the step from general to specific. Contextual knowledge can be defined as knowledge that is relevant to understand a given decision problem in a cooperation. When the definition of risk counter strategies are supposed to become more precise, a large part of contextual knowledge can be automatized according to the current focus of risk to mitigate (output of preceding step) (Brezillon & Pomerol, 1999).

Contextual knowledge in a cooperation is a composition of a number of factors which form the current situation of the cooperation. The number of contextual factors to take into account can theoretically be endless, depending in the level of detail which is aimed to achieve. Based on benchmarking and of Control Tower cooperation (see 2.4.4 Benchmarking) and literature review, an initial list of contextual factors is derived:

Social-cultural factors:

- Number of cooperation partners
- History of working together
- Cultural differences of cooperation partners
- Dependence on external partners

Economic factors:

- Vertical, horizontal or hybrid cooperation
- Available resources

Organisational factors:

- Difference in company size between partners
- Involvement of private, public or both organisations

Political factors:

- Laws and regulations
- Copyrights and patents from internal and external partners

The above-named factors do not claim comprehensiveness. Instead, these factors offers a starting point for the addition of factors which are observed in other cooperations. A process manager, responsible for the facilitation of the conceptual model, will develop an own list of contextual factors which will grow along the experience curve of the process manager.

(5) Develop strategy agenda and implementation plan

The final step of the conceptual model is to eventually select concrete risk counter strategies which can be adapted in the cooperation. In the best case, the preceding step has resulted into agreements between partners about which risks to mitigate. Risk counter strategies need to be selected which mitigate these risks. Thereby, benchmarking of previous cooperations and literature review of risk counter strategies provide a collection of possible strategies for a number of different risks. A preliminary list of possible risk counter strategies was developed in Part 2 (see 2.3.3 Risk mitigation in multi-actor risk management). Finally, an implementation plan for selected strategies needs to be developed which specifies who is responsible for the implementation and what tasks are associated with the implementation. The implementation plan also provides answers about which risk counter strategies are realised by the use of a Control Tower. Part 2 (see 2.4 Control Tower in logistics cooperations) provides insights into the business model of Control Towers including key processes, key resources, revenues/costs and information architecture. The implementation plan is supposed to define how these risk counter strategies can be integrated in the business model of a Control Tower.

The end of step five constitutes the start of a new round as multi-actor risk management is a continuous process. The internal and external environment of a cooperation changes over time as for example new partners enter and other partners leave. A changed environment may lead to a new set of potentially perceived risks of partners.

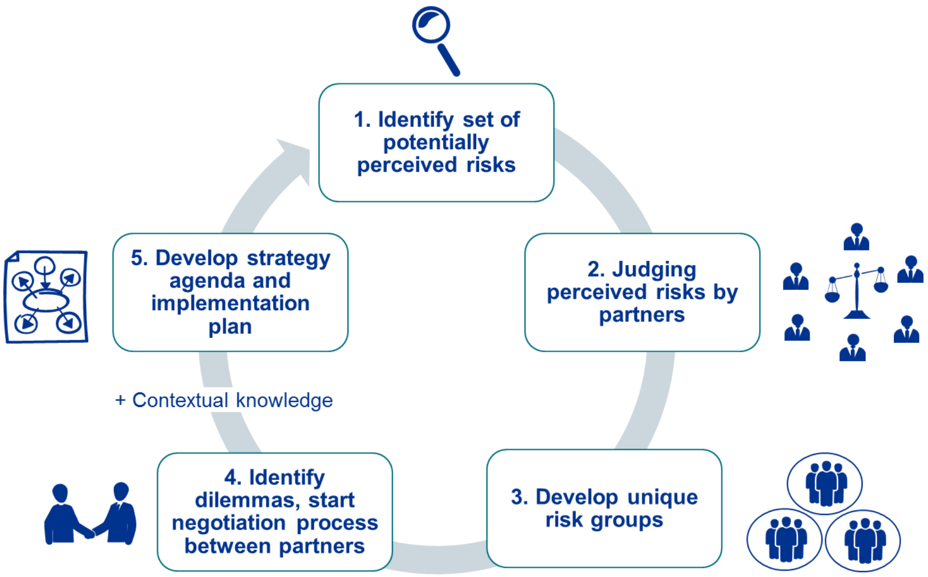


Figure 22: Conceptual model for to mitigate perceived risks in cooperations

3.2 Conclusion

The conceptual model describes the process of managing risks in cooperations in a continuous five-step approach, focussing on the mitigation of perceived risks of partners. Thereby, the model combines process theory from multi-actor risk management with the relatively new concept of Control Towers stimulate negotiations between partners which are supposed to result in concrete risk-counter strategies.

A Control Tower takes an important role in the execution of the conceptual model. In the scope of this research, control towers are considered as a combination between IT company and consultancy firm. Applying this these two roles on the conceptual model means that the consultancy firm takes over the position as a process manager who is in charge for execution of each step of the model. The consultancy firm is a neutral and independent party in the cooperation that identifies potential risks (step 1), lets partners judge these risks (step 2), derive risk groups from partner's judgements (step 3), identify dilemmas between partners and facilitate open negotiations among partners (step 4) and supports partners to develop the final strategy agenda to mitigate risks (step 5). The second role of a Control Tower, the IT company, comes into importance for the implementation of selected strategies. Selected strategies are revised with the capabilities of the IT company, e.g. advanced communication tools and monitoring systems, and decided which strategy should be conducted by the IT company. As a result, the conceptual model only works to develop and implement risk counter strategies in combination with both roles of a Control Tower.

The ambition of this research is to develop a model that can be practically applied in a cooperation. For that reason, it becomes necessary to provide methods on how each step of the conceptual model can be conducted. The following part focuses methods which can be applied in each step of the conceptual model.

Part 4: Empirical research design

A conceptual model has been developed in Part 3 of the thesis which is to be tested empirically. This part introduces and explains methods which can be applied in each of the five steps of the conceptual model. Two methods were selected to exemplarily demonstrate the application of the conceptual model that are Interviews and Q-method. Both methods build upon each other as qualitative results from interviews are handed over to the quantitative analysis of the Q-method.

4.1 Assigning empirical methods to steps of conceptual model

In order to apply the conceptual model in a cooperation, empirical methods need to be identified which make it possible to identify potential risks, facilitate individual judgement of partners, develop risk groups, identify dilemmas and develop a strategy agenda and implementation plan. For this purpose, two empirical methods are selected which enable to run through each of the five steps. These two methods are expert interviews and Q-method. First of all, expert interviews identify a wide range of potential risks in a cooperation (step 1). Based on interview results, partners are asked to rank risks according to their seriousness. This is done in the scope of a Q-sorting which is part of the Q-method (step 2). Q-sorting eventually results into a risk/importance matrix for each partner which allows to reveal correlations of risk perceptions between partners and thereby derive groups of partners which have similar risk perceptions (step 3). Subsequently, a comparison of risk groups results in the identification of dilemmas which gives input for the negotiation process between partners (step 4). Eventually, a shift from general to specific is made by selecting concrete risk counter strategies which cope with risks that are chosen to be mitigated. The selection of risk counter strategies is based on contextual knowledge that is known from the individual cooperation. Contextual knowledge consists out of different factors which can be derived for example from experiences and benchmarks on the. Additionally, an implementation plan is developed that specifies how a Control Tower can implement selected risk counter strategies (step 5).

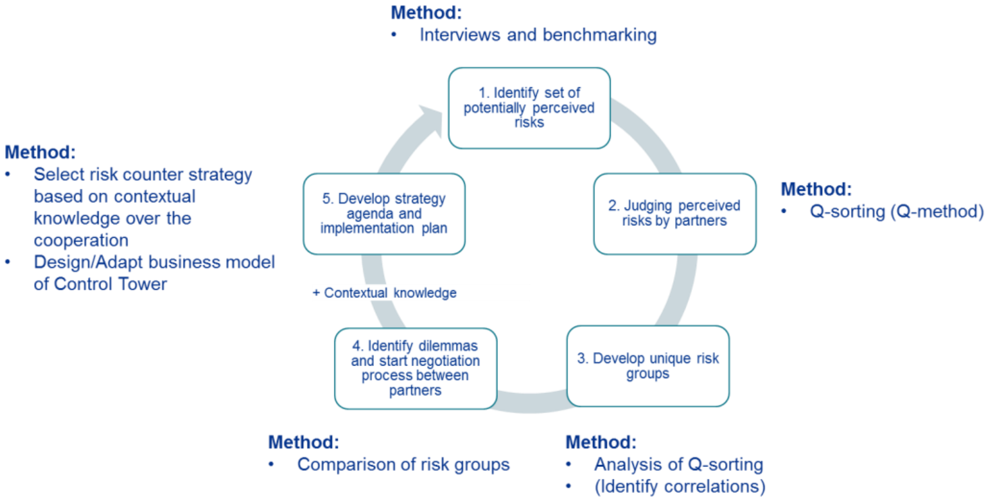


Figure 23: Methods to conduct each step of the conceptual model

The following sections explain expert interviews and Q-method in order to better understand the decisions to be made throughout the design of these methods.

4.2 Interviews

Interviews belong to the group of qualitative research methods. The aim of an interview is to uncover views, experiences, beliefs and motivations of individual persons. Therefore, interviews are appropriate when detailed insights are required from an interviewee (Silverman , 2000). In the scope of this research, interviews were chosen to identify perceived risks in multi-company cooperations which complement the list of identified risks throughout the literature research.

4.1.1 Type of interview

Three fundamental different types of interviews exist which are structured, unstructured and semi-structured interviews. In a structured interview a predefined set of questions are asked with no variations of questions and with no scope for follow-up questions to further elaborate on certain points. An unstructured interview often starts with a general opening question such as “Can you tell me about your experience as a project manager in a cooperation?” and then continues based on the initial response. Unstructured interviews are usually very time consuming and difficult to manage due to the lack of guidance with a set of pre-defined questions (May , 1991). In contrast, a semi-structured interview combines elements of structured and unstructured interviews. This type of interview consists of a set of key questions which need to be covered throughout the interview but the interviewer and interviewee may diverge to explore an idea in greater detail. This flexibility allows for gathering of information that is important to the interviewer but was not been considered before the interview. For that reason, a semi-structured interview is most appropriate for the purpose of this research because interviewees have the opportunity to bring in additional content and express opinions and perspectives in own terms (Bernard, 1988).

The conducted interviews should range from one to 1.5 hours depending how familiar the interviewee is with the research and thus how elaborated the introduction should be. Considering the duration of the interview, a the set of questions should not exceed a number of 5 questions .

4.1.2 Selection of interviewees

First of all, interviewees should have gained experience in multi-company cooperations in logistics. The requirement of experiences ensures that responses are based on actual experiences, so that a more comprehensive understanding of the perception of risks in cooperations can be obtained next to risks which were obtained by literature research. Therefore, practitioners should be chosen as interviewees who were already involved in the implementation or operation of a cooperation. In this respect, interviewees should be experts in different areas of a cooperation such as legal, governance, leadership, profit allocation, business models or operations. A number of different logistics cooperations exist in the Netherlands but also in other European countries that can serve as a source for the identification of suitable experts.

4.1.3 Analysis

Answers of interviewees should be written down in an interview protocol on which the subsequent analysis is based on. As the objective of interviews is to identify perceived risks in cooperation and enrich the existing list of risks from literature research, each protocol should be scanned for risks which experts see in cooperations. The result of this step should be a long list of risks. In a second step, all risks should be divided into the three risks categories introduced in Part 2 of this thesis which are relational, calculative and institutional risks.

4.2 Q-method design

As introduced in the conceptual model in Part 3 of this thesis, partner's perceived risks in a cooperation determine the level of trust. However, the perception of risks is subjective and often difficult to express directly in a conversation. For that reason, the Q-method is applied which was developed by Stephenson (1953)and allows to study subjectivity such as opinions, expectations and perspectives in different settings. The Q-method consists of five sequential steps: concourse development, Q sample selection, selection of P set, Q-sorting and analysis/ interpretation (see Figure 24). These six steps and their application in this research will be discussed in the following.

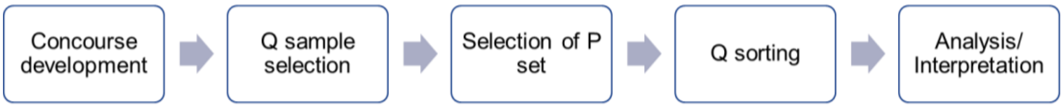


Figure 24: Sequential steps of Q-method

4.2.1 Concourse development

Concourse refers to the "flow of communicability surrounding any topic" (Brown, 1993) and represents the complete inventory of perceived risks in multi-company cooperations. The risk identification process should start by reading relevant scientific and other publicly available articles about cooperation and collaboration in logistics. Additional input for the concourse should come from expert interviews which were described in the previous section.

The goal of concourse development is to build a list of risks that can be possibly occur in the underlying cooperation. For instance, logistic risks relating to the environment such as earthquakes could arguably be relevant in any global logistics cooperations, since an earthquake can cause disruption in a logistics chain. However, the concourse should be based on the conceptual framework which includes unique risks in cooperation falling into the categories of relational, calculative and institutional risks. Although this is a simplification of the possible interpretation of risks occurring in multi-company cooperations in logistics, it goes along with the existing trust literature and therefore offers a practical and profound categorization of risks (see section 2.2.2. Trust building models).

4.2.2 Q-sample selection

A Q-sample is selected from the concourse. The objective is to narrow down the concourse to a representative sample of risks which covers an expected variety of viewpoints. Similar and recurring risks should be removed from the concourse to narrow down the selection. The size of the Q-sample must be made with the trade-off between representativeness of risks and the available time during the Q-sorting.

4.2.3 Selection of P-set

P-set describes to the sample of respondents participating in the Q-sorting. Since the empirical testing of the conceptual model will be based on the cooperation in the Dutch building industry, respondents should be selected which are involved in the implementation of the cooperation.

The respondents which form the P-set should be selected with expected differences in risk perceptions. For that reason the objective is not to obtain a fully representative sample of partners in the respective cooperation but to demonstrate that a variety of perspectives exists on risk perception between partners. Thereby, the P-set could be smaller than the Q-sample (see previous section) while still providing statistically significant results (Van Exel & de Graaf, 2005), again because the goal of the Q-method is not to describe every single partner involved in the cooperation but to uncover existing differences in risk perceptions. Therefore, a larger P-set would simply generate additional data points where a small P-set suffices in identifying distinct risk perceptions.

4.2.4 Q-sorting procedure

Before conducting the Q-sorting procedure, several decisions must be made. First of all, the sorting scale with respondents rank the risks has to be determined. Although no general advice is given for the numbering of the sorting scale, the scale should not consists of too few numbers, in order to allow a sufficient differentiation of perceived risks over an appropriate distribution scale. Thus, a sorting scale should range between fife and nine numbers. A forced normal distribution is used, as typically employed in the Q-method (Block, 1961). A Q-sorting can be conducted as an online survey or with support of other digital tools such as Microsoft Word or Microsoft Excel. Van Tubergen & Olins (1979) argue that results from self-administrated Q-sorting via digital techniques such as mail and online surveys are highly consistent with results from personal interviews. Two validation studies from Reber, Kaufmann & Cropp (2000) have even concluded that no significant differences in the reliability or validity exist between face-to-face interviews and digital surveys. However, interactive elements should be integrated when using a digital survey in order to simulate interaction with respondents that otherwise a researcher would have had while conducting Q-sorting physically by using a card deck. Additionally, a comprehensive instruction should be given to the respondent including background information about the objective of the research, confidentiality and guidelines on how to conduct the Q-sorting.

Finally, the survey should offer the possibility to add additional risks that respondents may miss. By doing so, the concourse grows for future Q-sorting procedures which are conducted throughout the a cooperation’s life cycle (see Figure 7 Cooperation’s life cycle) .

4.2.5 Analysis/ Interpretation

Factor analyses are run on the gathered data from Q-sortings using the PQMethod, a statistical software specifically designed for Q-analysis. Q-sorting data are analysed by using the Principal Component Analysis (PCA). The PQMethod software allows up to a maximum of seven factors output by the PCA. A factor is identified by each rotation that accounts for the most variation in the raw Q-sorting data. The output of this step is a matrix of eigenvalues of each Q-sorting for each identified factor, where an eigenvalue is the mathematical parameter characterising each Q-sorting. The absolute value of an eigenvalue is a proxy for the explanatory power of a factor for that particular Q-sorting. The number of factors to be used for further rotation should be based on eigenvalues and how useful the inclusion of additional factors may be. Q-sortings which score high on a factor are then flagged as a defining sorting for that factor. A final in-built function generates an analysis report, which provides an overview of an eigenvalue matrix, characterising and distinguishing risks of each factor.

For clarification, respondents load on a factor, while risks score on a factor. Distinguishing risks are risks which score high on a factor. For the sorting exercise, a high positive score would indicate that a risk strongly increase the perceived risks of a partner in a cooperation while a high negative score indicates a minor importance of risk to a partner.

4.2.6 Reflexion on empirical research methods

The combination of expert interviews and Q-method offers a fluent transition between qualitative collection of possible risks in cooperations and the quantitative analysis of risk perception in a cooperation. However, the empirical methods also come with some disadvantages. Interviews do not guarantee completeness of identified risks in a cooperation because the list of identified risks is limited to the experiences and knowledge of experts. Furthermore, due to the open-endedness of questions in the Q-sorting procedure, the interpretation of scores should be made with care. For example, a respondent's answer could be interpreted as either a risk is currently present or could be present in the future. The true respondents' interpretations of the questions remain unknown and can affect how the results should be interpreted.

4.3 Conclusion

The empirical methods interviews and Q-method offer an appropriate approach to conduct each of the five steps of the conceptual model. The advantage of choosing these methods is that qualitative results of interviews serve as input for the quantitative analysis of the Q-method which eventually results in distinctive risk groups of partners in a cooperation. Thereby, the Q-method offers a standardised approach to easily identify risk groups and simplify decision making in cooperations. Furthermore, information derived by the Q-method are assumed to enable efficient communication of currently perceived risks of partners.

Part 5: Evaluation of empirical research

Part 4 described empirical methods which are needed to apply the conceptual model on a case study. This part eventually conducts the empirical research and presents the results for the case of ShareShip. As the first step, results of expert interviews and the Q-method are described including risk groups of partners with a similar set of perceived risks and the development of risk counter strategies to cope with these risks. It concludes with a discussion about the process on how to implement selected risk counter strategies by the involvement of a Control Tower.

5.1 Set of potentially perceived risks (Expert interviews)

Figure 25: Conceptual model applied on ShareShip (Step 1)

Interviews needs to be conducted with experts who were involved in the implementation or operation of a multi-company cooperation in logistics, preferable in a similar context as ShareShip. For that purpose, existing cooperations mainly in the Benelux area were identified to search for possible interview partners. One cooperation is called Cooperation Concepts for Co-modality (CO^3) and represents an European project that aimed at "developing, professionalizing and disseminating information on the business strategy of logistics collaboration in Europe" in the time period between 2012 and 2014 (Cruijssen, 2012). A second identified cooperation is called TransMission and focusses on truck logistics in the Benelux. TransMission is a cooperation of 14 independent truck operators in the Netherlands and Belgium which expands their geographical reach and service scope through the collaboration. Screenshots of homepages of cooperation CO^3 and Trans-Mission are shown in Figure 26. , ShareShip is a cooperation in the Dutch building industry focussed on barge logistics. In total, nine experts from CO^3, TransMission and ShareShip are selected for an interview. A comprehensive list of all interviewees can be found in Appendix A.

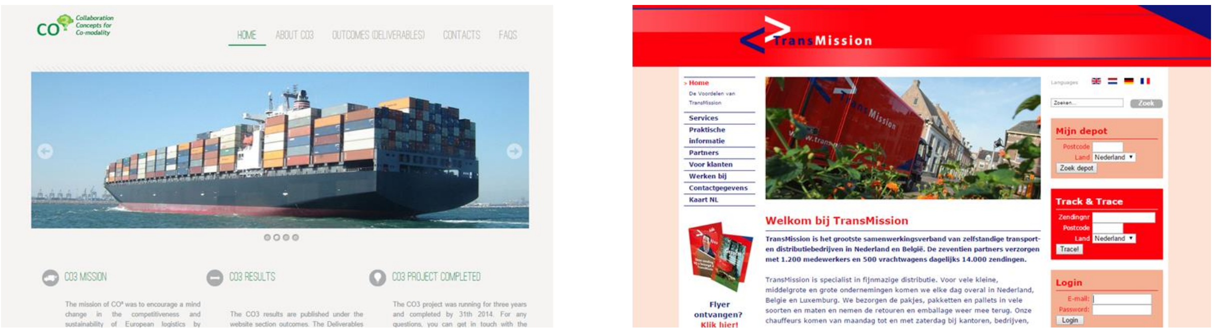


Figure 26: Screenshots of homepages of cooperation CO^3 (European wide) and Trans-Mission (Nederland and Belgium)

After conducting the interviews, an analysis took place by manually studying the interview protocols. An inventory of 57 risks is created which practitioners described during the interviews. The eventual output of all identified risks (concourse of Q-method) is a list of over 100 identified risks in multi-company cooperations coming from experts interviews and literature research. Thereby, risks related to the personal relationship between partners are mentioned more often than for example calculative and institutional risks. This observation emphasizes the importance of soft factors in cooperations. Risk inventory is then checked for recurring and distinctive types of risks in order to define risks which are clearly distinguishable. Additionally, risks are categorised into the three categories of relational, calculative and institutional risks which go along with the three trust categories from Part 2: Theory and concepts.

Throughout the literature search it became obvious that articles about horizontal cooperation in logistics, especially with a focus on control tower strategies, were published relatively recently which confirmed the actuality of that topic.

5.2 Judgment of perceived risks by partners (Q-sorting)

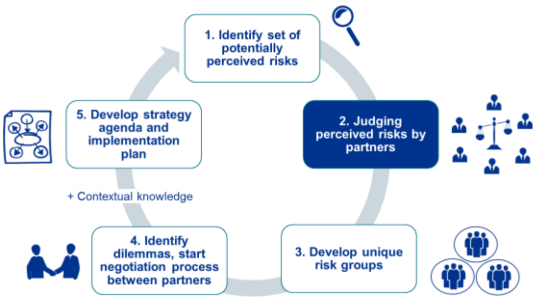


Figure 27: Conceptual model applied on ShareShip (Step 2)

Because Q-sorting procedure will be done by company's representatives of ShareShip, time needed for Q-sorting must be in an appropriate timeframe. In general, a number of 20 to 60 statements is considered as appropriate for the Q-sample (Krueger, et al., 2001).

The final Q-sample for the Q-sorting in ShareShip consists of 30 risk statements in order to ensure a process time that is considered as appropriate for respondents who mainly work at C-level management. The Q-sample consists of ten relational, ten calculative and ten institutional risk statements which are randomly numbered from 1 to 30 in the final Q-sorting exercise.

The final P-set consists of ten representatives from partner companies in the ShareShip cooperation. A key criteria for the selection as a respondent is the involvement in the implementation process of ShareShip in order to be able to reflect on perceived risks. For that reason, respondents do not necessarily have to work for one of the partner companies but can also hold a supportive role as an external party.

A seven-point scale (+1 to +7) is chosen in order to assure a reasonable and symmetric distribution of 30 risk statements across scores. As an additional orientation for respondents and to prevent confusion, scale number 1 is labelled with low risks, scale number 4 is labelled with medium and scale number 7 is labelled with high risks. Furthermore, the maximum number of risks which can be assigned to each risk number is indicated above each risk number (see Figure 28).
The Q-sorting survey comprises an instruction beforehand and the sorting exercise itself. The instruction include background information about the objective of the research, confidentiality and a

guideline on how to conduct the Q sorting. For that purpose, a simple to use Excel survey is designed which allows respondents to enter crosses in order to assign risk statements to risk numbers. Thereby, the respondent receives a visual feedback about the current amount of risks in each category and also whether one risk number contains to many risk statements (see Appendix C). A feedback is given to indicate that the Q-sorting procedure is successfully finished.

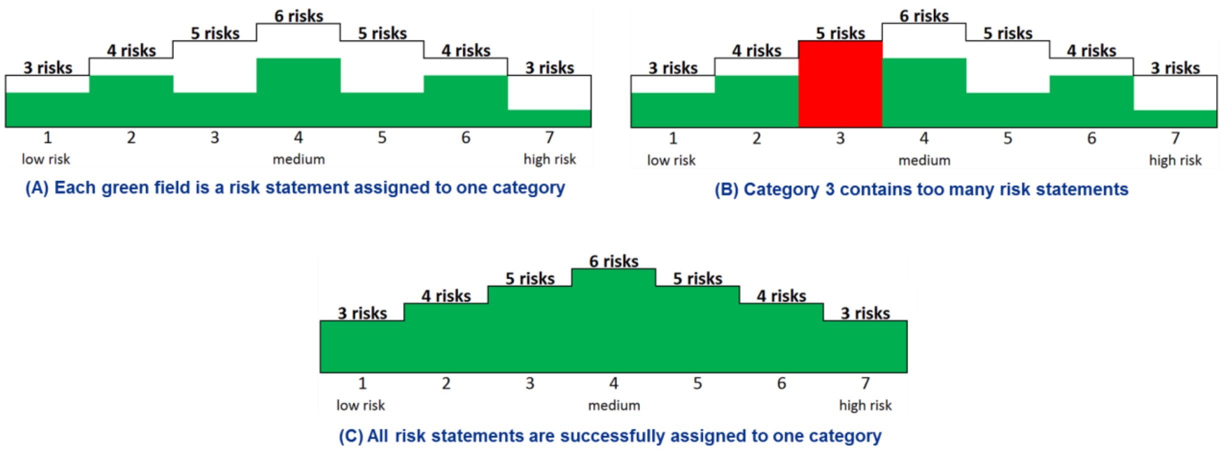


Figure 28: Real time visualization of Q-sorting procedure for respondents (Excel survey)

For the final Q-sorting procedure, respondents are asked the following question: “To what extent do you consider each risk as present in the ShareShip cooperation?” followed by the advice “Please rank them relatively to each other from 1 to 7”. Next to each risk is a field for voluntarily comments. Due to the fact that a digital survey does not allow mediation by the researcher during Q-sorting, the comment field allows the respondent to explain his/her respective choice. Furthermore, respondents have the chance to list additional risks they might consider important, but are not mentioned in the risk statements yet, in an additional field at the end of the survey. After filling in the survey, the respondent saves the Excel file and sends it back to the researcher

5.3 Development of unique risk groups (Q-analysis)

Figure 29: Conceptual model applied on ShareShip (Step 3)

The number of risk groups depends on factors and their eigenvalues. Eigenvalues are the measure of the relative contribution of a factor to explain the total variance in the correlation matrix (see Appendix D1). Factors with an eigenvalue greater than one explain more variance than a single statement would. Therefore, the maximum number of factors to take into account is equal to the number of initial factors with an eigenvalue greater than one (Krueger, et al., 2001). Factors are equal to risk groups as each factor comprises a set of risks that is characteristically for the respective factor.

Table 6 shows factors and eigenvalues of ShareShip. Four factor have an eigenvalue greater than one which would mean partners of ShareShip can be distinguished into four risk groups. The assignment of partners and risks to each risk group is done in the following stages.

Table 6: Principal Components Factor Analysis

Factor	Eigenvalues
1	2.5181
2	1.5133
3	1.3894
4	1.0896
5	0.9152
6	0.8020
7	0.7093
8	0.4938
9	0.3790
10	0.1903

Eigenvalues indicate the relative contribution on the representation of the overall risks perception.

For a factor to be interpretable, one requirement is an eigenvalue greater than one.

Each factor represents a group of respondents that belong to the factor.

Four eigenvalues score higher than one. Thus, the following analysis will focus on these four factors.

Subsequently to the identification of the number of risk groups comes the assignment of partners to the four risk groups. For that purpose, the software used for the Q-analysis offers a function that is called automatic pre-flagging. By using this function, the software marks partners which clearly load onto a risk group. Table 7 shows that the first risk group consists of three companies which are company A, E and D. Second risk group consists of two companies which are company A and B. Third risk group consists of only company C. Finally, fourth risk group also consists of only one company which is company A.

After automatic pre-flagging, it is possible to manually adjust the assignment of partners. This may become necessary in two circumstances. The first circumstance is a partner which is assigned to a risk group because of a negative loading. It is advised to avoid the assignment of partners to risk groups based on negative loadings because negative loadings only indicate disagreement to the set of risks of a risk group (Krueger, et al., 2001). The second circumstance that justifies manual adjustment of pre-flagging is a partner that does not clearly load onto a risk group. Due to the fact that the threshold to be assigned to a risk group is only 0.40 or -0.40 respectively, a partner that slightly loads above 0.40 or below -0.40 does not clearly belong to that risk group but is still assigned to that group via pre-flagging.

Given the results of pre-flagging of ShareShip partners, three manual adjustments become necessary. First adjustment affects the assignment of company B to the second risk group. Company B is assigned to the second risk group based on a negative loading of -0,46. As a negative load should not be a reason for the assignment to a risk group, company B is de-assigned from the second risk group.

Second and third manual adjustment concerns two respondents of company A which are assigned to the first and second risk group based on a negative loadings of -0.65 and -0.58 respectively. Both connections are annulled. Table 7 provides an overview of the results of pre-flagging and manual adjustments. Instances of manual adjustment are highlighted in grey. As a result, the partner composition of risk groups is the following: Risk group 1: company E and company D, Risk group 2: company A, Risk group 3: company C and Risk group 4: company A.

Table 7: Factor matrix with an X (flagging) indicating a defining sort

	Risk group (automatic flagging)				Risk group (flagging manually adjusted)			
Sorts	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1 (company A)	0.03	0.09	-0.04	0.86 X	0.03	0.09	-0.04	0.86 X
2 (company B)	-0.45	0.03	0.31	0.52	-0.45	0.03	0.31	0.52
3 (company B)	-0.02	-0.46 X	0.05	-0.16	-0.02	-0.46	0.05	-0.16
4 (company C)	0.59	-0.20	0.55	-0.17	0.59	-0.20	0.55	-0.17
5 (company C)	0.00	0.10	0.77 X	0.09	0.00	0.10	0.77 X	0.09
6 (company E)	0.75 X	0.11	0.23	-0.21	0.75 X	0.11	0.23	-0.21
7 (company D)	0.76 X	0.01	-0.08	0.08	0.76 X	0.01	-0.08	0.08
8 (company A)	-0.03	-0.58 X	0.52	-0.06	-0.03	-0.58	0.52	-0.06
9 (company A)	-0.06	0.92 X	0.15	-0.07	-0.06	0.92 X	0.15	-0.07
10 (company A)	-0.65 X	0.57	0.21	-0.17	-0.65	0.57	0.21	-0.17

The initial number of risk groups can be consolidated into three risk groups because second and fourth risk group contains the same company, namely company A. Therefore, partners of ShareShip can be distinguished into three different groups regarding their individual risk perception.

A first observation of the composition of risk groups shows company E and D form an own risk group and thereby share a similar set of perceived risks. This observation of perceived risks goes along with observation of behaviour of both companies in ShareShip because company E and D are the first ones which left the cooperation in the initiation phase.

Company B cannot be assigned to any risk group as it shows an indifferent perception on risks in ShareShip. Although company B has a slight tendency to risk group four (risk group of company A), it does not clearly load onto that risk group as other loadings of company B are spread over risk group one and two as well.

In a subsequent step, defining risks must be assigned to each risk group. For that purpose, appendix D8 shows normalized scores which give a first indication about of the risk profile of each risk group. Risk statements with a higher rank are more important to a risk group than statements with a lower rank. However, normalized scores do not allow an interpretation of the true differences in risk perceptions between risk groups yet. For that purpose, another output of the Q-analysis is needed that isolate risk statements which are distinctive for each risk group.

Table 8 indicates which risk statements are characteristic for each risk group. Characterising risk statements are marked with a either high or low grade depending whether a risk group agrees or disagrees to a risk statement. The analysis allows only one risk group to clearly agree or disagree to one risk statement. For example, risk group one may agree to risk statement two, meaning that no other risk group agrees to risk statement two as clearly as risk group one. However, it is still possible that another risk group may clearly disagree to risk statement two. In this case, an opposing risk perception between two risk groups would exist which can be considered as a dilemma. The analysis of dilemmas are conducted in the fourth step of the conceptual model.

Table 8: Distinguishing statements for factors 1 to 4

	Risk group							
	1		2		3		4	
Risk No.	**Score**	**Grade**	**Score**	**Grade**	**Score**	**Grade**	**Score**	**Grade**
2	0	High	-2	-	-2	-	-2	-
3	1	-	1	-	3	-	-2	Low
9	0	-	-1	-	3	High	0	-
10	0	-	-3	Low	0	-	1	-
17	3	High	-1	-	-1	-	-1	-
24	-1	-	-3	-	0	-	3	High
26	1	-	3	-	-3	Low	2	-
29	-3	Low	0	-	1	-	3	-
30	1	High	-2	-	-1	-	-3	-

Table 8 shows risk group one is characterised by four distinctive risks. Partners of this group agree to risks statement 2, 17 and 30 and disagree to risk statement 29. As described in the previous step, risk group two and four are consolidated because both groups comprise the same company (company A). Therefore, also risk statements of both groups are consolidated. As a result, partner of risk group two agrees to risk statement 24 and disagrees to risk statements 3 and 10. Eventually, risk group three has two distinctive risks. Its partner agrees with risk statement 9 and disagrees with risk statement 26.

Table 9 summarizes the results of the Q-analysis including number of risk groups, partners and distinctive risks of each group. Additionally, each group has got a name which reflects the general direction of its risk perception.

Table 9: Identified groups with similar risk perception in ShareShip

Risk group	More important risks		Less important risks		Companies	Group name
1	2	Partners receive profits, while not having any marginal contribution in the cooperation.	29	Lower profitability when desired speed of innovation cannot be achieved.	Company D and E	Hesitators
	17	Resistance of individuals at partners.				
	30	In-transparent profit allocation scheme lowers commitment of partners.				
2	24	Social dependencies for participation of partners in the cooperation.	10	Benefits of cooperation are lower than expected because partners keep optimising their networks individually.	Company A	Network-focussed innovator
			3	Difficulty of implementing cooperation platform at all partners.		
3	9	Limited willingness to cooperate of barge operators when they are not financially incentivised.	26	Data security cannot be guaranteed.	Company C	3rd PL-focussed partner

*Assignment of statements to groups is based on distinguishing statements (Table 8)

Group 1 – "Hesitators"

This group is called hesitators because it consists of partners who left ShareShip during the initiation phase. The group comprises companies which perceive the highest amount of risk compared to other risk groups.

Partners are afraid that some other partners might receive profits while not adding any marginal contribution to the cooperation. Another perceived risk which steers in the same direction is an in-transparent profit allocation scheme. Both risks are indicative of high personal importance of "fair" profit allocation to this risk group. Another perceived risks is the resistance of individuals. Partners of this group are conscious about the social complexity of a cooperation and fear the power of individuals who may refuse to cooperate.

On the other hand, this risk group is not afraid at all about slow progression of innovation in ShareShip. It can be assumed that an initiation phase of ShareShip, which is conducted relatively fast, might scare these partners away.

Group 2 – "Network-focussed innovator"

This group is called network-focussed innovator because of two reasons. First of all, the group consists of only one partner which is the initiator of ShareShip. Its effort to found a cooperation in the Dutch barge logistics is relatively innovative and give evidence of an entrepreneurial spirit. The second reason can be found in partner's risk perception of social dependency on other partners. Company A is conscious about the social complexity of such a new cooperation and knows about its dependency on other partners to make it a success.

On the other hand, company A stays optimistic regarding the implementation of the cooperation platform at all partners. Furthermore, company A is not afraid about opportunistic behaviour of other partners that might negatively affect profitability of ShareShip.

Group 3 – “3rd PL-focussed partner”

This group is called 3rd PL-focussed partner because risk perception in this groups deals with the dependency on external logistics service providers. In the case of ShareShip, most important logistics service providers are barge operators which are mainly family owned businesses. Company C is concerned about the willingness of barge operators to cooperate if they are not financially incentivised. A risk that is considered as low by that group is the leakage of data due to lack of data security.

5.4 Identification of dilemmas

Figure 30: Conceptual model applied on ShareShip (Step 4)

This step of the conceptual model deals with the identification of dilemmas of risk perceptions between partners in ShareShip. A dilemma can occur in two circumstances. In the first circumstance, two partners have opposing perceptions on a single risk. For example, one partner agrees to the risk of data leakages while another partner disagrees to the same risk. The second circumstance are two partners who agree to two different risks which cannot be mitigated in parallel. For example, in-transparent and complex profit allocation schemes go hardly hand in hand with a “fair” profit allocation schemes from cooperative game theory.

Risk groups of ShareShip, derived in the preceding step show no risks on which one partner agrees and another partner disagrees on. Therefore, no dilemmas exist in ShareShip based on the first circumstance. Dilemmas based on the second circumstance are less straightforward to identify because it is a personal interpretation of the process manager whether two risks cannot be mitigated in parallel. The following five risks are the ones which partners in ShareShip perceive as high.

- Risk 2: Partners receive profits, while not having any marginal contribution in the cooperation (calculative risk).
- Risk 17: Resistance of individuals at partners (relational risk).
- Risk 30: In-transparent profit allocation scheme lowers commitment of partners (institutional risk).
- Risk 24: Social dependencies for participation of partners in the cooperation (relational risk).

- Risk 9: Limited willingness to cooperate of barge operators when they are not financially incentivized (relational risk).

A first look at these five risks gives an indication whether dilemmas exists in the mitigation of these risks. Risk one and three deal with the profit allocation scheme in ShareShip. Risk one asks for a “fair” profit allocation scheme which aligns profits to the marginal contribution of each partner. These profit allocation schemes originate from cooperative game theory and are the opposite of proportional allocation schemes which are based on load of shipments, number of customers, distance travelled or others (Cruijssen, 2012). The disadvantage of profit allocation schemes from cooperative game theory is their complexity and in-transparency. For that reason, there might be a dilemma for the parallel mitigation of risk one and three as risk three requires a transparent profit allocation scheme.

Risk two, four and five are relational risks and emphasize the importance of collaboration of partners and external stakeholders for the success of ShareShip. Therefore, these risks can be put into one cluster because they can be mitigated in parallel with risk counter strategies which incentives partners and barge operators to cooperate in ShareShip.

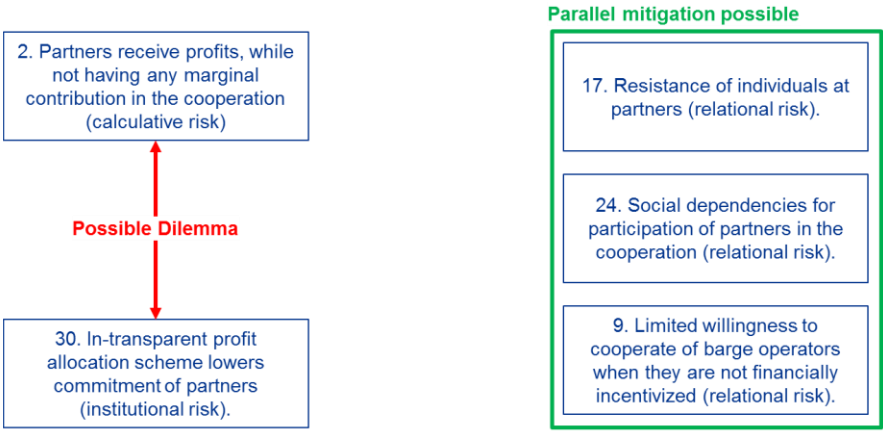


Figure 31: Risk dilemma and possibility of parallel risk mitigation in ShareShip

This step of the conceptual model concludes with a list of risks to mitigate which is accepted by all partners. The list is developed in the course of a negotiation between partners. The scope of this thesis does not offer the possibility to simulate a negotiation process between partners of ShareShip. Nonetheless, the next step of the conceptual model provides recommendation regarding the risk counter strategies based on context of ShareShip.

5.5 Strategy agenda and implementation plan for Control Tower

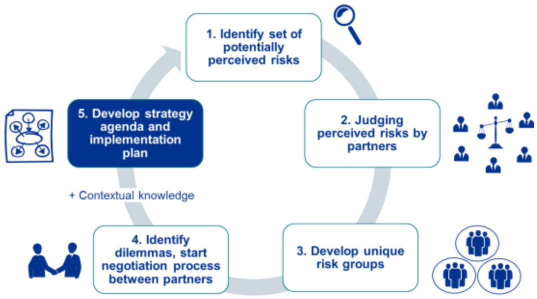


Figure 32: Conceptual model applied on ShareShip (Step 5)

As a first step, contextual factors of ShareShip are described which determine the environment in which risk counter strategies must finally be implemented.

Contextual knowledge

Social-cultural factors:

ShareShip consists of five companies in the Dutch building industry. No cooperation history exists so far between these companies. Cultural background regarding values and norms between partners can be considered as similar. Cultural differences should not be mixed up with internal business cultures of partners which are part of organisational factors. Furthermore, success of ShareShip depends on the cooperation of barge operators which provide transportation capacity.

Economic factors:

ShareShip is a hybrid cooperation which consists of producers and customers in the Dutch building industry. Therefore, competition exists between some partners. Company A is the sponsor of the initiation and implementation phase of ShareShip. Therefore, ShareShip is financially depended on company A.

Organisational factors:

Difference in company size in terms of total employees worldwide are enormous between partners in ShareShip (see **Error! Reference source not found.**). Number of employees give an indication of different decision making processes as large organisations tend to have more formal processes than smaller ones. On the other hand, partners in ShareShip contribute a relatively even share of transportation volume to the cooperation. Some smaller partners even contribute more volume to the ShareShip than larger partners.

Political factors:

ShareShip has the potential to consolidate a large share of total volume of Dutch barge logistics under one roof. Therefore, activities in ShareShip must be closely aligned with European competition laws.

Selection of risk counter strategies

Step four of the conceptual model has identified a dilemma between risk 2 (Partners receive profits, while not having any marginal contribution in the cooperation) and risk 30 (In-transparent profit allocation scheme lowers commitment of partners). Risk 2 would stay in favour for the introduction of a profit allocation scheme from cooperative game theory. A prominent example is an allocation using the Shapley value. The Shapley value allocates profits to partners based on their true contribution to the cooperation gain. However, research on the practical use of allocation schemes from cooperative game theory have revealed a threshold of four partners. Cooperations which require an allocation of profits among more than four partners are less suitable for the use of profit allocation schemes from cooperative game theory. The reason can be found in the exponentially growing complexity with the addition of other partners in the future (van Bree, 2015). As a consequence, ShareShip which consists of five partners, should rather rely on a proportional allocation scheme of profits which is also better scalable for partners which may join the cooperation at a later stage.

In order to mitigate risk 30, transparency must be ensured in the allocation of profits. A transparent profit allocation is based on proportional factor(s) on which the allocation is aligned on, for example transportation volume (tons), distances (km), served customers (number). Thereby, partners should continuously be provided with an overview of allocated profits to each partner.

Risk 17 deals with resistance of individual, meaning employees working at the individual partners. Resistance is a natural reaction to change and partners can mitigate resistance by addressing employee's concern regarding job security, future tasks and loss of control by open communication. Concerns should not be kept secret but partners need to facilitate and participate in discussions about changes which go along with the foundation of ShareShip. Furthermore, partners should emphasise advantages for employees created through ShareShip. In order to reduce employees's fear to lose control, Partners can involve employees in the decision making process, asking for their active support in the design of ShareShip.

Risk 24 describes the social dependency for participation of partners in ShareShip. In this regard, some partners make their participation in ShareShip subject to the participation of other partners. It seems obvious to offer those strategic partners special condition, e.g. additional profits, to convince them to participate in ShareShip. However, an unequal treatment of partners could result in an decrease of commitment of other partners. This receives special relevance in the background of a transparent profit allocation scheme which offers partners information about received profits of each partner. Therefore, it is not advised to promise higher profits to some partners. Instead, the social dependence between partners should be reduced. This could be achieved by developing scenarios (or business cases) of ShareShip with different compositions of partners to emphasise advantages in every possible partner composition.

Risk 9 focuses on the limited willingness of barge operators to cooperate when they are not financially incentivised. Barge operators are crucial for the success of ShareShip because they bring in transport capacities in an otherwise asset-light business model of ShareShip. In order to ensure commitment in ShareShip, barge operators should participate on the benefits of the cooperation. ShareShip must either provide competitive prices per transported ton or guarantee high utilization rate to barge operators.

In summary, the following risk counter strategies are advised to introduce in ShareShip:

1. Proportional and transparent profit allocation scheme.
2. Open communication with employees and involvement of employees in the design of ShareShip.

3. Development of scenarios (business cases) with different partners compositions.
4. Offer competitive prices or provide guarantees of transport volume to barge operators.

Implementation plan (Control Tower)

Four risk counter strategies are selected which must be implemented in ShareShip. Thereby, the focus is on the application of a Control Tower and how a Control Tower can help to implement selected risk counter strategies. Thereby, a Control Tower is a combination between an information technology and consultancy provider.

Risk counter strategy 1: "*Proportional and transparent profit allocation scheme*"

A Control Tower stays in the centre of allocation of profits between partners with its neutral position and its access to information over shipments in ShareShip. Thereby, the information technology part of a Control Tower conducts calculations on profit allocations based on proportional factors such as transported volume, travelled distance or served customers. Partners periodically (monthly or quarterly) receive an overview about total profits (or costs savings) achieved in ShareShip and how these benefits are allocated to all partners. The overview also provides information on the underlying factors of the calculation which allows them to recalculate the allocation.

Risk counter strategy 2: "*Open communication with employees and involvement of employees in the design of ShareShip"*

Manging internal resistance must take place on a partner level because a Control Tower is responsible for network management of all partners. However, the consultancy part of a Control Tower can offer partners support and help them to develop the right communication strategy to their employees and to involve employees in the design of ShareShip.

Risk counter strategy 3: "*Development of scenarios (business cases) with different partners compositions*"

Developing scenarios or business cases of ShareShip comprising different partner compositions is done by the consultancy part of the Control Tower. Each scenario describes the individual (financial) benefits of participating partners, thereby reducing social dependency of partners. In ShareShip, different scenarios of partner compositions have been developed by the consultancy firm KPMG, showing total transport volume of the cooperation, utilization rate of barges and CO^2 emissions of participants.

Risk counter strategy 4: "*Offer competitive prices or guarantees of transport volumes to barge operators*"

Competitive prices can only offered to barge operators when existing market prices are continuously monitored. The consultancy part of a Control Tower could observe existing price levels in the barge logistics market and provides thresholds of competitive pricing to the information technology part of the Control Tower which eventually manages reimbursement of barge operators. Additionally, the information technology part of a Control Tower could derive forecast on transport volumes based on previous shipments in order to offer barge operators guarantees of transport volumes.

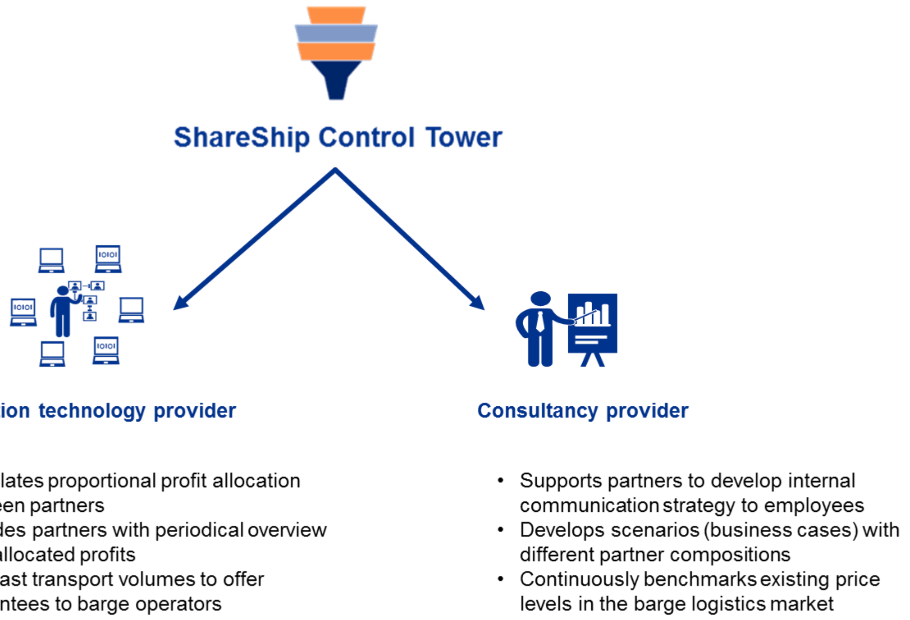


Figure 33: Proposed risk counter measures implemented via ShareShip Control Tower

5.6 Conclusion

The application of the conceptual model on the case of ShareShip shows how decision makers can regain ability to act in an otherwise complex and multifaceted subject of trust building. The ShareShip case shows that the conceptual model does not automatically results into a “right” selection of risk counter strategies but depends on the expertise and interpretation of the process manager of the conceptual model (Control Tower). For example step 3 (Development of unique risk groups) requires manual adjustments after an automatic assignment of partners to risk groups. Step 4 (Identification of dilemmas) also requires individual interpretation about which risk can be achieved in parallel. Finally, step 5 (Selection of risk counter strategies) requires experiences in risk management to define appropriate risk counter strategies. As a consequence, the quality of outcome of the conceptual model (selection of risk counter strategies) varies according to the experiences and expertise of the process manager in place. Therefore, a Control Tower, which holds position of a process manager, has a significant impact on the effectiveness of risk mitigation in a logistics cooperation using the conceptual model.

Part 6: Conclusion and Implications

Trust building in multi-company cooperations can effectively be managed through mitigation of perceived risks from partners. Risk mitigation in cooperations is different to traditional risk management as it requires consequent involvement of partners. Therefore, a conceptual model for multi-actor risk management in cooperations is developed and tested, by putting theoretical concepts into practice. The conceptual model is primarily intended for cooperations in logistics as it involves the use of a Control Tower, a relatively new appearance in logistics. A Control tower is a combination of an information technology and consultancy provider, facilitating and coordinating logistic networks of different parties. Thereby, a Control Tower performs a neutral and independent role toward partners. This part returns to the initial research question(s) and will extract answers from the underlying research. Furthermore, a reflection on the research design and limitations of the research are presented. It concludes with recommendations for future research.

6.1 Returning to the main research question

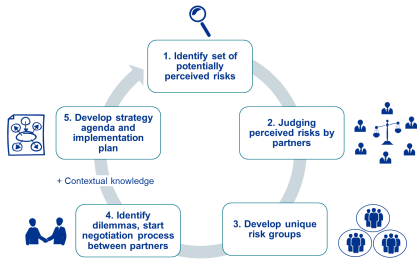
This research aims at answering the question “How to design a trust-building control tower strategy for multi-company cooperations in logistics?”. In order to come to an answer, this question has been broken down into four sub-questions which will be answered subsequently.

1. *Sub-question: What is a plausible conceptual framework for managing trust building in a multi-company cooperation in logistics?*

In the literature, trust is often described as a multidimensional concept which difficult to manage. Thereby, trust building is considered as a great challenge and trust difficult to sustain. In order to make trust manageable, a conceptual model is designed that makes use of the causal connection between trust an risks in a cooperation. The casual connection lies in the fact that trust is a risk coping mechanism and a lack of trust reflects an excess of risks which cannot be compensated by the existing trust level anymore.

Multi-actor risk management becomes necessary to apply in order to reduce the existing risk level. Multi-actor risk management describes a sub-area of risk management that can be applied in complex multi-actor networks, such as in cooperations. This area of risk management takes a fundamental different approach to risk mitigation than traditional risk management. Instead of accumulating the seriousness of each risk (probability multiplied by potential damage), multi-actor risk management analyses risk perception of individual partners and facilitates a negotiation process between them which is supposed to lead to compromises and package deals about risk counter strategies to be implemented. As a consequence, multi-actor risk management is more dynamic than traditional risk management as it continuously adapts to changing risk perception of partners in a cooperation.

The developed conceptual model orientates on multi-actor risk management and consists of the following five steps:



1. Risk identification,
2. Risk judgement,
3. Identification of risk groups,
4. Identification of dilemmas and negotiation and
5. Selection of risk counter strategies.

Between step four to step five takes place a transition from general to specific. Risk perception of partners is translated into specific risk counter strategies to be implemented. Contextual knowledge is critical during this transition in order to satisfy unique characteristics of each cooperation. Contextual knowledge consists of different factors which vary per cooperation such as social-cultural factors (e.g. history of working together), economical factors (e.g. vertical, horizontal or hybrid cooperation), organisational factors (e.g. difference in company sizes of partners) and political factors (e.g. competition laws). Contextual factors place the selection of possible risk coping strategies in the context of the respective cooperation. Thereby, options for risk counter strategies are narrowed to the most applicable ones. The conceptual model ensures that decision makers regain ability to act in the otherwise complex and multifaceted subject of trust building.

The application of the conceptual model on ShareShip have exemplarily shown the development of risk counter strategies based on perceived risks of partners. Through the application of the model became clear that the development of risk counter strategies strongly depends on the interpretation of a process manager. A process manager is responsible for the overall facilitation of the conceptual model and is actively involved in various steps of the model. For example, a process manager interpret results of partner surveys in order to derive risk groups (step 3 of the conceptual model) and identifies dilemmas between risk perception of different partners (step 4 of the conceptual model). For that reason, the quality of outcome of the conceptual model depends on experiences and expertise of the process manager in place.

2. *Sub-question: What are perceived risks of companies which are involved in logistics cooperations?*

Perceived risks of partners in a cooperation constitute the basis of the developed conceptual model. Existing risk management literature offers a number of different categorisation of risks. In the scope of this research, a risk categorisation must be chosen that supports the logic of existing trust building models.

For that reason, a risk categorisation is chosen which is derived from trust building models developed by Rousseau et al. (1998) and Lewicki & Bunker (1995). Thereby, perceived risks in cooperations are divided into three categories:

- Relational,
- Calculative and
- Institutional risks.

Relational risks are risks regarding the reliability and integrity of partners in a cooperation. Calculative risks are based on rational choice and credible information such as costs and benefits. Institutional risks include all risks which originates from the institutional setting of a cooperation including legal control mechanisms (e.g. contracts), governance structures and other arrangements between partners.

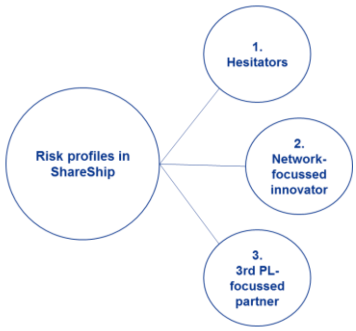
Results of empirical research in ShareShip revealed a dominance of relational risks perceived by partners in the ShareShip cooperation, followed by calculative risks. An explanation for the predominance of relational risks can be found in the characteristics of a cooperation. Cooperations typically lack hierarchical order and partners depend on each other. This interdependence places partners in a vulnerable position, exposed to the sometimes unpredictable behaviour of other partners. Partners are conscious about their vulnerable position and consider behaviour of other partners as the most important source of risks. Thereafter come risks regarding a "fair" and transparent allocation of profits in ShareShip (calculative and institutional risk).

3. *Sub-question: How to develop risk profiles of partners in a cooperation with respect to perceived risks?*

Risk profiles or risk groups represent partners which perceive a similar set of risks in a cooperation. The identification of risk groups reduces complexity in the selection of appropriate risk counter strategies. However, the identification of risk groups is complicated as partner's subjectivity must be obtained and similarities be identified, preferably in a quantitative manner.

Perceived risks can only be identified with methods which study subjectivity of partners. Based on benchmarking and expert interviews, a long list of possible risks can be developed serving as input for the Q-method. The Q-method offers a structured approach in which partners are firstly ask to rank potential risks in a cooperation according to their own risk perception from low to highly important (Q-sorting). The outcome of Q-sorting is a matrix that can be analysed regarding correlations between rankings of partners. Correlations lead to distinctive groups of partners which appear to have similar perception(s) on risks. Subsequently, risk groups are used to identify risk dilemmas between partners and facilitate a negotiation process about which risks to mitigate in the cooperation.

In ShareShip, three distinctive risk groups can be identified from results of Q-sorting. Each group is named according to its set of perceived risks. Partners in ShareShip are divided in the groups of "Hesitators", "Network-foccussed innovator" and "3rd PL-focussed partner". A comparison of these risk groups eventually led to a recommendation of risk counter strategies which are assumed to create least resistance among partners.



4. *Sub-question: How can a Control Tower support building and sustaining of trust in a logistics cooperation?*

The concept of a Control Tower is a relatively new appearance in literature. Therefore, the definitions of tasks a Control Tower is supposed to fulfil vary per author. Generally, a Control Tower is a neutral and independent party in a logistics cooperation functions as a facilitator for the implementation of a cooperation on the one hand and as a coordinator of transactions between partners. In this regard, a

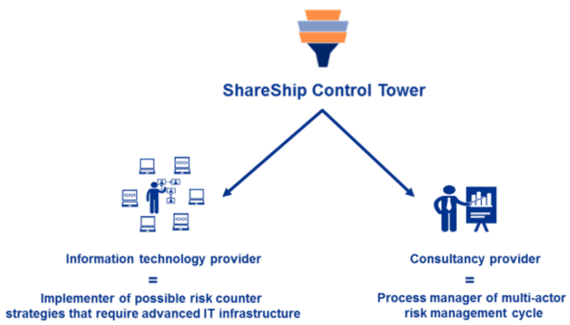
Control Tower is a combination of an information technology and consultancy provider. However, existing literature does not specify yet which role(s) a Control Tower take(s) to actively support trust building in a cooperation. Some authors simply refer to the neutral position of a Control Tower. However, neutrality is merely a characteristic of a Control Tower and does not define specific tasks which support trust building.

This research has defined tasks supporting trust building to the two roles of the Control Tower which are an information technology and consultancy role. The consultancy role represents a process manager for multi-actor risk management. Thereby, it facilitates the identification of perceived risks of partners, the development of distinctive risk groups, identification of dilemmas and selection of specific risk counter strategies (see five steps of conceptual model).

On the one hand, the IT role represents an operational part of a Control Tower, offering an advanced information architecture to partners. The implementation of some risk counter strategies can be done through information and communication technologies of a Control Tower. For example, monitoring of collaborative KPIs or offering advanced communication tools between partners are possible risk counter strategies which can be implemented via a Control Tower.

Besides distinctive roles of a Control Tower which fulfil trust building activities, the sheer presence of a Control Tower itself support the development of trust as well. The causal diagram at the end of Part 2 (Theory and concepts) illustrates the importance of partner's trustworthiness as a determinant of trust level in a cooperation. Amongst others, the key characteristic of a Control Tower is a trustworthy image. Therefore, a Control Tower brings in additional trustworthiness into a cooperation.

Two different roles of a Control Tower can also be observed within ShareShip. The consultancy role is taken over by KPMG, including facilitation of partner meetings, development of a business plan and selection of external partners (e.g. technology providers). On the other hand, the information technology provider is newly founded company, supported by two external technology firms. The situation of ShareShip shows that the two roles of a Control Tower do not necessarily need to be fulfilled by a single actors. Instead, a Control Tower can also be a virtual organisation, consisting of a network of companies that together build a Control Tower.



Main research question: "How to design a trust building control tower strategy for multi-company cooperations in logistics?"

In the light of the complex and multifaceted subject of trust, it becomes necessary that decision makers gain the ability to actively influence the process of trust building and preservation in a cooperation. This research aims at equipping decision makers with an hands-on approach to design a cooperation strategy that supports trust building by applying multi-actor risk management and involving the new concept of Control Towers.

The developed conceptual model brings together findings from trust-building, risk-management and process management research and integrates those into a five-step model. First step of the model is the identification of possible risks. Thereby, three categories of risks can be distinguished which are relational, calculative and institutional risks. Subsequently, partners are asked to rank risks according to its importance in the cooperation. In the third step takes place an analysis of correlations between partner's rankings. Based on these correlations, risk groups of partners are formed which share a similar set of perceived risks. Due to the distinction between three risk categories, it can be analysed which risk group is dominated by which risk category or whether a dominance can be observed after all. Individual risk groups are then compared with each other in the fourth step of the design process in order to identify dilemmas. Dilemmas are opposing risk perceptions of two or more partners which cannot be mitigated in parallel. In the following, negotiations between partners take place which are supposed to result in a selection of risks that all partners agree on to mitigate. The final selection of specific risk counter strategies is made in the fifth step and takes into account contextual knowledge over the respective cooperation to ensure appropriateness of counter strategies.

6.2 Reflection

Reflection on research design

The research initially started with the question on how to build up trust in logistics cooperations which comprise a Control Tower. Thereby, the research question developed around an observed problem in the ShareShip cooperation, namely the hesitation of potential partners to engage in ShareShip despite an attractive business model that promises financial returns to every partner. As a consequence, it is assumed that financial incentives are not sufficient to convince partner to participate and trust constitutes another important variable.

Based on the case study of ShareShip, the research design is developed around the following corner stones:

- Development of a conceptual model that supports trust building in logistics cooperations
- Involvement of a Control Tower
- Testing of the conceptual model on the case of ShareShip

This approach of designing a research on the basis of a case has some advantages and disadvantages compared to choosing the case based on research design. Beginning with advantages, the chosen approach has given direction and depth to the research. The concept of a Control Tower is a relatively new appearance in logistics. If the integration of a Control in the research design had not be predefined in the beginning, it might be questionable whether the focus would have been on Control Towers at all, a topic which does not enjoy much attention in academic literature yet. The specialisation on Control Towers made it possible to enrich the exiting literature of Control Towers with additional functions in regard to multi-actor risk management.

On the other hand, an early specialisation on Control Towers set aside other logistics cooperations which do not involve a Control Tower. For example, trust building and multi-actor risk management are relevant issues in other internal and external cooperations as well, comprising complex networks. Aligning a research design on a given case could lead to an unnecessary bounding of the research scope.

Reflection on conceptual model

The development of the conceptual model is based on the relationship between risk and trust. Each partner has an own perception on risks, leading to the fact that many individual risk levels exist in a cooperation. Therefore, the conceptual model aims at identifying individual risk perception of partners and strives to derive suitable mitigation strategies. By doing so, the conceptual model takes a clear focus on trustor(s) in a cooperation. A trustor is the person or company that eventually places trust into a trustee (another person or company).

On the other hand, trust in a cooperation also depends on trustees and their trustworthiness. The conceptual model does not separately analyses trustworthiness of trustees. The reason can be found in the fact that perception on trustee's trustworthiness is a subjective evaluation of trustor(s) which takes place as an unconscious step before trustor(s) evaluate relevance or importance of certain risks in a cooperation. Therefore, perceived trustworthiness of trustees is implicitly included in the risk evaluation of each partner (step two of conceptual model). For example, a partner that perceives low trustworthiness to other partners will judge risk of opportunistic behaviour as high.

Additionally, the concept of trustworthiness is not only implicitly included in the conceptual model. Instead, a new party is added to the cooperation, which is a Control Tower, and takes over the role of a process manager of the conceptual model. Besides expertise, experience and technological know-how, also a trustworthy image is a key characteristic of a Control Tower (Verstrepen, 2015). Thereby, a Control Tower increases trustworthiness of the conceptual model as such.

Reflection on empirical research

The application of the conceptual model on the case of ShareShip is supposed to illustrate how outcomes of each step can be analysed and interpreted in order to eventually derive appropriate risk counter strategies. However, recommendations for ShareShip derived from the conceptual model only reflect a snapshot of the current situation. Throughout the time, ShareShip and its partner composition may change, so as perceptions on risks may change. For that reason, the five-step process of the conceptual model must be repeated periodically and risk counter strategies must be adapted.

Furthermore, the empirical research cannot observe the dynamics of negotiations between partners which take place in step four of the conceptual model. For that reason, the outcome of the empirical research is changed from a specific strategy agenda to recommendations based on the context of ShareShip (contextual knowledge). This approach allows to focus on the context of ShareShip that is necessary to take into account when developing appropriate risk counter strategies.

6.3 Limitations

Development of trust depends on the individual context of a cooperation and is difficult to be generalized for all possible contexts. For that reason, the conceptual model includes contextual knowledge which aims to make the model adaptable for different types of logistics cooperations. However, the context of a cooperation is defined by its contextual factors and these factors vary per cooperation. Therefore, the quality of outcome of the conceptual model strongly depends on the process manager and his ability to identify relevant contextual factors of a cooperation. A pre-defined list of contextual factors which may be applicable to all cooperations would be open ended and as too many variations of possible cooperations exist.

The conceptual model is based on the connection between trust and risks. Thereby risks which are considered as risk-worthy indicate the existence of trust. However, contexts may exist which do not resonate with that logic. For example, when partners are not allowed to take any risks irrespectively whether they consider a risk as risk-worthy. In this case, the avoidance of risk-taking behaviour would not be an indication for a lack of trust.

Another limitation can be found in the role definition of a Control Tower. In the course of this research a Control Tower fulfils two roles which are an information technology and consultancy provider (see 2.4.1 Role of a Control Tower). The reason for this role definition is a clear distinction to other 3rd and 4th party logistics service providers. However, an overlap may exists between Control Towers with its IT and advisory capabilities and 4th party logistics service providers with its operational strengths. In this regard, some Control Towers may even own vehicles, facilities and other equipment which distances themselves from an asset light business model of a Control Tower.

This research has set its focus on the mitigation of perceived risks of partners in order to remove barriers to trust. Thereby, the goal is not to create a situation that comprises no risks at all but to ensure all remaining risks are considered as risk-worthy by partners. However, there is also a second alternative to make trusting more attractive for partners which is offering higher benefits. For example, Harland (2002) describes the process of benefit and risk sharing in cooperations within innovation management. A comparison of the effectiveness between benefit sharing and risk mitigation in regard to trust building reveals a theoretical dominance of risk mitigation. Risk mitigation could theoretically lead to a situation in which partners consider each risk as risk-worthy. On the other hand, benefit sharing attempts to offer partners a proper compensation for their perceived risks. However, this strategy is limited to the total amount of benefits which can be created in a cooperation through synergy effects. If total benefits are lower than total risks perceived, benefit sharing would never be able to compensate for all risks taken. In practice, benefit sharing and risk mitigation are complementary strategies to support trust building in a cooperation. Therefore, the developed conceptual model is not a stand-alone solution but should be combined with proper benefit sharing mechanisms between partners.

6.4 Recommendation for future research

A possibility for further research is on the contextual knowledge, included in the conceptual model. Some contextual factors have been identified in the scope of this research. However, these factors are bounded to the chosen benchmarks and the case of ShareShip. Additional factors need to be identified to meet requirements of a broader variety of cooperations.

Another possibility for future research exist on the impact of cultural background of partners on the perception of risks in cooperations. As perceived risks can be distinguished between relational, calculative and institutional risks, it might be possible that the importance of each category differs between cultures. For instance, Asian cultures are assumed to be more relationship focussed whereas Western cultures are assumed to be more focussed on financial incentives. This becomes especially relevant in international cooperations. In this regard it may be necessary to investigate how risk counter strategies can be developed in the environment of strongly diverging risk perceptions of partners from different cultural backgrounds.

Additionally, a possibility for future research exists on the allocation of benefits between partners. As benefit sharing and risk mitigation are complementary strategies, future research could investigate the interdependencies between both strategies in order to better align them with each other.

The developed conceptual model describes the process of mitigation of perceived risks in a logistics cooperation. However, the same model could also be adopted in other situations which involve complex networks and require multi-actor risk management. An example is an internal innovation project involving a number of different departments. Interesting to investigate in this regard would be the adapted role of a Control Tower. In this case, the concept of a Control Tower as a neutral and independent party that facilitates and manages collaboration between actors could be mirrored on an internal actor in the organisation.

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Appendix

Appendix A: List of interviewees

Name	Affiliated organisation	Expertise	Date
Bas van Bree (Program Manager)	DINALOG	• Involved in the European CO^3 project as program manager for business models	26 June 2015
Jikke Biermasz (Attorney at law)	Kneppelhout & Korthals	• Involved in the European CO^3 project for the legal framework • Involved in the implementation of ShareShip, support for legal framework	6 July 2015
Arnoud Blaakmeer (Project member ShareShip)	KPMG Operations Strategy Group	• Involved in the implementation of ShareShip, development of business model	7 July 2015
Paul Hoekstra (Project member ShareShip)	KPMG Operations Strategy Group	• Involved in the implementation of ShareShip, development process model	7 July 2015
Lennart Rommens (Project manager ShareShip)	KPMG Operations Strategy Group	• Project manager of the ShareShip project	8 July 2015
Sven Verstrepen (Business Development Director & Founding Partner)	Tri-Vizor	• Involved in the European CO^3 project, development of business cases and facilitation partner meetings	9 July 2015
Christian Heuing (Head of Supply Chain Strategy)	Peek & Cloppenburg	• More than 15 year' experience in third party logistics (about 5 years c-level)	14 July 2015
Jan Bram de Ferrante (Project member ShareShip)	KPMG Operations Strategy Group	• Involved in the implementation of ShareShip, development of governance model	16 July 2015
Peter Tjalma (Managing Director)	TransMission BV	• More than 17 years' experience in managing a cooperation between shippers in truck logistics in the Benelux region	6 August 2015

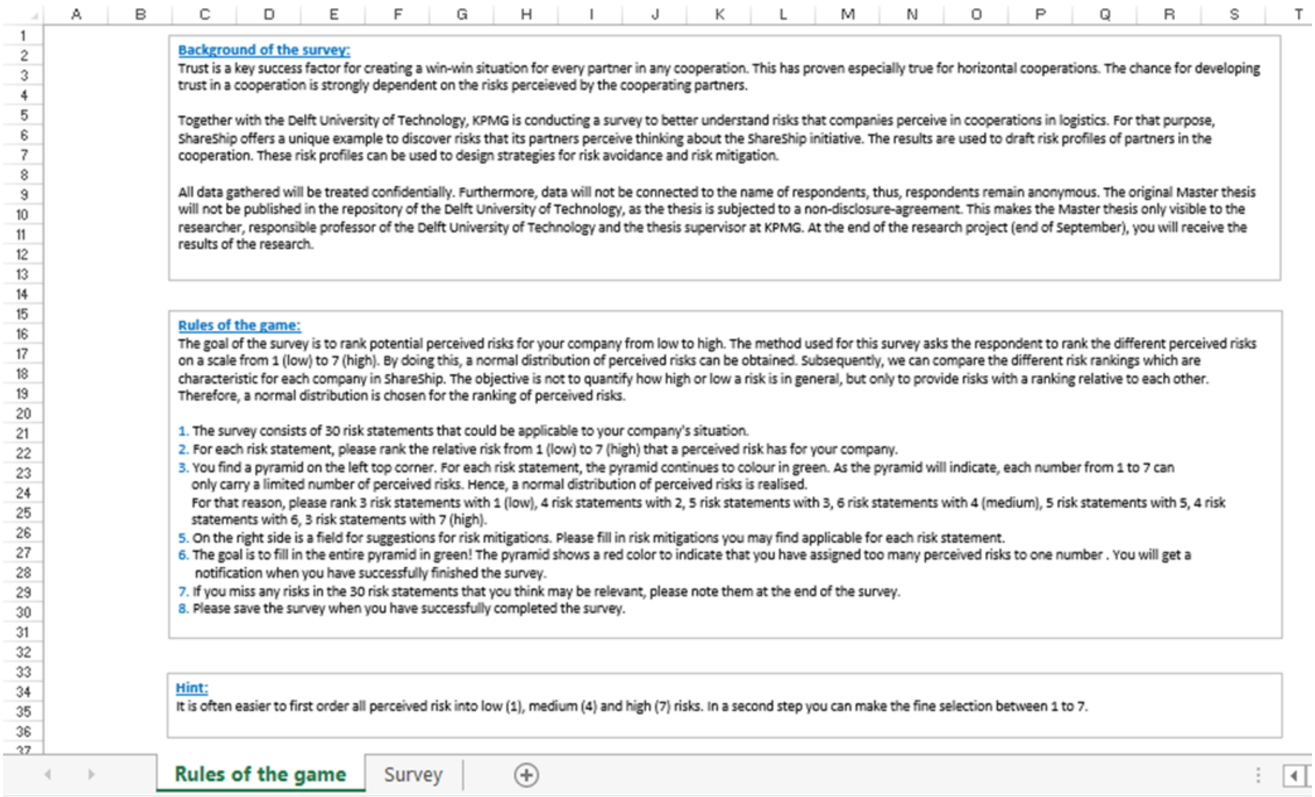
Appendix B: Concourse for Q sorting

Relational risks			Calculative risks			Institutional risks		
No.	**Statement**	**Rational behind**	**No.**	**Statement**	**Rational behind**	**No.**	**Statement**	**Rational behind**
3	Success of ShareShip could be at risk through difficulty of implementing the cooperation platform at all partners.	People - Resistance of partners to implement new ICT system.	1	Participating in ShareShip could be unprofitable for partner(s).	Profit allocation - Individual rationality.	6	Success of ShareShip is at risk when no formal contracts are in place.	Governance - Need for formal contracts.
9	Cooperation of barge operators will be at risk when they are not financially incentivised.	External stakeholders - Critical external stakeholders refuse to cooperate.	2	Potential partners in ShareShip could receive profits, while not having any marginal contribution in the cooperation.	Profit allocation - Dummy player property.	8	Participation of partners is at risk because of potential non-compliance with competition law.	Legal - Noncompliance with competition law.
10	Benefits of ShareShip will be lower than expected because partners will optimise their network individually.	People - Opportunistic optimisation in favor of individual partners.	4	Profitability of ShareShip is at risk when potential partners decide not to participate.	Profitability - Profitability depends on partner's participation.	13	Success of ShareShip is at risk when not having the right operational knowledge from partners in the ShareShip control tower.	Governance - Difficulties of knowledge transfer.
11	Long-term performance of ShareShip is at risk if business cultures of partners cannot be aligned.	Culture - Business cultures of partners are not aligned.	5	ShareShip could cause higher costs than expected because of underestimatin g complexity of partner's networks.	Costs - Higher coordination costs than expected.	15	Participation of partners is at risk when decisive power in ShareShip is not equally divided between partners.	Governance - Partner's decisive power on design and operation.
12	Participation in ShareShip could make partner(s) too dependent on other partner(s) in ShareShip.	Organisation - Cooperation increases dependency on partners.	7	Benefits of ShareShip will be lower than expected because complementari ness of partner's networks is lower than expected.	Benefits - Partners are less complementary than expected.	23	A lack of formal control mechanisms (e.g. financial control) in ShareShip could lead to undesired behaviour of partners.	Governance - Control mechanisms.
14	Long-term participation in ShareShip is at risk because of changing strategic goals of partners.	People - Change of strategic goals.	21	Partners could receive unequal profits while having an equal marginal contribution in	Profit allocation - Profit allocation is not symmetric.	19	Participation in ShareShip may cause partners to lose core competences.	Capabilities - Loss of core competences.

				the cooperation.				
17	Success of ShareShip could be at risk because of resistance of individuals at partners.	People - Internal resistance.	22	Benefits for partners will be lower because the market adapts to lowered price levels.	Benefits - Market adapts to lower prices.	20	Participation in ShareShip could negatively affect service levels of partners towards their customers.	Capabilities - Reduced service level.
18	Participation in ShareShip may negatively influence partner's reputation.	Reputation - Reduced reputation.	16	Participation of partners is at risk when ShareShip cannot be competitive to other platforms.	Business Case - Proof of competiveness of ShareShip.	25	Participation of partners is at risk when activities of ShareShip and partners are potentially conflicting.	Governance - Conflicting activities between ShareShip and partners.
24	Participation of partners is at risk because of the dependency on participation of other potential partners.	People - Social interdependenc y	27	Sub-coalitions among partners could negatively affect benefits of other partners.	Profit allocation - Profit allocation is not stable.	26	Participation of partners is at risk when data security cannot be guaranteed.	Information - Visibility of sensitive information (Data security).
28	Success of ShareShip could be at risk because of not having the right management in the ShareShip control tower.	People - Wrong management in the control tower.	29	Profitability of ShareShip is at risk when desired speed of innovation cannot be achieved.	Profitability - Speed of innovation.	30	An in-transparent profit allocation scheme will negatively influence partner's commitment in ShareShip.	Transparency – In-transparent profit allocation scheme lowers commitment.

Appendix C: Survey for Q-method

Appendix C1: Screenshot of instructions of Q-sorting exercise



Background of the survey:

Trust is a key success factor for creating a win-win situation for every partner in any cooperation. This has proven especially true for horizontal cooperations. The chance for developing trust in a cooperation is strongly dependent on the risks perceieved by the cooperating partners.

Together with the Delft University of Technology, KPMG is conducting a survey to better understand risks that companies perceive in cooperations in logistics. For that purpose, ShareShip offers a unique example to discover risks that its partners perceive thinking about the ShareShip initiative. The results are used to draft risk profiles of partners in the cooperation. These risk profiles can be used to design strategies for risk avoidance and risk mitigation.

All data gathered will be treated confidentially. Furthermore, data will not be connected to the name of respondents, thus, respondents remain anonymous. The original Master thesis will not be published in the repository of the Delft University of Technology, as the thesis is subjected to a non-disclosure-agreement. This makes the Master thesis only visible to the researcher, responsible professor of the Delft University of Technology and the thesis supervisor at KPMG. At the end of the research project (end of September), you will receive the results of the research.

Rules of the game:

The goal of the survey is to rank potential perceived risks for your company from low to high. The method used for this survey asks the respondent to rank the different perceived risks on a scale from 1 (low) to 7 (high). By doing this, a normal distribution of perceived risks can be obtained. Subsequently, we can compare the different risk rankings which are characteristic for each company in ShareShip. The objective is not to quantify how high or low a risk is in general, but only to provide risks with a ranking relative to each other. Therefore, a normal distribution is chosen for the ranking of perceived risks.

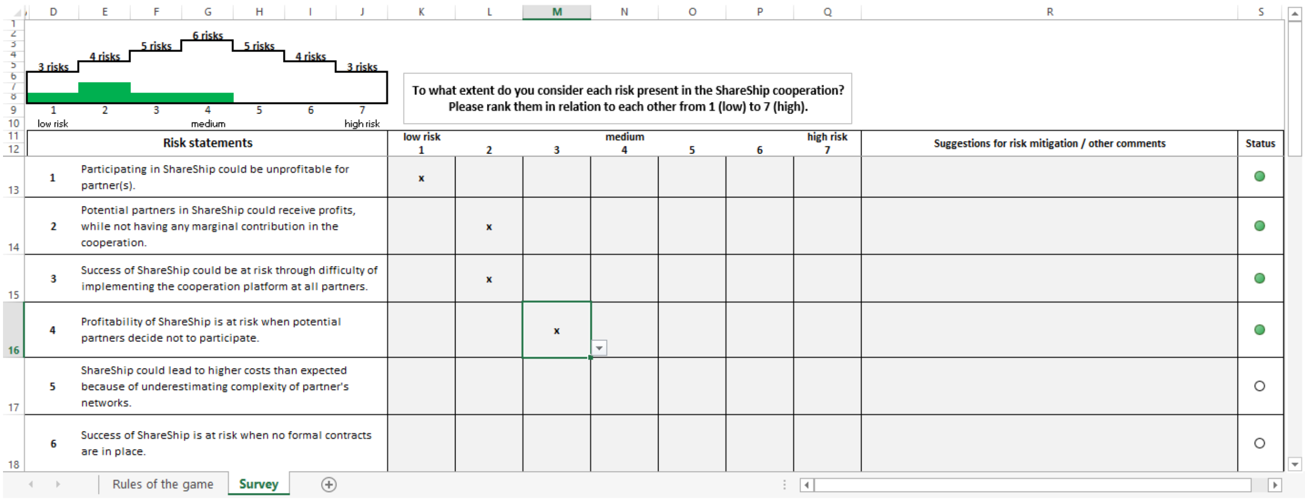
1. The survey consists of 30 risk statements that could be applicable to your company's situation.
2. For each risk statement, please rank the relative risk from 1 (low) to 7 (high) that a perceived risk has for your company.
3. You find a pyramid on the left top corner. For each risk statement, the pyramid continues to colour in green. As the pyramid will indicate, each number from 1 to 7 can only carry a limited number of perceived risks. Hence, a normal distribution of perceived risks is realised.
For that reason, please rank 3 risk statements with 1 (low), 4 risk statements with 2, 5 risk statements with 3, 6 risk statements with 4 (medium), 5 risk statements with 5, 4 risk statements with 6, 3 risk statements with 7 (high).
5. On the right side is a field for suggestions for risk mitigations. Please fill in risk mitigations you may find applicable for each risk statement.
6. The goal is to fill in the entire pyramid in green! The pyramid shows a red color to indicate that you have assigned too many perceived risks to one number . You will get a notification when you have successfully finished the survey.
7. If you miss any risks in the 30 risk statements that you think may be relevant, please note them at the end of the survey.
8. Please save the survey when you have successfully completed the survey.

Hint:

It is often easier to first order all perceived risk into low (1), medium (4) and high (7) risks. In a second step you can make the fine selection between 1 to 7.

Rules of the game | Survey

Appendix C2: Screenshot of Q-sorting grid



To what extent do you consider each risk present in the ShareShip cooperation?
Please rank them in relation to each other from 1 (low) to 7 (high).

	Risk statements	low risk 1	2	3	medium 4	5	6	high risk 7	Suggestions for risk mitigation / other comments	Status
1	Participating in ShareShip could be unprofitable for partner(s).	x								
2	Potential partners in ShareShip could receive profits, while not having any marginal contribution in the cooperation.		x							
3	Success of ShareShip could be at risk through difficulty of implementing the cooperation platform at all partners.		x							
4	Profitability of ShareShip is at risk when potential partners decide not to participate.			x						
5	ShareShip could lead to higher costs than expected because of underestimating complexity of partner's networks.									
6	Success of ShareShip is at risk when no formal contracts are in place.									

Rules of the game | Survey

Appendix D: PQ Analysis

Appendix D1: Correlation matrix between sorts

Sorts	1	2	3	4	5	6	7	8	9	10
1	100	20	-5	-15	0	-8	-6	-5	8	-3
2	20	100	-4	-16	15	-30	-18	3	5	29
3	-5	-4	100	14	1	3	2	8	-24	-12
4	-15	-16	14	100	26	52	32	31	-14	-31
5	0	15	1	26	100	2	-2	15	15	6
6	-8	-30	3	52	2	100	36	11	10	-29
7	-6	-18	2	32	-2	36	100	-5	-5	-44
8	-5	3	8	31	15	11	-5	100	-37	-10
9	8	5	-24	-14	15	10	-5	10	100	58
10	-3	29	-12	-31	6	-29	-44	-10	58	100

Appendix D2: Principal Components Factor Analysis

Sorts	Eigenvalues	As percentages	Cumulative percentages
1	2.5181	25.18%	25.18%
2	1.5133	15.13%	40.31%
3	1.3894	13.89%	54.21%
4	1.0896	10.90%	65.10%
5	0.9152	9.15%	74.26%
6	0.8020	8.02%	82.28%
7	0.7093	7.09%	89.37%
8	0.4938	4.94%	94.31%
9	0.3790	3.79%	98.10%
10	0.1903	1.90%	100.00%

Appendix D3: Unrotated factor matrix

	Factors							
Sorts	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	-0.2195	-0.0879	-0.0094	0.8398	0.0882	0.4338	-0.1629	0.0712
2	-0.4544	-0.2505	0.4184	0.3670	0.0720	-0.2799	0.5308	-0.2083
3	0.2634	-0.3622	0.0641	-0.1981	0.8426	0.1759	0.0657	0.0900
4	0.7137	0.2090	0.4369	-0.0004	0.0182	0.0571	0.0965	-0.2166
5	0.0384	0.1650	0.7610	0.1034	0.1349	-0.3241	-0.4829	0.0345
6	0.6338	0.5197	0.0761	0.0299	-0.0112	0.3382	0.1818	-0.2059
7	0.5903	0.3332	-0.2141	0.3060	0.0927	-0.3862	0.2472	0.4190
8	0.3622	-0.4309	0.5333	-0.1040	-0.3810	0.2890	0.1345	0.3521
9	-0.4847	0.7840	0.1272	-0.0135	0.1341	0.1384	0.0439	0.1320

10	-0.7528	0.2433	0.2965	-0.3070	0.0434	0.1735	0.2002	0.1725
Eigenvalues	2.5181	1.5133	1.3894	1.0896	0.9152	0.8020	0.7093	0.4938

Appendix D4: Factor matrix with an X indicating a defining sort

	Factors			
Sorts	**1**	**2**	**3**	**4**
1 (company A)	0.0313	0.0981	-0.0419	0.8654 X
2 (company B)	-0.4538	0.0353	0.3183	0.5201
3 (company B)	-0.0233	-0.4608 X	0.0558	-0.1672
4 (company C)	0.5988	-0.2024	0.5589	-0.1791
5 (company C)	-0.0004	0.1071	0.7739 X	0.0909
6 (company E)	0.7522 X	0.1161	0.2306	-0.2145
7 (company D)	0.7653 X	0.0071	-0.0796	0.0834
8 (company A)	-0.0322	-0.5768 X	0.5239	-0.0628
9 (company A)	-0.0595	0.9146 X	0.1476	-0.0656
10 (company A)	-0.6463 X	0.5662	0.2059	-0.1657

Appendix D5: Factor matrix with an X indicating a defining sort (after manual adjustment)

	Factors			
Sorts	**1**	**2**	**3**	**4**
1 (company A)	0.0313	0.0981	-0.0419	0.8654 X
2 (company B)	-0.4538	0.0353	0.3183	0.5201
3 (company B)	-0.0233	-0.4608	0.0558	-0.1672
4 (company C)	0.5988	-0.2024	0.5589	-0.1791
5 (company C)	-0.0004	0.1071	0.7739 X	0.0909

6 (company E)	0.7522 X	0.1161	0.2306	-0.2145
7 (company D)	0.7653 X	0.0071	-0.0796	0.0834
8 (company A)	-0.0322	-0.5768	0.5239	-0.0628
9 (company A)	-0.0595	0.9146 X	0.1476	-0.0656
10 (company A)	-0.6463	0.5662	0.2059	-0.1657

Appendix D6: Factor characteristics

Factor	1	2	3	4
No. of Defining Variables	2	1	1	1
Average Rel. Coef.	0.800	0.800	0.800	0.800
Composite Reliability	0.889	0.800	0.800	0.800
S.E. of Factor Z-Scores	0.333	0.447	0.447	0.447

Appendix D7: Standard Errors for Differences in Factor Z-Scores (Diagonal Entries Are S.E. Within Factors)

Factors	1	2	3	4
1	0.471	0.558	0.558	0.558
2	0.558	0.632	0.632	0.632
3	0.558	0.632	0.632	0.632
4	0.558	0.632	0.632	0.632

Appendix D8: Factor scores with corresponding ranks

	Factors							
	1		2		3		4	
Statement No.	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**
1	0.02	17	-0.55	23	-1.65	30	-1.65	30
2	0.02	17	-1.10	27	-1.10	27	-1.10	27
3	0.39	12	0.55	12	1.65	3	-1.10	27
4	-0.64	21	0.55	12	0.00	18	1.10	7
5	0.32	15	0.00	18	-0.55	23	0.00	18
6	-0.69	24	0.55	12	0.55	12	-0.55	23

7	-0.34	19	0.55	12	-0.55	23	0.55	12
8	2.00	1	1.10	7	0.55	12	-0.55	23
9	0.32	15	-0.55	23	1.65	3	0.00	18
10	0.32	15	-1.65	30	0.00	18	0.55	12
11	-1.01	25	0.00	18	1.10	7	0.00	18
12	1.67	2	-0.55	23	1.10	7	-1.10	27
13	-0.67	22	-1.10	27	0.55	12	-0.55	23
14	0.69	8	-0.55	23	0.00	18	1.10	7
15	0.99	4	1.10	7	0.00	18	0.55	12
16	-0.02	18	1.65	3	-1.10	27	0.55	12
17	1.33	3	-0.55	23	-0.55	23	-0.55	23
18	0.69	8	-1.65	30	-1.65	30	0.00	18
19	0.97	5	0.00	18	1.10	7	1.10	7
20	-1.35	28	1.10	7	1.65	3	-1.65	30
21	-1.33	27	-1.10	27	-0.55	23	0.00	18
22	-1.67	29	0.00	18	-1.10	27	0.55	12
23	-1.31	26	1.10	7	0.55	12	-0.55	23
24	-0.62	20	-1.65	30	0.00	18	1.65	3
25	0.64	10	0.55	12	1.10	7	1.65	3
26	0.67	9	1.65	3	-1.65	30	1.10	7
27	-0.69	24	0.00	18	-1.10	27	-1.10	27
28	0.69	8	1.65	3	0.00	18	0.00	18
29	-2.00	30	0.00	18	0.55	12	1.65	3
30	0.62	11	-1.10	27	-0.55	23	-1.65	30

Appendix D9: Correlation between factor scores

Factors	1	2	3	4
1	1.0000	0.0285	-0.0008	-0.0879
2	0.0285	1.0000	0.1458	0.0833
3	-0.0008	0.1458	1.0000	0.0000
4	-0.0879	0.0833	0.0000	1.0000

Appendix D10: Factor Q-sort values for each statement

	Factors			
Statement No.	**1**	**2**	**3**	**4**
1	0	-1	-3	-3
2	0	-2	-2	-2
3	1	1	3	-2
4	-1	1	0	2
5	0	0	-1	0

6	-2	1	1	-1
7	-1	1	-1	1
8	3	2	1	-1
9	0	-1	3	0
10	0	-3	0	1
11	-2	0	2	0
12	3	-1	2	-2
13	-1	-2	1	-1
14	1	-1	0	2
15	2	2	0	1
16	0	3	-2	1
17	3	-1	-1	-1
18	1	-3	-3	0
19	2	0	2	2
20	-3	2	3	-3
21	-2	-2	-1	0
22	-3	0	-2	1
23	-2	2	1	-1
24	-1	-3	0	3
25	1	1	2	3
26	1	3	-3	2
27	-2	0	-2	-2
28	1	3	0	0
29	-3	0	1	3
30	1	-2	-1	-3

Appendix D11: Distinguishing statements for factor 1 (P < .05 ; Asterisk (*) Indicates Significance at P < .01)

			Factor 1		**Factor 2**		**Factor 3**		**Factor 4**	
No.	**Statement**	**Risk category**	**Q sort value**	**Z score**	**Q sort value**	**Z score**	**Q sort value**	**Z score**	**Q sort value**	**Z score**
17	Success of ShareShip could be at risk because of resistance of individuals at partners.	Relational risk	3	1.33*	-1	-0.55	-1	-0.55	-1	-0.55
30	An in-transparent profit allocation scheme will negatively influence partner's commitment in ShareShip.	Institutional risk	1	0.62	-2	-1.10	-1	-0.55	-3	-1.65

2	Potential partners in ShareShip could receive profits, while not having any marginal contribution in the cooperation.	Calculative risk	0	0.02	-2	-1.10	-2	-1.10	-2	-1.10
29	Profitability of ShareShip is at risk when desired speed of innovation cannot be achieved.	Calculative risk	-3	-2.00*	0	0.00	1	0.55	3	1.65

Appendix D12: Distinguishing statements for factor 2 (P < .05 ; Asterisk (*) Indicates Significance at P < .01)

			Factor 1		**Factor 2**		**Factor 3**		**Factor 4**	
No.	**Statement**	**Risk category**	**Q sort value**	**Z score**	**Q sort value**	**Z score**	**Q sort value**	**Z score**	**Q sort value**	**Z score**
10	Benefits of ShareShip will be lower than expected because partners will optimise their network individually.	Relational risk	0	0.32	-3	-1.65*	0	0.00	1	0.55

Appendix D13: Distinguishing statements for factor 3 (P < .05 ; Asterisk (*) Indicates Significance at P < .01)

			Factor 1		**Factor 2**		**Factor 3**		**Factor 4**	
No.	**Statement**	**Risk category**	**Q sort value**	**Z score**	**Q sort value**	**Z score**	**Q sort value**	**Z score**	**Q sort value**	**Z score**
9	Cooperation of barge operators will be at risk when they are not financially incentivised.	Relational risk	0	0.32	-1	-0.55	3	1.65	0	0.00
26	Participation of partners is at risk when data security cannot be guaranteed.	Institutional risk	1	0.67	3	1.65	-3	-1.65*	2	1.10

Appendix D14: Distinguishing statements for factor 4 (P < .05 ; Asterisk (*) Indicates Significance at P < .01)

No.	Statement	Risk category	Factor 1 Q sort value	Factor 1 Z score	Factor 2 Q sort value	Factor 2 Z score	Factor 3 Q sort value	Factor 3 Z score	Factor 4 Q sort value	Factor 4 Z score
24	Participation of partners is at risk because of the dependency on participation of other potential partners.	Relational risk	-1	-0.62	-3	-1.65	0	0.00	3	1.65*
3	Success of ShareShip could be at risk through difficulty of implementing the cooperation platform at all partners.	Relational risk	1	0.39	1	0.55	3	1.65	-2	-1.10*

Appendix D15: Summary of distinguishing statements for factors 1 to 4

No.	Statement	Factor 1 Score	Factor 1 Grade	Factor 2 Score	Factor 2 Grade	Factor 3 Score	Factor 3 Grade	Factor 4 Score	Factor 4 Grade
1	Participating in ShareShip could be unprofitable for partner(s).	0	-	-1	-	-3	-	-3	-
2	Potential partners in ShareShip could receive profits, while not having any marginal contribution in the cooperation.	0	High	-2	-	-2	-	-2	-
3	Success of ShareShip could be at risk through difficulty of implementing the cooperation platform at all partners.	1	-	1	-	3	-	-2	Low
4	Profitability of ShareShip is at risk when potential partners decide not to participate.	-1	-	1	-	0	-	2	-
5	ShareShip could cause higher costs than expected because of underestimating complexity of partner's networks.	0	-	0	-	-1	-	0	-

6	Success of ShareShip is at risk when no formal contracts are in place.	-2	-	1	-	1	-	-1	-
7	Benefits of ShareShip will be lower than expected because complementariness of partner's networks is lower than expected.	-1	-	1	-	-1	-	1	-
8	Participation of partners is at risk because of potential non-compliance with competition law.	3	-	2	-	1	-	-1	-
9	Cooperation of barge operators will be at risk when they are not financially incentivised.	0	-	-1	-	3	High	0	-
10	Benefits of ShareShip will be lower than expected because partners will optimise their network individually.	0	-	-3	Low	0	-	1	-
11	Long-term performance of ShareShip is at risk if business cultures of partners cannot be aligned.	-2	-	0	-	2	-	0	-
12	Participation in ShareShip could make partner(s) too dependent on other partner(s) in ShareShip.	3	-	-1	-	2	-	-2	-
13	Success of ShareShip is at risk when not having the right operational knowledge from partners in the ShareShip control tower.	-1	-	-2	-	1	-	-1	-
14	Long-term participation in ShareShip is at risk because of changing strategic goals of partners.	1	-	-1	-	0	-	2	-
15	Participation of partners is at risk when decisive power in ShareShip is not equally divided between partners.	2	-	2	-	0	-	1	-
16	Participation of partners is at risk when ShareShip cannot be competitive to other platforms.	0	-	3	-	-2	-	1	-
17	Success of ShareShip could be at risk because of resistance of individuals at partners.	3	High	-1	-	-1	-	-1	-
18	Participation in ShareShip may negatively influence partner's reputation.	1	-	-3	-	-3	-	0	-

19	Participation in ShareShip may cause partners to lose core competences.	2	-	0	-	2	-	2	-
20	Participation in ShareShip could negatively affect service levels of partners towards their customers.	-3	-	2	-	3	-	-3	-
21	Partners could receive unequal profits while having an equal marginal contribution in the cooperation.	-2	-	-2	-	-1	-	0	-
22	Benefits for partners will be lower because the market adapts to lowered price levels.	-3	-	0	-	-2	-	1	-
23	A lack of formal control mechanisms (e.g. financial control) in ShareShip could lead to undesired behaviour of partners.	-2	-	2	-	1	-	-1	-
24	Participation of partners is at risk because of the dependency on participation of other potential partners.	-1	-	-3	-	0	-	3	High
25	Participation of partners is at risk when activities of ShareShip and partners are potentially conflicting.	1	-	1	-	2	-	3	-
26	Participation of partners is at risk when data security cannot be guaranteed.	1	-	3	-	-3	Low	2	-
27	Sub-coalitions among partners could negatively affect benefits of other partners.	-2	-	0	-	-2	-	-2	-
28	Success of ShareShip could be at risk because of not having the right management in the ShareShip control tower.	1	-	3	-	0	-	0	-
29	Profitability of ShareShip is at risk when desired speed of innovation cannot be achieved.	-3	Low	0	-	1	-	3	-
30	An in-transparent profit allocation scheme will negatively influence partner's commitment in ShareShip.	1	High	-2	-	-1	-	-3	-