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**EFFICIENCY IN PROJECT NETWORKS:**  
the role of inter-organizational relationships in  
project implementation

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## **Abstract in English**

In many project-based industries such as construction and shipbuilding, the delivery of projects requires the participation of multiple heterogeneous firms. The objective of this dissertation is to explore how inter-organizational relationships influence the efficiency of the implementation phase in project networks. Project networks are defined as temporary inter-organizational networks set up for delivering a project to a client. Furthermore, it is examined how project implementation influences the development of inter-organizational relationships between firms involved in project networks. Based on a review of literature on project business, inter-organizational relationships, transaction cost economics, and critical incidents, a conceptual framework is developed to guide the multiple case study involving four project networks from the Finnish shipbuilding industry. Altogether, the empirical data analyzed in this study consists of a total of 40 personal interviews with individuals representing 13 different organizations, and a broad range of documentation including contracts, meeting memorandums and project plans.

The results of this study demonstrate evidence of a relation between inter-organizational relationships and the efficiency of project implementation. Critical incidents unforeseen by the participating actors were analyzed in the four project networks. A part of these critical incidents was found to be related to inter-organizational relationships and to contribute to the efficiency of project implementation by affecting the ex post transaction costs of monitoring, planning, and adapting transactions between involved firms. Furthermore, the contribution of critical incidents on the efficiency of project implementation was found to be predominantly unfavorable as increases, as opposed to decreases, in transaction costs were found as frequent. In two studied project networks, in which inter-organizational relationships between project network actors were characterized by high degrees of trust and dependence, inter-organizational relationships were found to frequently constitute strengths which reduced the unfavorable contribution of critical incidents to the efficiency of project implementation. In all four studied project networks, inter-organizational relationships were also found to frequently constitute weaknesses which increased the unfavorable contribution of critical incidents to efficiency of project implementation. The results of this study also illustrate that the influ-

ence of project implementation on the development of inter-organizational relationships between project network actors can often be characterized as modest, as inter-organizational relationships in three studied project networks were rather stable across the observed one year period. However, when project network actors assess the responses of each other to critical incidents as unacceptable, even highly established inter-organizational relationships may deteriorate rapidly as occurred in one of the four studied project networks.

This dissertation complements existing knowledge concerning the relatedness of inter-organizational relationships and efficiency of economic transactions by describing how critical incidents function as a mechanism relating these two concepts in project network contexts. In addition, this study contributes to our understanding of how inter-organizational relationships develop between firms operating in project-based industries. Further, this dissertation sheds new light to our understanding of the factors that contribute to the efficiency of work carried out in project contexts by emphasizing the importance of transaction costs that incur between involved firms during the implementation phase of the project life cycle. The results of this study have also implications for practitioners responsible for marketing and managing inter-firm projects who can be considered, to a considerable extent, accountable for both the development of inter-organizational relationships between firms they are employed by and other firms in the surrounding business environment, and the efficiency of work carried out in projects in which their employing firms participate.

**Keywords:** project network, project management, inter-organizational relationships, efficiency, transaction costs, project business, critical incident

## Abstract in Finnish

Useilla projektimuotoisesti toimivilla teollisuuden aloilla, kuten rakennusteollisuudessa ja meriteollisuudessa, projektien toteuttaminen edellyttää useiden heterogeenisten yritysten osallistumista. Tämän väitöskirjan tavoite on tutkia miten yritysten väliset liikesuhteet vaikuttavat työn tehokkuuteen projektiverkostoissa. Projektiverkosto on määritelty tilapäiseksi yritysverkostoksi, joka perustetaan projektin toimittamiseksi asiakkaalle. Lisäksi, tämä väitöskirja tarkastelee miten projektin toteuttaminen vaikuttaa siihen osallistuvien yritysten välisten liikesuhteiden kehittymiseen. Perustuen projektiliiketoimintaa, yritysten välisiä liikesuhteita, transaktiokustannuksia, sekä kriittisiä tapahtumia käsittelevään kirjallisuuteen, työssä luodaan käsitteellinen viitekehys joka ohjaa neljää suomalaisen meriteollisuuden projektiverkostoa tarkastelevan tapaustutkimuksen toteuttamista. Kokonaisuutena, työssä käytetty empiirinen aineisto koostuu 13 yritystä edustavista 40 henkilökohtaisesta haastattelusta, sekä laajasta tarkasteltuihin projekteihin liittyvästä kirjallisesta aineistosta.

Tutkimuksen tulokset tukevat käsitystä jonka mukaan yritysten väliset liikesuhteet ovat yhteydessä niiden yhdessä toteuttaman työn tehokkuuteen. Tutkimuksessa tarkasteltiin kriittisiä tapahtumia, jotka tapahtuivat projektiverkostoihin kuuluvien yritysten kannalta ennalta odottamattomasti. Osan näistä tapahtumista havaittiin olevan yhteydessä yritysten välisiin liikesuhteisiin, sekä vaikuttavan toteutettavan työn tehokkuuteen joko lisäämällä tai vähentämällä *ex post* transaktiokustannuksia, jotka koostuvat työn valvonnan, työn suunnittelun, sekä käytäntöjen mukauttamisen kustannuksista. Lisäksi, kriittisten tapahtumien vaikutukset havaittiin tarkasteltujen projektiverkostojen kannalta pääsääntöisesti epätoivottaviksi, sillä tapahtumat useammin lisäsivät transaktiokustannuksia, kuin vähensivät niitä. Kahdessa tarkastellussa projektiverkostossa, joissa yritysten välisiä liikesuhteita kuvasi vahva luottamus ja molemminpuolinen riippuvuus, liikesuhteet muodostivat usein vahvuuksia, jotka vähensivät kriittisten tapahtumien epäsuotuisia vaikutuksia työn tehokkuuteen. Lisäksi, kaikissa neljässä tarkastellussa projektiverkostossa liikesuhteiden havaittiin muodostavan myös heikkouksia, jotka lisäsivät kriittisten tapahtumien epäsuotuisia vaikutuksia työn tehokkuuteen. Tutkimuksen tulokset osoittavat myös, että liikesuhteiden kehitys projektiverkostoihin osallistuvien yritysten välillä

on usein maltillista, sillä kolmessa tarkastellussa projektiverkossa havaitut muutokset liikesuhteissa olivat vähäisiä vuoden tarkastelujaksolla. Kuitenkin, silloin kuin projektiverkoston toimijat arvioivat toistensa toiminnan mahdottomaksi hyväksyä, jopa vakiintuneet liikesuhteet voivat heikentyä nopeasti, kuten yhdessä tarkastellussa projektiverkostossa havaittiin käyneen.

Tämä väitöskirja täydentää aiempaa tietämystä yritysten liikesuhteiden ja työn tehokkuuden välisestä yhteydestä kuvaamalla miten kriittiset tapahtumat muodostavat mekanismin, joka yhdistää nämä kaksi käsitettä toisiinsa projektiverkostojen kontekstissa. Lisäksi, tämä väitöskirja lisää ymmärrystämme yritysten välisten liikesuhteiden kehittymisestä projektimuotoisesti toimivilla toimialoilla. Lopuksi, tämä tutkimus, korostamalla yritysten välisten transaktiokustannusten merkitystä, täydentää aiempaa tietämystä tekijöistä, jotka vaikuttavat työn tehokkuuteen projektiverkostoissa. Tutkimuksen tuloksilla on implikaatioita niille liike-elämässä toimiville, jotka vastaavat yritysten välisten projektien markkinoinnista tai toteutuksesta, sillä heidän toimensa ja ratkaisunsa vaikuttavat sekä projekteihin osallistuvien yritysten välisten liikesuhteiden kehittymiseen, että projekteissa tehtävän työn tehokkuuteen.

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Kuusamo, October 4, 2009

Tuomas Ahola



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# 1 INTRODUCTION

## 1.1 *Background*

Projects have a significant role in the creation of wealth and well-being in modern societies. Major investments in infrastructure such as roads, water supply and power supply are generally organized as projects. Projects are also used as vehicles for achieving significant leaps in science and technology. Project Apollo, the Human Genome Project, and the development and assembly of the International Space Station are examples of large projects of this kind. In addition to their importance as societal investments or for facilitating scientific progress, project-based organizing is also a salient feature of many of today's industries. For example in construction, shipbuilding, management consulting, film, and software industries, work is generally organized as projects. Several authors have shown that project-based organizing is very prevalent in modern societies (Hadjikhani, 1996; Whittington, Pettigrew, Peck, Fenton, and Conyon, 1999; Lundin and Steinthórsson, 2003; Whitley, 2006; Arto and Kujala, 2008).

An important feature characterizing a considerable proportion of projects is that they are *jointly carried out by more than one firm*. By examining large projects or international projects in general, it is actually rather difficult to find examples of projects delivered by a single firm. Instead, firms operating in many project-based industries tend to focus on their core value-creating activities and processes, while the remaining activities are carried out by other firms in their environments (see e.g. Miller, Hobday, Leroux-Demers, and Olleros, 1995; Gadde and Jellbo, 2002; Ahola, Kujala, Laaksonen, Eloranta, 2006; Ruuska, Arto, Aaltonen, and Lehtonen, 2009). In industries characterized by low volume production of technologically highly complex systems such as telecommunication, aviation, construction, rail transportation, architectural services, computers, and oil and gas, large firms often adopt the role of a systems integrator (see e.g. Davies, 2004; Brady et al. 2005; Hobday et al. 2005; Woiceshyn and Daellebbach, 2005). Systems integrators create value by taking responsibility of the design of the system architecture and integration of the heterogeneous capabilities of a broad range of external actors in a manner that allows the delivery of a system that satisfies the requirements of

their customers (see e.g. Brady, Davies, and Gann, 2005; Hobday, Davies, and Prencipe, 2005; Davies, Brady, and Hobday, 2006). Whenever firms are either unable or unwilling to commit to carrying out projects individually, temporary project organizations involving multiple firms need to be set up for the purpose of delivering the project to its client. After the project has been delivered to the client, these organizations are disbanded. The primary focus of this dissertation is on these temporary arrangements, from now on referred to as *project networks*, that bring together the resources, capabilities, and knowledge of multiple firms, and function as a prevalent means of organizing projects in many of today's industries. Researchers have demonstrated that project networks are widely used for organizing production in industries such as construction (Eccles, 1981), shipbuilding (Tikkanen, 1997), fashion (Uzzi, 1997), film (Miles and Snow, 1986), advertising (Grabher 2002b), oil and gas (Olsen, Haugland, Karlsen, and Husøy, 2005; Ahola et al., 2006), sport events and festivals (Pitsis, Clegg, Marosszeky, and Rura-Polley, 2003), and television production (Windeler and Sydow, 2001).

During the last fifteen years, in which most of the academic work on project networks has been published, influential articles elaborating the concept of a project network have appeared in several academic journals, in particular the *Scandinavian Journal of Management* (Hellgren and Stjernberg, 1995; Larson and Wikström, 2007), *Organization Studies* (Windeler and Sydow, 2001; Grabher, 2004), *Regional Studies* (Grabher, 2002a; Grabher, 2002b; Sydow and Staber, 2002), *International Journal of Project Management* (Blackburn, 2002; Manning, 2005; Ruuska et al., 2009), and *International Journal of Managing Projects in Business* (Artto, Eloranta, and Kujala, 2008). In general, articles addressing project networks have relied primarily on literature on organization theory, especially when adopting a viewpoint of projects as temporary open systems, literature on project management, contributions of the International Marketing and Purchasing group, literature on inter-organizational relationships, and literature on contractual relations – often adopting a transaction cost economics viewpoint.

While our knowledge of project network as a form of project organization has slowly started to develop, there are still several questions that have thus far received only scant attention from academics (Söderlund, 2004; Artto and Wikström, 2005). First, contribu-

tions elaborating the salient characteristics that distinguish project network from other forms of project organization are still few in number. In addition to the few articles with an explicit focus on project network (see e.g. Hellgren and Stjernberg, 1995; Windeler and Sydow, 2001; Manning, 2005) there exists a considerable number of books and articles that represent the broad stream of literature on project management. These publications discuss several central factors, such as the organizations of tasks and goals related to both the deliverable of the project and to the project organization; however, these contributions rarely consider how these factors may be distinctive to project networks.

Second, while it has been shown that inter-organizational relationships play a considerable role in project networks, the extant literature has not adequately identified and described causal mechanisms through which inter-organizational relationships and the functioning of project networks may be related (see e.g. Hellgren and Stjernberg, 1995; Bengtson, Havila, and Åberg, 2001; Grabher, 2002a; Ruuska et al. 2009). For example, the literature has shown that experiences obtained during past projects, i.e. the shadow of the past, can affect the selection of actors for a project network (Eccles, 1981), how expectations of future collaboration, i.e. the shadow of the future, can affect the behavior of firms participating in a project network (Bengtson et al., 2001), and how a lack of long-term inter-organizational relationships between firms participating in a project network may even lead to project failure (Söderlund and Andersson, 1998). However, contributions discussing mechanisms through which inter-organizational relationships may affect work carried out during different phases of the project life cycle are virtually nonexistent. In addition, with the exception of Bengtson et al. (2001) who elaborate how inter-organizational relationships between project network actors may outlive the duration of the project, and Eloranta (2007) who argues how the periodic nature of project business creates difficulties for firms to develop inter-organizational relationships characterized by trust and commitment, no studies appear to describe how project networks may affect the development of inter-organizational relationships between actors participating to the project network. One could expect that, for example, repeated positive experiences obtained by working with other project network actors may lead to the development of strong inter-organizational relationships to the actors in question.

Third, extant contributions have not adequately explored the various, often unexpected events that may either unfavorably or favorably contribute to the implementation phase of the project life cycle. Many sources have presented evidence highlighting the often poor performance of large and complex projects, particularly in regard to maintaining budgets and schedules (see e.g. Morris and Hough, 1987; Morris, 1994; Flyvbjerg, Bruzelius, and Rothengatter, 2003). Orr (2005) and Orr and Scott (2008) reported 23 cases from large international projects in which participating actors had reported unexpected costs and demonstrated evidence that a high proportion of these costs in these cases had incurred during the implementation phase of the project life cycle. This is consistent with several other authors who have demonstrated that the implementation phase of the project life cycle often involves conflicts between both participating project actors and among the project objectives (see e.g. Thamhain and Wilemon, 1975; Morris, 1983; Hällgren and Maaninen-Olsson, 2005; Hällgren, 2007), and the literature emphasizing the role of the project manager in solving these conflicts as they arise (see e.g. Gaddis, 1959; Slevin and Pinto, 1987; Söderholm, 2008).

Finally, the contributions discussing how efficiency can be evaluated in large project contexts involving multiple actors can be evaluated tend to emphasize factors that are straightforward to operationalize and measure using a survey instrument, such as adherence to budget and schedule (Pinto and Mantel, 1990; Shenhar, Dvir, Levy, and Maltz, 2001; Dvir and Lecher, 2004). Pinto and Mantel (1990) also propose two further measures of efficiency: meeting the technical goals of the project and maintaining smooth working relationships within the (project) team and parent organization. Shenhar et al. (2001) & Dvir and Lechler (2004) operationalize efficiency with only two variables: adherence to budget and adherence to schedule. While undoubtedly highly valuable, these measures provide virtually no information concerning the reasons or underlying mechanisms explaining efficiency, or lack of it, and as such, are of limited value for improving project performance.

The present study attempts to provide new insight related to gaps in literature discussed above by bridging four discourses: literature on project business, literature on inter-organizational relationships, literature on critical incidents and literature on transaction

cost economics, and via empirically observing the functioning of four project networks. The next section (Section 1.2) presents the detailed objectives and research questions guiding this study.

The motivation of the author to study project networks can be described as follows. During the past five years and two consecutive research projects, the author has investigated projects that involve multiple organizational actors. The first research project, carried out during 2004-2005, focused on project networks in the construction industry that delivered real estate development projects. This research project triggered the author's interest to attempt to develop the arguably ambiguous concept of a project network further. In the more recent research project (2006-2008) the author conducted more conceptual work and collected the empirical data reported in this dissertation. This project focused on measuring the performance of project networks in the Finnish shipbuilding industry, in which project networks are used exclusively for the production of new vessels. Meetings and interviews with more than eighty individuals involved in the production of the world's largest and most demanding cruise vessels proved that acting as a part of a project network in this context is highly challenging, and that firms participating in a typical shipbuilding project often have to encounter and deal with severe, unexpected difficulties during the implementation phase of the project life cycle. These meetings also pointed out that within the industry there exists both a strong will and a strong need to continuously improve prevalent ways of working. As a result, it can be expected that contributions which help firms to employ project networks as a part of their business activities face demand from the ranks of industry executives as well as academics.

## **1.2 Objective and scope**

Based on the preceding section, the objective of this study is to explore the relatedness of inter-organizational relationships between firms participating in project networks and the efficiency of project implementation, and in particular, the role of unexpected events, i.e. critical incidents<sup>1</sup> in such a relation. To meet this objective, both a primary

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<sup>1</sup> See section 1.3.6 for an explicit definition.

and a secondary research question were derived to direct the research process. The primary research question focuses on the role of inter-organizational relationships for the efficiency of project implementation in project networks.

**Primary research question:** *How do inter-organizational relationships between firms participating in a project network influence the efficiency of project implementation?*

The secondary research question concerns whether inter-organizational relationships among project network actors can be considered as static during project implementation, or whether these relationships are more accurately described as dynamic, meaning that they may develop significantly during the implementation of a single project.

**Secondary research question:** *How is the development of inter-organizational relationships between firms participating in a project network influenced by project implementation?*

To accomplish the objective of this study and find answers to these two research questions, salient features characterizing *project network*, which represents the dominant form of project organization in many industries, such as shipbuilding and construction, need to be identified and described, and, in addition, a method for measuring the efficiency of project implementation suitable for project network contexts needs to be developed.

Nine limitations regarding the scope of this study also need to be mentioned here. First, this study investigates project networks that, as defined earlier, include several participating organizational actors. This delimits both delivery projects carried out by individual firms and internal development projects carried out within the boundaries of individual organizations. Second, the empirical part of this study focuses on four project networks within one specific industry, namely shipbuilding, which reduces the generalizability of any results obtained by this study to other contexts, including other project-based industries such as construction. Third, the present study focuses specifically on

the implementation phase of the project life cycle. As a result, other phases of the project life cycle, namely conceptualization, planning, and termination (see e.g. Pinto and Slevin, 1988), are given only limited attention. Fourth, as this study focuses on how inter-organizational relationships may influence efficiency in project networks, other related issues that are likely to be of central importance for understanding and explaining the functioning of project networks such as how inter-organizational relationships might influence effectiveness or the creation of value in project network contexts are left to future studies. Fifth, this study examines efficiency by focusing exclusively on such ex post transaction costs that occur during the implementation phase of the project life cycle. This delimits both ex ante transaction costs and production costs as discussed in detail in section 2.3.3. Sixth, as discussed in greater detail in the literature review chapter, the development of the conceptual framework for this study is based primarily on the literature about projects business, inter-organizational relationships, critical incidents, and transaction cost economics. As a consequence, other equally<sup>2</sup> applicable theories are left to reduced attention. Seventh, due to the mainly qualitative nature of this study and the utilization interviews as the primary method for collecting empirical data, the studied case project networks are limited in size to four organizations and three inter-organizational relationships per network. As a result, the structural properties (in terms of number of actors and relationships connecting actors) of studied project networks are constant across cases, making the use of network-level properties such as density and the existence of structural holes unfeasible in this study. Eighth, the empirical research data for this study was collected within the period of approximately one year, and as a result, the development of inter-organizational relationships between involved organizations over several consequent projects could not be observed. Finally, as discussed in detail later in Chapter 3, the focus of empirical observation was directed on unexpected events that occurred in the studied projects as opposed to activities or events considered as routine.

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<sup>2</sup> For a discussion on the selection of theories for the present study, see chapter 2.

### 1.3 Definition of central concepts

Ambiguous and even conflicting definitions for several concepts used throughout this study have been presented in literature. In order to clarify these concepts and facilitate the comparison of results obtained from this study to results obtained from other studies, definitions for the following central concepts are now provided:

- ❖ Inter-organizational relationship (IOR) & inter-organizational network
- ❖ Project
- ❖ Project network & business network
- ❖ Project implementation phase
- ❖ Efficiency & efficiency of project implementation
- ❖ Critical incident & critical incident technique

#### 1.3.1 Inter-organizational relationship & inter-organizational network

Several articles have elaborated the nature of inter-organizational relationships (IOR; e.g. Levine and White, 1961; Schermerhorn, 1975; Van de Ven, 1976; Galaskiewicz, 1985, Powell, 1990). In this study, an inter-organizational relationship is assumed to form between *two organizations that repeatedly interact with each other*. In practice, this interaction typically involves economic transactions between the two organizations. Second, an IOR is considered as a goal-oriented social action system<sup>3</sup>. Third, an IOR is understood as inherently multidimensional<sup>4</sup>. Finally, IORs typically include formally structured arrangements<sup>5</sup> for coordination between the two involved parties. An inter-organizational network is a *set of organizations, from which two or more nodes are connected by inter-organizational relationships*.

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<sup>3</sup> Consistently with Van de Ven (1976) this highlights the importance of social relationships between individuals. See section 1.4 for a discussion concerning the assumptions held by the author.

<sup>4</sup> Dimensions of IORs often used in literature include, for example, trust, commitment and dependence. See section 2.3.1 for a detailed discussion.

<sup>5</sup> Contract is an example of such an arrangement.



### 1.3.2 Project

*Project* is a temporary organization set up to fulfill a specific goal, often involving the delivery of a product or a system to a client (Cleland and King 1983; Morris and Hough, 1987; Pinto and Prescott, 1988; Packendorff, 1995). Deliverables of projects can often be characterized as unique, even though the degree of uniqueness varies considerably (Cova and Holstius, 1993; Shenhar, 2001<sup>6</sup>). Further, projects tend to be subject to several performance goals (Pinto and Prescott, 1988; PMBOK, 2004) and the execution of work typically involves complex interdependencies between activities, giving rise to challenges in planning and managing them (e.g. Stinchcombe, 1985; Pinto and Prescott, 1988; Eloranta, 2007; Ruuska et al., 2009). Finally, projects can be conceptualized to follow a life cycle that can be divided into multiple sequential phases, i.e. the project life cycle (see e.g. Morris, 1983; Pinto and Slevin, 1987; PMBOK, 2004; APM, 2006).

### 1.3.3 Project network & business network

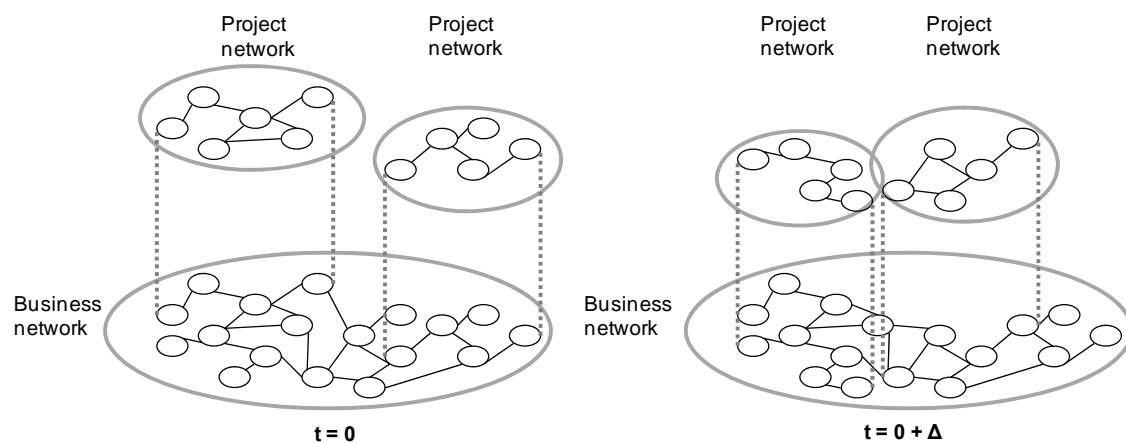
Projects can be categorized based on whether they are delivered by a single organization or jointly by multiple organizations. Consistently with several authors (see e.g. Hellgren and Stjernberg, 1995; Grabher, 2002a; Ruuska et al. 2009) a project of the latter type is referred to in this study as a *project network*. Thus, project network is a temporary organization that exists for the duration of one specific project, and encompasses all organizations and the inter-organizational relationships between these organizations that participate in the delivery of the project. This includes all actors ranging from those that are central to the project network a play a very important role in the project (e.g. main contractor), to peripheral actors such as subcontractors that deliver materials for the project. A typical project network in a project-based industry such as construction or shipbuilding involves several dozens or even hundreds of firms. The salient characteristics of project networks are discussed further in section 2.2.

The concept of a project network is related to the concept of a *business network*. A business network consists of all organizations that operate in a specific project-based

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<sup>6</sup> In the article Shenhar discusses “technological uncertainty”. In projects characterized by a low degree of uniqueness, technological uncertainty can be considered as low.

industry and geographical region and the inter-organizational relationships connecting these organizations together. As a result, the existence of business networks is not tied to any specific project delivery as the existence of project networks always is. Business networks are, however, not static but they are constantly shaped as organizations either enter or exit the network, or as the inter-organizational relationships between organizations gradually develop. Organizations that are a part of a business network form temporary project networks to deliver projects as illustrated in Figure 1 below.



**Figure 1 – Organizations that are a part of a business network form project networks to deliver projects**

Source: adapted from Eloranta, 2007

The concept of a project network overlaps partially with the following concepts: *inter-firm project* (Dahlgren and Söderlund, 2001), *temporary multiorganization* (Cherns and Bryant, 1984), *project coalition* (Winch, 1989), *multi-organization enterprise* (Grün, 2004), and *quasifirm* (Eccles, 1981). The emphasis in these concepts differs slightly: Dahlgren and Söderlund focus on the involvement of several firms, Cherns and Bryant emphasize the limited duration of the project, Winch uses the notion of coalition to highlight the requirement for inter-firm collaboration and the use of contracts in the project organization, while Grün places emphasis on the often considerable financial significance of the project for the participating firms. The concept of a quasifirm is more established than any of the former concepts, especially in literature on inter-organizational exchange, but differs clearly from the concept of a project network.

While a project network exists for the duration of a *specific*<sup>7</sup> project, a quasifirm is not tied to any specific transaction. A quasifirm can, for example, encompass repeated transactions over several consequent projects between a general contractor and a stable set of special trade subcontractors (Eccles, 1981). The concept of a business network also overlaps partially with existing concepts such as *industry network* in a project-based industry (Bower and Young, 1995) and *project ecology* (Grabher, 2002b). The characteristics of business networks are discussed further in section 2.1.

#### **1.3.4 Project implementation phase**

Projects are generally conceptually divided into several distinct and consequent phases that constitute the project life cycle (Morris and Hough, 1987; Slevin and Pinto, 1987; Morris, 1994). Project Management Institute's Project Management Body of Knowledge (PMBOK, 2004) lists five project management process groups: initiating, planning, executing, closing, and monitoring & controlling (PMBOK, 2004). Association for Project Management's Body of Knowledge distinguishes between six project phases: concept, definition, implementation, handover & closeout, operations, and termination (APM, 2006). Pinto and Slevin (1987) in their widely cited paper divide the project life cycle into four phases: conceptualization, planning, execution, and termination. As there clearly does not exist any universally accepted practice for dividing the project life cycle into phases, it can be argued that several concepts central to studies focusing on projects such as project implementation or project execution are likely to hold different and potentially conflicting meanings for different individuals.

This study adopts the following definition for *project implementation phase* presented in Association for Project Management's Body of Knowledge: "In the project implementation phase the Project Management Plan (PMP) is executed, monitored, and controlled. In this phase the design is finalized and used to build the deliverables" (APM, 2006, p. 86). Further, in this study the terms *project implementation* and *project implementation phase* are used interchangeably.

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<sup>7</sup> As discussed in section 2.2 project networks are, however, often partially reconstructed from one project to the next.

### 1.3.5 Efficiency & efficiency of project implementation

The concept of *efficiency* is central to most economic approaches to the study of organization (Plott, 1986)<sup>8</sup>, and is the primary focus, for example, in transaction cost economics (Williamson, 1975). According to Möller and Törrönen (2003, p. 111) efficiency “refers to the efficacious use of current resources, in other words, getting more out the resources used.” The concept of efficiency is distinct but related to the concept of *effectiveness*, which refers to the ability to achieve pre-determined goals or objectives (Jugdev and Müller, 2005). Efficiency is widely considered as synonymous to doing things right whereas effectiveness is considered as synonymous to doing the right things (Drucker, 1974; Belout, 1998; Jugdev and Müller, 2005).

*Efficiency of project implementation* is a construct developed for this study (defined later in section 2.3.4.) that directs attention towards the use of resources in activities carried out during the implementation phase of the life cycle of a project<sup>9</sup>. For example, if we consider two project networks A and B that are otherwise identical, and produce identical outcomes, but A utilizes fewer resources during the implementation phase as compared to B, the *efficiency of project implementation* is higher in A than in B. Both the concept of efficiency and the construct efficiency of project implementation are elaborated further in sections 2.3.3 and 2.3.4.

### 1.3.6 Critical incident & critical incident technique

The concepts of *critical incident* and the *critical incident technique* are central for this study. *Critical incident* refers to an exceptional or notable event that either occurs or has occurred in the past that can be empirically studied, while the *critical incident technique* refers to a set of procedures for empirically collecting observations of critical incidents (Flanagan, 1954). Thus, the critical incident technique can be considered to constitute a collection of research methods and directions on how to use them. Both the concept of a

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<sup>8</sup> Efficiency in a project context is discussed in section 2.3.4.

<sup>9</sup> Whereas the *effectiveness* of project implementation would focus on whether the activities that are carried out supports the achievement of goals of objectives of actors participating to the project (Jugdev and Müller, 2005). As discussed in section 1.2, the focus of this study is on efficiency.

critical incident and the critical incident technique have their origins in the 1940's and 1950's and have since been used in empirical studies conducted in various fields of research such as sociology, psychology, medicine, and marketing (Stiegelbauer, Goldstein, and Huling, 1982; Miles and Huberman, 1994; Gremler, 2004; Butterfield, Borgen, Amundson, and Maglio, 2005).

#### **1.4 Assumptions affecting the selection of theories and research methods**

It is the view of the author that reality consists of both an objective and a subjective component. There exists one objective reality which is interdependent with more than six billion subjective realities that are socially constructed by humans<sup>10</sup>. Further, the author considers that scientific knowledge can be produced by studying either the objective component of reality, which is observable via various instruments including, e.g. a scale and a linear accelerator, or the subjective component of reality, which can be studied with methods that enable the researcher to obtain information on the socially constructed realities held by the human actors. For example, in-depth interviews may often be used for this purpose. Finally, the author views human actors as voluntaristic and boundedly rational social beings which are simultaneously guided by selfish and altruistic motives.

All individuals hold implicit or explicit assumptions concerning ontology, epistemology, and human nature (Burrell and Morgan, 1979). Assumptions about ontology concern what can be known, assumptions about epistemology concern how knowledge can be acquired, and assumptions regarding human nature concern motives and limitations of human actors which, ultimately, can be considered as the focus of social sciences. These assumptions have considerable implications for both the selection and application of

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<sup>10</sup> This view is analogous to Berger and Luckmann (1966) who have discussed society as a human product. To illustrate the differences between objective and subjective realities consider a tall tree in a forest. Its existence can be verified empirically by anyone and following this logic we can argue that it exists objectively. Despite how any individual subjectively constructs her or his reality he or she cannot walk through this tree. One can, however, based on something in her or his subjective reality make the decision to cut down this tree and do so.

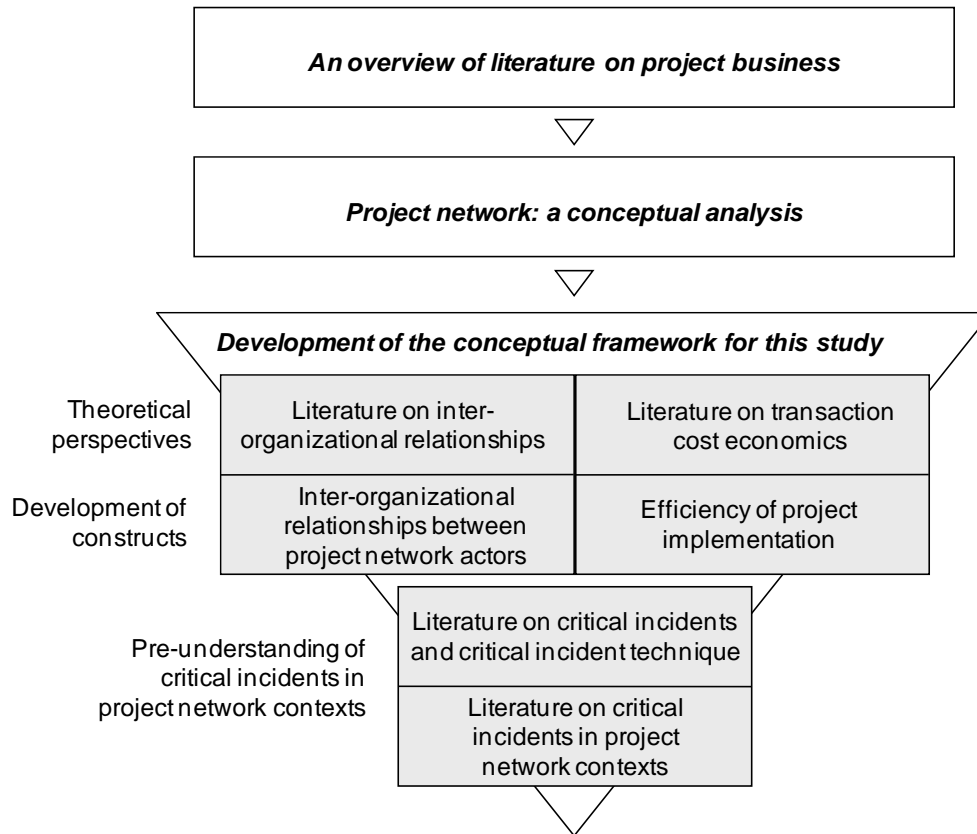
theories and research methods - and for the evaluation of the conclusions that have been drawn based on an empirical study. As a result, the statement of such assumptions in research that is not limited to the study of the objective component of reality, as is the case in this study, is of paramount importance (Maitland, Bryson, and Van de Ven, 1985; Bacharach, 1989). A clear statement of these assumptions allows, for example the evaluation of whether several theories used in combination are compatible with each other as discussed in the beginning of Chapter 2 (Maitland et al., 1985).

### **1.5      *Structure of the dissertation***

This dissertation consists of five chapters. Chapter 1 introduces the study to the reader. Chapter 2 lays the theoretical foundation of this study, relying on literature on project business, literature on project networks, literature on inter-organizational relationships, literature on transaction cost economics, and literature on critical incidents. Then, based on the literature review, a conceptual framework for this study is developed. Chapter 3 discusses the research design. First, the research approach and the rationale which led to its selection are elaborated on. Then, the context of the project-based Finnish shipbuilding industry and the selection of cases, organizations, and informants are discussed. After that, the process and methods used for collecting the empirical data for this study are elaborated. Finally, the analysis of empirical data is discussed. Chapter 4 presents the results of this study. First, the role of critical incidents that occur during project implementation is explored, and then results are presented on a more holistic project network level. Chapter 5 first discusses the results obtained in this study and reviews their theoretical contribution and managerial implications. Following this discussion, an evaluation of this study is presented. Finally, directions for future research are suggested.

## 2 LITERATURE REVIEW

This chapter lays the theoretical foundation for this dissertation. First, a review of literature on project business is provided and the concept of a *project network* is positioned within this literature. Second, two theoretical perspectives or ‘lenses’, through which project networks are empirically studied in this study are introduced to the reader. More specifically, these perspectives rely on literature on inter-organizational relationships and transaction cost economics. Based on viewing literature on project business through these theoretical lenses, two constructs to be applied in the empirical part of this study are developed. In addition, literature focusing both the concept of critical incident as a phenomenon that can be empirically studied and the critical incident technique as a research method are briefly introduced and prior research on critical incidents in a project context is reviewed. A discussion on the application of the critical incident technique from a methodological viewpoint is provided to the reader later in section 3.6.3. Finally, a conceptual framework that helped to focus and guide the empirical part of this study is introduced to the reader. Figure 2 below illustrates the structure of this chapter.



**Figure 2 – Structure of Chapter 2**

A brief description of the process for selecting the two theoretical perspectives used in this study is provided before moving on to reviewing literature on project business. In addition to the aforementioned theories used in this study, there are a number of theories that possess considerable potential for providing answers to the two research questions guiding this study (posed in Section 1.2). These alternative or complementary perspectives include institutional theory, literature on industrial marketing<sup>11</sup>, literature on project marketing, literature on social capital and corporate social capital, literature on organizational culture, literature on actor-network-theory, literature on supply chain management, and literature on purchasing. With regard to the selection of the core theories that lay the foundation of any empirical study, it is argued here that scientific work can be considered quite analogous to the art of photography. Different theories or streams of literature used in scientific research may be considered to represent optic

<sup>11</sup> By industrial marketing, the author refers to the numerous and highly insightful contributions of the International Marketing and Purchasing (IMP) group.



lenses used in photography. When looking through either theoretical or optic lenses, *alternative, complementary*, and in many cases *equally valuable* descriptions of the observed phenomenon may be obtained. Thus, the selection of a lens for any given situation is therefore primarily a matter of the scholar's, or photographer's, preference and experience. Theories can be considered to function as tools of abstraction that help us in studying the complex world we live in as they focus our attention on a *limited* set of issues held as important. However, it is important to note that even though scientific theories are always built on a more or less explicit or implicit set of assumptions, some considerations do need to be taken when combining several theoretical perspectives. If the assumptions underlying selected theories contrast sharply, the theories should not be united or a distorted view of reality may result (for a more elaborate discussion on this topic, see e.g. Maitland et al., 1985 and Bacharach, 1989). In the present study, the two theoretical perspectives were chosen primarily because the author is comfortable with them, expects that they are able to bring valuable novel insight into our understanding of project networks, and finally as the underlying assumptions behind these streams of literature are sufficiently<sup>12</sup> compatible with each other (Larson, 1992; Adler, 2001; Butterfield et al., 2005) and with the assumptions held by the author<sup>13</sup>. The alternative perspectives listed above are all likely to increase our understanding of project networks and are hopefully included in future studies. They are, however, excluded from the present one. Only industrial marketing makes a partial exception here. This body of literature is often cited in the literature on inter-organizational relationships. Industrial marketing, however, can hardly be considered as a core theory in the present study, as

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<sup>12</sup> All of these streams of literature encompass a considerable number of articles and other contributions. In addition, many scholars do not explicitly state their ontological and epistemological assumptions. As a result it is not possible to objectively identify the underlying assumptions of many of the individuals who have contributed to these streams. However, some clearly dominant assumptions in these streams of literature can be identified, especially in transaction cost economics, where they are very clearly stated by Oliver Williamson (1975). To further complicate matters, literature on inter-organizational relationships can be categorized into several schools (see Oliver and Ebers, 1998). These schools are based on different theoretical perspectives and as a result tend to adopt the assumptions common among different perspectives.

<sup>13</sup> See section 1.4.

several of its core concepts, e.g. as the actor-resource-activity (ARA) model, are neither discussed nor applied.

## **2.1 Research on project business**

This section first presents an overview of the evolution of literature on projects business and then goes on to discuss research on project networks in detail.

Projects have played a significant role in the history of mankind for more than three thousand years. The construction of practically all wonders of the world such as the Egyptian pyramids and the Great Wall of China were organized as projects. Advances in engineering science in the 15th and 16th centuries, and the development of new materials and technology in 19th and 20th centuries enabled the realization of even more complex undertakings (Morris, 1994). As an academic discipline, the history of project management (PM) is significantly shorter. Developments such as the Gantt chart in 1917, Program Review and Evaluation Technique (PERT) and Critical Path Method (CPM) in the 1950's, and Work Breakdown Structure (WBS) in the 1960's represent significant milestones in the development of the discipline (Morris, 1994; Packendorff, 1995; Söderlund, 2004; Artto and Kujala, 2008). During that time the focus of most research and development related to PM was on large governmental programs such as high-tech military systems. Research was primarily guided by the pragmatic need to increase the efficiency of work, considered possible through the development of improved planning and scheduling techniques (Morris, 1994; Engwall, 1995). The Project Management Institute (PMI), which has had a major influence on the development of the discipline, for example, through publishing the widely adopted Project Management Body of Knowledge (PMBOK, 2004), was founded in 1969. Later, in the 1970's, the main interest of research was to a large extent directed towards developing PM software and applications. In the 1980's the focus switched to project failure/success factors, build-own-operate-transfer (BOOT) projects, risk management and costing practices such as design-to-cost (DTC), earned value (EV) and life-cycle-costing (LCC) (Morris, 1994; Kloppenborg and Opfer, 2002; Söderlund, 2004; Artto and Kujala, 2008). Later, in the 1990's PM research focusing on human resources and their management started to become increasingly common.

Even though projects are all temporally limited, there are also substantial differences between them. Projects have been classified according to technological uncertainty, complexity, level of system scope, uncertainty of project environment (Shenhar, 2001; Jensen, Johansson, and Löfström, 2006; Crespín-Mazet and Ghauri, 2007). Most academic research on projects and their management has focused on the management of a single project, predominantly adopting the viewpoint of a single firm, following Evaristo and Fenema (1999), Söderlund (2004), Artto (2008), and Artto and Kujala (2008). Despite this tendency, research on project business can nevertheless be classified into four categories depending on whether one or multiple projects and one or multiple firms are involved. These categories are: *research on management of a project*, *research on management of a project-based firm*, *research on management of a project network*, and *research on management of a business network*.<sup>14</sup> Figure 3 below illustrates the categorization of research on project business.

	<b>One firm</b>	<b>Multiple firms</b>
<b>One project</b>	Management of a project	Management of a project network
<b>Multiple projects</b>	Management of a project-based firm	Management of a business network

**Figure 3 – Categorization of research on project business<sup>15</sup>**

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<sup>14</sup> Terminology used by Söderlund (2004), Artto (2008), and Artto & Kujala (2008) differs somewhat. Artto (2008) describes research on projects and their management from the perspective of *project business*, while Söderlund adopts a slightly less *managerial/normative* perspective towards categorizing extant research. This difference can be observed, for example, in the naming of categories (cf. “management of a project-based firm” and “multi-project firms”) suggested by the authors.

<sup>15</sup> This is adapted from Artto (2008).

### ***Research on management of a project***

The majority of research on management of a project has focused on individual projects, while simultaneously either explicitly or implicitly emphasizing a single-firm viewpoint (Winch, 1989; Engwall, 2003; Artto and Kujala, 2008). Research in this category is typically concerned with two principal problems. Firstly, several contributions address the question of how to structure and plan the project in a manner which ensures that it will meet its pre-assigned performance criteria and utilize available resources efficiently. Project management literature is abundant with tools and techniques for this purpose, from which many were mentioned earlier in this section. Secondly, several contributions discuss how to ensure or control that the project is executed efficiently and according to plan (see e.g. Wheelwright and Clark, 1992; Turner and Keegan, 2001; Whitley, 2006). A third significant stream of research on project management focuses on project success and project failure factors (see e.g. Pinto and Slevin, 1987; Pinto and Mantel, 1990; Kharbanda and Pinto, 1996). Most research on project management can be described as predominantly normative in nature (Packendorff, 1995).

### ***Research on management of a project-based firm***

Another significant stream of project research focuses on the management of multiple projects by a single project-based firm. In this category of research, the unit of analysis is the firm rather than the project (Artto, Heinonen, Arenius, Kovanen, and Nyberg, 1998; Artto and Wikström, 2005). A project-based firm can be defined as a firm that utilizes projects as vehicles for accomplishing its business objectives (Artto and Wikström, 2005). Research on project-based firms has addressed several managerial problems related to running multiple projects simultaneously, including: determining a suitable organizational structure (Hobday, 2000; Gann and Salter, 2000; Turner and Keegan, 2001), selecting and prioritizing projects and resources available to them (Cooper, Edgett, and Kleinschmidt 1997a, 1997b; Archer and Ghasemzadeh, 1999; Aalto, Martinsuo, and Artto, 2003, Martinsuo and Lehtonen, 2007a), achieving objectives through several interdependent projects (i.e. a program; see Pellegrinelli, 1997; Artto and Dietrich, 2004; Dietrich, 2007; Martinsuo and Lehtonen, 2007b), marketing and purchasing projects (e.g. Cova and Holstius, 1993; Hadjikhani, 1996; Cova and Hoskins, 1997; Mandják and Veres, 1998; Cova, Ghauri, and Salle, 2002; Skaates and

Tikkanen, 2003; Laitinen, 2007; Ahola, Laitinen, Kujala, and Wikström, 2008), capabilities, innovation and learning in projects and project-based organizations (Barlow, 2000; Gann and Salter, 2000; Arenius, Artto, Lahti, and Meklin, 2002; Keegan and Turner, 2002; Davies and Hobday, 2005; Blindenbach-Driessen and Van den Ende, 2006; Martinsuo, Hensman, Artto, Kujala, and Jaafari, 2006), supplier network management in the context of a project-based organization (Artto et al., 1998; Eloranta, 2007; Artto et al., 2008), and integrating complex products, systems, and services (e.g. Hobday, 1998; Brady et al., 2005; Artto, Wikström, Hellström, and Kujala, 2007).

### ***Research on management of a project network***

This emerging stream of research on projects and their management focuses on projects undertaken by multiple firms, often referred to as *project networks* (see e.g. Hellgren and Stjernberg, 1995; Eloranta, 2007; Ruuska et al, 2009), *inter-firm projects* (see e.g. Söderlund, 2004), *temporary multiorganizations* (Cherns and Bryant, 1984), *project coalitions* (Winch, 1989), or *multi-organization enterprises* (Grün, 2004)<sup>16</sup>. As project network is the phenomenon of primary interest in this study, literature on project networks is reviewed in detail later (see section 2.2).

### ***Research on management of a business network***

Project business networks, which encompass multiple firms engaging in multiple projects, have recently been subject to increasing academic interest. The concept of a business network shares similarities with other partially overlapping concepts of *project ecology*, *industrial district*, *innovative milieux* (or innovative milieu), *industry network*, *external network*, *cluster*, *learning region*, and *regional innovation system* (see Ebers and Jarillo, 1998; Grabher, 2002b; Soda et al., 2004). A characteristic that is specific to business networks is that participating firms engage from time to time in mutual projects (Artto, 2008). Firms included in business networks typically organize production in the form of temporary project networks, which in turn shape the inter-organizational relationships between these actors (Eccles, 1981; Hellgren and Stjernberg, 1995; Dubois and Gadde, 2000; Bengtson et al., 2001; Grabher, 2002b). Further,

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<sup>16</sup> See section 1.3.3 for a discussion on these concepts.

business networks are simultaneously characterized by long-term inter-organizational relationships that accelerate interactive learning and innovation, and are driven by rivalry between participating organizations (Grabher, 2002b). Construction (Eccles 1981; Hellgren and Stjernberg, 1995; Barlow and Jashapara, 1998; Winch, 1998; Dubois and Gadde, 2000; Bengtson et al., 2001), shipbuilding (Tikkanen, 1997; Malinen 1998; Toivonen, 2000), fashion (Uzzi, 1997), film (Miles and Snow, 1986; Powell 1990), advertising (Grabher 2002b); and television production (Windeler and Sydow, 2001; Sydow and Staber, 2002; Soda, Usai, and Zaheer, 2004; Manning, 2007) are examples of industries where the existence of business networks can be observed. Most studies that discuss business networks have focused on either describing their salient features or on discussing the interdependencies between business networks and project networks (Hellgren and Stjernberg, 1995; Barlow and Jashapara, 1998; Ebers and Jarillo, 1998; Winch, 1998; Halinen, Salmi, and Havila, 1999; Bengtson et al., 2001; Grabher 2002a, 2002b; Sydow and Staber, 2002; Söderlund, 2004; Ahola et al., 2006; Artto et al., 2008).

## **2.2 Research on project networks**

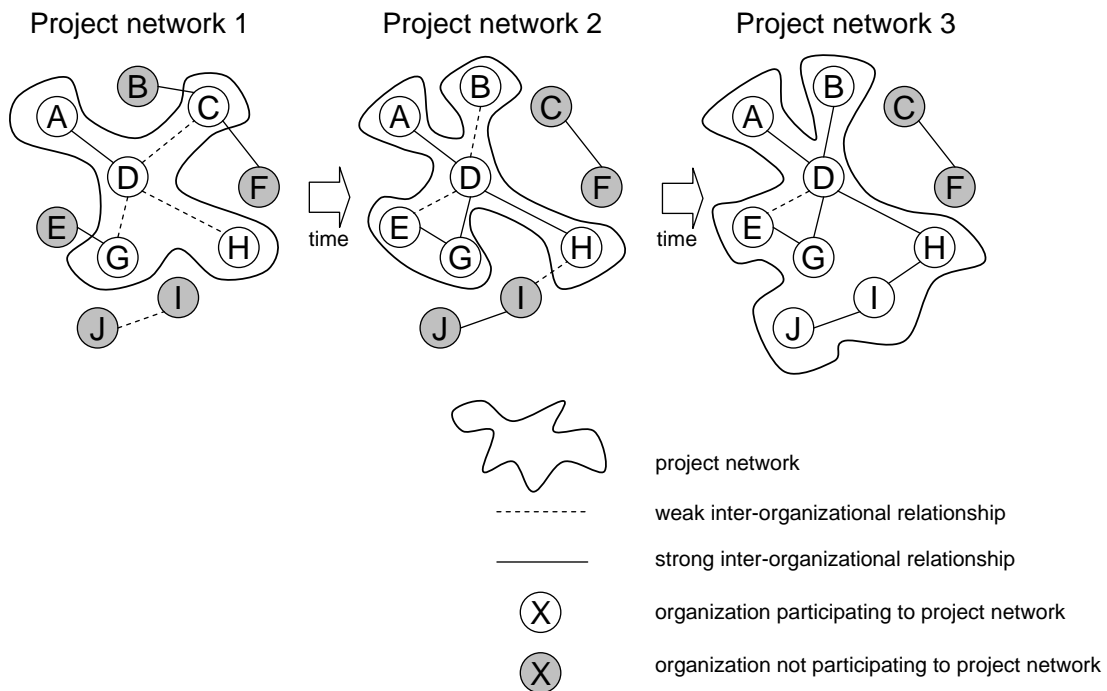
A project carried out by multiple organizations was earlier defined as a project network<sup>17</sup>. In several project-based industries, such as construction (Eccles, 1981), shipbuilding (Tikkanen, 1997), fashion (Uzzi, 1997), film (Miles and Snow, 1986), advertising (Grabher 2002b), oil and gas (Olsen et al., 2005), sport events and festivals (Larson and Wikström, 2007), and television production (Windeler and Sydow, 2001), the project network represents a prevalent form of organizing production. This section reviews literature focusing on project networks, placing emphasis on contributions that either discuss features specific to project networks, or examine project networks empirically.

Even though all projects, including project networks, are inherently temporary organizations (Lundin and Söderholm, 1995; Hellgren and Stjernberg, 1995; Jones 1996; Lundin and Steinthórsson, 2003; Cova and Salle, 2004; Eloranta, 2007; Artto et al, 2008), both

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<sup>17</sup> See section 1.3.3.

the composition and functioning of project networks are affected by both the shared history of involved actors and the actors' expectations of collaboration beyond the current project. Hellgren and Stjernberg (1995) have argued that project networks are partially reconstructed from one project to the next, meaning that it is typical that several of the actors participating to a given project network participate also to subsequent project networks. Thus, experiences obtained during past projects contribute to the selection of actors for future project networks. For example, Eccles (1981) has demonstrated how in the construction industry, the main contractors tend to use specific trade subcontractors from one project to the next. In addition, it has been shown that inter-organizational relationships between project network actors, developed during the course of subsequent projects, may also lead to opportunities for learning, a reduced need for supervision costs, and reduced risk of project failure (Eccles, 1981; Söderlund and Andersson, 1998; Windeler and Sydow, 2001, Bengtson et al., 2001; Sydow and Staber, 2002). However, obtaining these benefits in practice may not be straightforward because the discontinuous nature of project-business may lead to difficulties in developing strong inter-organizational relationships between participating actors (Hadjikhani, 1996; Ahola et al., 2006; Eloranta, 2007). In addition to the history shared by participating actors, the actors' expectations of collaboration past the current project may also affect their behavior, for example, by reducing the willingness to resort to opportunistic behavior (Eccles, 1981; Winch, 1989; Hadjikhani, 1996; Windeler and Sydow, 2001; Dubois and Gadde, 2001; Sydow and Staber, 2002; Grabher, 2002a, 2002b, 2004). Figure 4 below illustrates how project networks are partially reconstructed from one project to the next.



**Figure 4 – The role of time in shaping project networks**

Project networks are set up to complete a predefined task shared by central participating organizational actors - the *raison d'être* of the project network (Hellgren and Stjernberg, 1995, Lundin and Söderholm, 1995; PMBOK, 2004). However, in addition to this shared task, each project network actor possesses, and is guided by, individual short-term and long-term goals, which may conflict with goals of other project network actors (Morris and Hough, 1987; Winch, 1989; Hellgren and Stjernberg, 1995; Lundin and Söderholm, 1995; Flyvbjerg et al., 2003; Orr, 2005; Eloranta, 2007, Artto et al., 2008; Ruuska et al., 2009). For example, Ruuska et al. (2009) discuss how conflicts amongst the goals of project network actors contributed unfavorably towards the implementation phase of a nuclear power plant project.

Similarly to projects carried out by a single firm, tasks in project networks are organized into sequential phases, i.e. the project life cycle (Morris, 1983; Pinto and Slevin, 1987; Morris and Hough 1987). However, as the organization of tasks in a project network always involves the coordination of resources controlled by several organizational actors, both the role and importance of complex interdependencies and non-routine activities is emphasized (Eccles, 1981; Pinto and Prescott, 1988; Packendorff, 1995; Hellgren



and Stjernberg, 1995; Jones, 1996; Dahlgren and Söderlund, 2001). Artto et al. (1998) have introduced the notion of the *project delivery chain* to illustrate how large projects consist of several interrelated sub-projects, often delivered by different organizational actors. Problems related to inter-organizational coordination in large projects has often been argued as factor contributing unfavorably towards the success of large inter-organizational projects (Morris and Hough, 1987; Morris, 1994; Flyvbjerg et al., 2003). In order to cope with the difficulties related to organizing tasks in project networks, it is typical that one central project network actor, for example the main contractor, assumes the role of a systems integrator, responsible for combining the outputs produced by several project network actors into a fully functional product or system that creates value for the client (Davies, 2004; Brady, Davies, and Gann, 2005; Hobday et al., 2005).

Hellgren and Stjernberg (1995) have argued that there exist no definite criteria for identifying and controlling the boundary of a project network. In practice, project networks may involve tens if not hundreds of organizational actors. As a result, identifying the boundaries of a project network at any given period of time is difficult. First, as individual project network actors are typically free to join new actors to the network, for example, by subcontracting work, there exists neither a formal nor a legal definition of the project network that would be shared by all participating actors (Hellgren and Stjernberg, 1995; Jones, 1996). Further the composition of a project network in terms of participating actors is dynamic. As a project proceeds along its life cycle, the composition of the project network typically changes over time. For example, organizations involved in the design phase may not participate during the implementation phase (Hellgren and Stjernberg, 1995).

It is common for project networks to include multiple organizational actors that are highly heterogeneous (Eccles, 1981; Cherns and Bryant, 1984; Winch, 1989; Jones, 1996; Davies, 2004; Brady, Davies, and Gann, 2005; Hobday et al., 2005; Manning and Sydow, 2008). They create value by combining the complementary resources, capabilities, and knowledge of the participating network actors. In addition, inter-organizational relationships connecting project network actors have shown to differ considerably (Manning, and Sydow, 2008). For example, inter-organizational relationships between

project network actors may be characterized by trust and commitment or function as sources of risk in project networks (Eloranta, 2007; Arto et al., 2008).

Finally, no single actor can act as a legitimate authority for project network as a whole (Hellgren and Stjernberg, 1995). Instead, participating actors vary in terms of their power to influence other project network actors, and, in practice, this power is often unevenly distributed in the project network (Hellgren and Stjernberg, 1995; Olander and Landin, 2005). Table 1 below summarizes the salient characteristics of project network as a form of project organization.

**Table 1 – Salient characteristics of project network as a form of project organization**

Characteristic	Project network	Key contributions
Duration of existence	❖ A project network exists for a delimited time (from its formation until the joint goal of the network is either accomplished or abandoned)	Eccles, 1981; Cherns and Bryant, 1984; Winch, 1989; Hellgren and Stjernberg, 1995; Jones, 1996; Eloranta, 2007; Arto et al., 2008
Role of history	<ul style="list-style-type: none"> <li>❖ Experiences of working together affect the inclusion of actors in the project network</li> <li>❖ Long-term relationships between participating actors may lead to opportunities for learning and reduced need for supervision costs</li> <li>❖ Lack of long-term inter-organizational relationships between participating actors may increase probability of project failure</li> </ul>	Eccles, 1981; Hellgren and Stjernberg, 1995; Hadjikhani, 1996; Söderlund and Andersson, 1998; Dubois and Gadde, 2000; Windeler and Sydow, 2001; Bengtson et al., 2001; Sydow and Staber, 2002; Cova and Salle, 2004
Role of future	❖ Expectations of continuity affect the behavior of actors in the project network (e.g. opportunistic behavior may be reduced)	Eccles, 1981; Winch, 1989; Hadjikhani, 1996; Windeler and Sydow, 2001; Dubois and Gadde, 2001; Sydow and Staber, 2002; Grabher, 2002a, 2002b, 2004; Eloranta, 2007

Goals	<ul style="list-style-type: none"> <li>❖ A common task shared by central participating actors (e.g. construction of a building)</li> <li>❖ Individual and potentially conflicting goals possessed by each participating actor</li> <li>❖ Short-term and long-term goals of actors may be divergent</li> </ul>	Morris and Hough, 1987; Winch, 1989; Hellgren and Stjernberg, 1995; Lundin and Söderholm, 1995; Flyvbjerg et al., 2003; PMBOK, 2004; Orr, 2005; Eloranta, 2007; Artto et al., 2008; Ruuska et al., 2009
Organization of tasks	<ul style="list-style-type: none"> <li>❖ Divided into several sequential phases, i.e. the project life cycle</li> <li>❖ Tasks often complex, interdependent, and non-routine in nature</li> <li>❖ It is typical that an actor in the project assumes the role of a system integrator</li> <li>❖ Organization of tasks involves all participating actors</li> </ul>	Eccles, 1981; Morris, 1983; Pinto and Slevin, 1987; Morris and Hough, 1987; Pinto and Prescott, 1988; Morris, 1994; Packendorff, 1995; Hellgren and Stjernberg, 1995; Jones, 1996; Artto et al, 1998; Dahlgren and Söderlund, 2001; Flyvbjerg et al., 2003; Davies, 2004; Brady, Davies, and Gann, 2005; Hobday et al., 2005
Network boundaries	<ul style="list-style-type: none"> <li>❖ The project network as a whole cannot control the entrance or exclusion of actors</li> <li>❖ Individual actors can add and remove new actors to/from the project network</li> <li>❖ The composition of network may change during its life cycle</li> <li>❖ Project networks are neither formally nor legally defined</li> </ul>	Hellgren and Stjernberg, 1995; Jones, 1996
Participating actors and relationships	<ul style="list-style-type: none"> <li>❖ Multiple organizational actors involved</li> <li>❖ Actors typically highly heterogeneous in terms of resources, capabilities, and knowledge</li> <li>❖ There may exist both long-term and emerging relationships between participating actors</li> </ul>	Eccles, 1981; Cherns and Bryant, 1984; Winch, 1989; Jones, 1996; Davies, 2004; Brady, Davies, and Gann, 2005; Hobday et al., 2005; Eloranta, 2007; Artto et al., 2008; Manning and Sydow, 2008

Power	<ul style="list-style-type: none"> <li>❖ No single actor may act as a legitimate authority for the project network as a whole</li> <li>❖ Power is often unevenly distributed in the project network</li> </ul>	Hellgren and Stjernberg, 1995; Olander and Landin, 2005
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Empirical research focusing on project networks has examined dynamism and unexpected changes in project networks (Thamhain and Wilemon, 1975; Slevin and Pinto, 1987; Hellgren and Stjernberg, 1995; Vaaland and Håkansson, 2000; Hällgren and Maaninen-Olsson, 2005; Ahola et al., 2006; Eloranta, Kujala, and Artto, 2006; Artto et al., 2008; Söderholm, 2008), management of stakeholders in project networks (Winch, 2004; Olander and Landin, 2005; Eloranta, Kujala, and Oijala, 2007; Aaltonen, Kujala, and Oijala, 2008; Aaltonen and Sivonen, 2009), bureaucracy and difficulties inherent to project networks (Stinchcombe, 1985), governance structures and coordination mechanisms in project networks (Stinchcombe, 1959; Eccles, 1981; Winch, 1989; Levitt and March, 1995; Söderlund and Andersson, 1998; Hobday, 1998; Dahlgren and Söderlund, 2001; Windeler and Sydow, 2001; Dubois and Gadde, 2001; Bengtson et al., 2001; Turner and Simister, 2001; Sydow and Staber, 2002; Grabher, 2002a, 2002b; Zaghoul and Hartman, 2003; Manning, 2005; Larson and Wikström, 2007; Crespín-Mazet and Ghauri, 2007), inter-organizational relationships between project network actors (Cherns and Bryant, 1984; Söderlund and Andersson, 1998; Hadjikhani, 1996; Cova and Salle, 2000; Bengtson et al., 2001; Ahola et al., 2006; Eloranta et al., 2006; Eloranta, 2007; Larson and Wikström, 2007; Artto et al., 2008;), the influence of stakeholders and the environment on project networks (Hellgren and Stjernberg, 1995; Olander and Landin, 2005; Jensen et al., 2006; Cova and Salle, 2005; Eloranta et al., 2006; Eloranta, 2007; Artto et al., 2008; Söderholm, 2008), capabilities at the project network level (Owusu, 2003; Manning and Sydow, 2008), learning in project networks (Håkansson, Havila, and Pedersen, 1999; Grün, 2004), the effects of project networks on individual careers (Jones, 1996), and the interdependence between temporary project networks and semi-permanent business networks (Cherns and Bryant, 1984; Blomquist and Packendorff, 1998; Gann and Salter, 2000; Windeler and Sydow, 2001; Dubois and Gadde, 2001; Bengtson et al., 2001; Sydow and Staber, 2002; Engwall, 2003; Grabher, 2004; Cova and Salle, 2005; Manning, 2007).

### 2.3 *Development of constructs*

The objectives of this section are to introduce two different, yet complementary theoretical lenses through which to study project networks, and to develop two constructs that were empirically applied in this study. Constructs and variables are considered units of theoretical statements and according to Bacharach (1989) constructs are defined as units *approximated* and variables units *observed* in the empirical world. Furthermore, constructs are related to each other via propositions and variables to each other via hypotheses. The use of constructs and variables focuses (and thus, delimits) empirical research, increases its transparency, and consequently acts as a tool to communicate the research setup to others (Eisenhardt, 1989; Miles and Huberman, 1994). Along with research methods, constructs can be conceptualized as the “tools of the trade” for researchers, used to collect various information concerning phenomena of interest. Eisenhardt (1989) further argues that a priori specification of constructs in qualitative studies permits researchers to measure observed phenomena more accurately.

Whenever possible, it is preferable to utilize existing constructs that have been validated by others in previous studies. Utilization of existing constructs reduces risks related to validity and facilitates the comparison of results obtained from different studies. Unfortunately, no pre-existing constructs were available that could be directly applied to this study<sup>18</sup> and as a result, two constructs: *inter-organizational relationships between project network actors*, and *efficiency of project delivery* were developed. Eisenhardt (1989, p.541) describes the development and sharpening of constructs in qualitative research as a two-part, often iterative process including refining the definition of the construct and building evidence which measures the construct. Further, she differentiates between constructs used in qualitative research and quantitative research. In qualitative research no specific technique, such as factor analysis, can be used for assessing construct validity, and researchers often rely on tables or case descriptions to summarize evidence underlying the construct (Miles and Huberman, 1994). With the mainly qualitative approach adopted in this study, the constructs are used in a somewhat flexible and

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<sup>18</sup> As, unfortunately, is often the case with qualitative research. For examples, see e.g. Sutton & Callahan, (1987) and Miles & Huberman (1994).

iterative manner, allowing their refinement during the collection of the data (Eisenhardt, 1989). The validity of the constructs developed for this study is discussed later in section 5.6.

### **2.3.1 Research on inter-organizational relationships**

Several studies have demonstrated that individuals tend to form inter-personal relationships to other individuals and these relationships affect to how they interact with each other (see e.g. Granovetter 1973; Uzzi, 1997). Further, as organizations are essentially composed of several individuals, it is a logical consequence that organizations are also connected to other organizations by inter-organizational relationships<sup>19</sup>. The importance of inter-personal and inter-organizational relationships is crystallized in *the argument of embeddedness*, according to which the behavior of organizations, institutions, and individuals is affected and constrained by social relations and construing them as independent would be a grievous misunderstanding (Granovetter, 1985). Following this argument, one could expect that focusing research efforts towards describing and understanding relationships that exist between individuals and organizations can provide valuable insight into how transactions are organized. As a project network may be conceptualized as a system of multiple transactions between several organizational actors, the broad literature on inter-organizational relationships arguably provides a valuable lens for analyzing and explaining the characteristics and functioning of project networks.

There exists a vast literature on inter-organizational relationships that can be categorized into several clusters or ‘schools of thought’ (for excellent reviews of IOR literature see e.g. Grandori and Soda, 1995 & Oliver and Ebers, 1998). Schools of thought can be differentiated based on, for example, their theoretical background, antecedent variables, outcomes of interest, applied level of analysis, and how relationships are perceived. As a whole, literature focusing on IORs draws from diverse disciplines such as sociology, economics, marketing, and strategy, and from many theoretical perspectives such as population ecology, transaction cost economics, social exchange theory, institu-

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<sup>19</sup> This argument does not imply that an inter-organizational relationship between two organizations is merely the *sum* of the inter-personal relationships between individuals employed by these organizations.

tional theory, industrial marketing, and resource dependence theory. One consequence resulting from the use of such a broad range of theories is that inter-organizational relationships have been referred to with several terms including: relationship, recurring tie, buyer-seller relationship, and partnership. As for example, while research in the area of ‘economic geography’ (see e.g. Grabher 2002a) focuses on ties between organizations, often characterized by trust or reputation, researchers subscribing to the ‘industrial networks’ school (see e.g. Håkansson and Snehota, 1995) tend to refer to *interfirm* relationships encompassing activity links, resource ties and actor bonds. As a result, it is fairly easy to get lost in the “terminological jungle in which any newcomer can plant a tree” as Nohria (1992:3) described the broad research on inter-organizational relationships. To avoid unnecessary terminological complexity, the term inter-organizational relationship is used *exclusively* in this study.

The interest towards studying inter-organizational relationships can to a large extent traced back to the introduction of the open systems view of organizations, which emerged in the mid 20<sup>th</sup> century, and has since spread rapidly among academics studying organizations (see e.g. Lawrence and Lorsch, 1967; Thompson, 1967; Perrow, 1973). As discussed earlier<sup>20</sup>, inter-organizational relationships form between two organizations that repeatedly interact with each other, and in many areas of literature, such as marketing and strategy, inter-organizational relationships, IORs are often viewed predominantly from an economic and calculative standpoint. In addition to this calculative viewpoint, social scholars have proposed a complementary, social viewpoint, according to which all economic activity is embedded in and affected by a social structural context formed by individuals connected to others through inter-personal relationships (see e.g. Granovetter, 1973, 1985; Krackhardt, 1992; Powell, 1990; Gulati, 1995b; Uzzi 1997).

A significant amount of research on inter-organizational relationships (IOR) has focused on identifying the relevant dimensions<sup>21</sup> of IORs and categorizing them accordingly

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<sup>20</sup> See section 1.3.1.

<sup>21</sup> The noun attribute is used by some academics as a synonym for the term dimension (e.g. Naudé and Buttle, 2000).

(Grandori and Soda, 1995; Oliver and Ebers, 1998; Ritter and Gemünden, 2003). The use of the notion of dimension in the present study requires some clarification. In this study, inter-organizational relationships are viewed as *inherently multidimensional*, meaning that they cannot be accurately described or categorized based on a single dimension (such as, for example, their duration or frequency of communication between involved actors). Instead, *multiple dimensions need to be used simultaneously in order to be able to provide a rich and comprehensive understanding of an IOR.*

Relying either on a single or on multiple dimensions, IORs have been characterized, for example, as weak or strong (Granovetter, 1973), arm's-length or embedded (Uzzi, 1997), and long-term or short-term (Van de Ven, 1976). According to Granovetter (1973), a strong relationship (as opposed to a weak relationship) is characterized by long temporal duration, emotional intensity, intimacy, and reciprocity. Granovetter focuses on relationships between individuals, but the proposed dimensions have also often been used to categorize inter-organizational relationships. Another approach to categorizing IORs has been proposed by Uzzi (1997, p. 36-37), according to whom an embedded relationship, as opposed to an arm's length relationship, is characterized by trust, inter-personal relationships, and "thick" information exchange of tacit and proprietary know-how<sup>22</sup>. Legal scholars have also distinguished between transactional and relational relationships (Macneil, 1978, 1980). Dimensions often argued to be central in describing the characteristics of IORs include: *trust, commitment, frequency of interaction, interdependence, sharing of fine-grained information*<sup>23</sup>, *opportunism, power/control,*

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<sup>22</sup> The author considers a *strong* relationship and an *embedded* relationship (and similarly, a weak relationship and an arm's length relationship) as highly similar concepts. Perhaps the key difference between the two concepts is that while Uzzi places slightly more emphasis on economic exchange in the relationship, Granovetter emphasizes the importance of social inter-personal relationships.

<sup>23</sup> According to Uzzi (1997) *fine-grained* information is both proprietary and holistic in nature, such as, e.g. information on strategy and profit margins. Fine-grained information is not shared openly with all exchange partners (*ibid.*). As opposed to fine-grained, *coarse-grained* information may be defined to consist of all information that is available to all parties operating in a specific market. Furthermore, the concept of fine-grained needs to be distinguished from the concept of *stickiness* (see e.g. Szulanski, 1996), which refers to the difficulty of *transferring* specific knowledge between actors, not to the whether it is proprietary or non-proprietary in nature.



*persistence, goal congruence, investments in relationship, stability, conflict, presence of social bonds, contractual coordination mechanisms, legitimacy, and adaptation* (IMP, 1982; Thorelli, 1986; Johanson and Mattsson, 1987; Ring and Van de Ven, 1992; Grandori and Soda, 1995; Gulati, 1995a; Holmlund and Törnroos, 1997; Dyer, 1997; Uzzi, 1997; Oliver and Ebers, 1998; Sobrero and Schrader, 1998; Walter, Müller, Helfert, and Ritter, 2003; Geyskens, Steenkamp, and Kumar, 2006). Furthermore, in addition to the identification of various dimensions characterizing IORs, a broad stream of literature has focused on defining individual dimensions and discussing their role in various situations and contexts. For example, the dimension of *trust*<sup>24</sup> has been further separated into calculative trust, relational trust, and institutional trust (Rousseau, Sitkin, Burt, and Camerer, 1998). Similarly, many other dimensions describing IORs listed in the previous paragraph have been subject to considerable discussion. While the author acknowledges that there exist no universally accepted definitions for any of the fifteen dimensions mentioned above, the literature discussing these dimensions individually will not be reviewed in detail. Instead, the author acknowledges that individuals have hold differing views to e.g. the dimensions of *trust, commitment, and interdependence* in an inter-organizational relationship. Furthermore, some individuals may consider some of the dimensions as interdependent or even overlapping<sup>25</sup>.

Several models elaborating how inter-organizational relationships develop over time have been presented. These include both processual models and models based on discrete evolutionary phases. Ring and Van de Ven (1994) have presented a much cited framework which describes the development of IORs as a continuous process. In their model, the organizations involved continuously engage in negotiations, commit themselves for future action, and execute what they are committed to while continuously assessing the relationship. Dwyerr, Shurr, and Oh (1987) and Larson (1992) have presented models describing the development of inter-organizational relationships as a process involving several discrete and sequential stages. According to these models,

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<sup>24</sup> For several articles elaborating the concept of trust further, see e.g. the special issue of *Academy of Management Review* of trust (volume 23, number 3).

<sup>25</sup> For further discussion on the selection of IOR dimensions empirically observed in this study, see section 2.3.2 and for the operationalization of these dimensions, see APPENDIX A.

over time the relationship passes on from stage to stage and changes in its characteristics and nature. For example, while the early stages of an IOR may focus on exploring the capabilities of the other party, later stages may be more oriented towards expanding collaboration and exploiting the benefits of the IORs between the involved parties. The dissolution of IORs has also been viewed from a processual viewpoint. In her doctoral dissertation, Tähtinen (2001) described the dissolution of inter-organizational relationships as a six phased process, which includes stages of communication, consideration, disengagement, enabling, restoration, and sense-making & aftermath. All of the models discussed above emphasize that the development of IORs has a processual nature and that both time and several consequent exchanges between involved parties are required for the development of long-term IORs.

Many studies have focused on the outcomes resulting from IORs and several of those have directed attention towards the governance implications of IORs. For example, Jones, Hesterly, and Borgatti (1997) discuss how IORs characterized by trust may enable the utilization of social coordination mechanisms such as collective sanctions, restricted access, macroculture, and reputation for coordinating and safeguarding economic exchange. Bradach and Eccles (1989) and Adler (2001) propose the dimension of trust as a coordination mechanism to complement prices and authority. In his study of the fashion business in New York City, Uzzi (1997) discovered that embedded IORs can lead to various benefits such as transfer of fine-grained information and joint problem solving arrangements between transacting parties<sup>26</sup>. In addition, possessing embedded IORs appeared to reduce the risk of encountering opportunistic behavior from other parties (*ibid.*). Several scholars have also discussed how developing IORs may lead to increased performance and the reduction of transaction costs in dyadic exchange (Ouchi, 1980; Jarillo, 1988; Noordewier, John, and Nevin, 1990; Gerlach, 1992; Parkhe, 1993; Dyer, 1997; Dyer and Singh, 1998; Zaheer, McEvily, and Perrone, 1998; Gulati,

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<sup>26</sup> Some outcomes or benefits of inter-organizational relationships may also be considered as dimensions of IORs. For example, sharing of fine-grained information may be a consequence or result of developing embedded long-term IORs as demonstrated by Uzzi (1997). Sharing of fine-grained information, or more specifically, to which extent it occurs, can also be considered a dimension of IOR. Accordingly, some IORs are characterized by less sharing of fine-grained information than other IORs.

Nohria, and Zaheer, 2000; Zaghoul and Hartman, 2003; Kadefors, 2004; Crespim-Mazet and Ghauri, 2007).

Inter-organizational relationships have been studied in various empirical contexts and from many different theoretical perspectives, from which many have been previously mentioned. Examples of industries, where the importance of IORs for firm success has been emphasized are construction (e.g. Eccles, 1981), automobile industry (e.g. Dyer, 1996), biotechnology (e.g. Powell, 1996), television industry (e.g. Windeler and Sydow, 2001), advertising (e.g. Grabher, 2002b), financing (Uzzi and Gillespie, 2002), and fashion (e.g. Uzzi, 1997). Critique of research on IORs has mostly been addressed at individual studies, and as they employ highly diverse combinations of theories and methods, most of the critique is not generalizable to research on IORs in general. Actually, one strong criticism of IOR research concerns the wide use of different theories and perspectives. Nohria (1992, p. 3) has referred to IOR research as a “terminological jungle in which any newcomer can plant a tree”<sup>27</sup>. Researchers have warned of adopting an undersocialized (Granovetter, 1985; Gulati, 1998; Sobrero and Schrader, 1998) as well as an oversocialized (Granovetter, 1985) view to studying economic action. In addition, it should be noted that most research on IORs has focused on the positive sides of IORs and as a result, many researchers have recognized the need for more research on its potentially harmful effects, i.e. the negative side of inter-organizational relationships (Gulati, 2002; Ritter and Gemünden, 2003)<sup>28</sup>.

### **2.3.2 Construct: inter-organizational relationships between project network actors**

Eisenhardt (1989) describes the development of constructs in qualitative studies as often iterative processes, in which initial constructs may need to be ‘sharpened’ based on experiences obtained from their application. Similarly, drawing from existing literature, a construct for studying inter-organizational relationships that exist between project net-

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<sup>27</sup> Oliver and Ebers (1998) argue the opposite. According to their study IOR research is rather clustered and a limited number of concepts strongly dominate the field.

<sup>28</sup> See, for example, Grayson and Ambler (1999) for a study representing the few exceptions.

work actors was developed a priori and then applied in the empirical part of the study. This section proceeds in the following manner. First, literature discussing inter-organizational relationships in a project context is reviewed. This review focuses, in particular on contributions that have addressed projects as networks of multiple organizations interconnected by inter-organizational relationships, contributions that have elaborated the various functions IORs can have in a project context, and contributions that have discussed the development of IORs in project-based industries. On the other hand, this focus delimits both contributions that have focused on projects internal to a firm and contributions that have conceptualized projects involving multiple organizations as hierarchies that under control of a *single* organization<sup>29</sup>. Second, existing related constructs are discussed and the need for developing a novel construct highlighted. Third, the construct *inter-organizational relationships between project network actors* is defined. Finally, its application in the present study is discussed.

Several articles have discussed inter-organizational relationships in a project context. The discontinuous nature of demand characterizing many project-based industries results in difficulties for project actors to develop long-term inter-organizational relationships characterized by trust and commitment (Eloranta, 2007). This difficulty is imminent, for example, in relationships between clients and main contractors (Dahlgren and Söderlund, 2001; Berggren, Söderlund, and Anderson, 2001). Bresnen and Marshall (2000) have discussed several additional challenges, in particular, the role of organizational culture in developing IORs. In many industries it is often the case that the client will not purchase another project from the same contractor for several years or even decades (Hadjikhani, 1996). In addition, firms taking part in projects need to continuously balance their short- and long-term interests (Hellgren and Stjernberg, 1995). As such, IORs simultaneously facilitate and constrain project organizing (Manning, 2008). Karim, Marosszeky, and Davis (2006) have discussed how some of the challenges related to the development IORs can be systematically identified and addressed. Further, Bourne and Walker (2006) have presented a tool to support the active development of IORs between project actors. There are also project-based industries such as construc-

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<sup>29</sup> If a project involving multiple organizations is viewed as a hierarchy that can be controlled by a single organization, IORs between participating actors are assumed to play either a minor or insignificant role.

tion, in which the main contractor may be able to work with its subcontractors on a more recurrent basis, jointly delivering projects for different clients (Eccles, 1981). Some researchers even argue that some project-based industries such as film production are essentially characterized by long-term IORs that accelerate learning and innovation (Grabher, 2002a). Other benefits that may result from developing long-term IORs in a project context are market access (Ahola et al., 2006), support for project marketing activities (Cova et al., 2002), reduction of contractor's risk premium (Zaghoul and Hartman, 2003), creation of a shared understanding among project participants of task requirements (Windeler and Sydow, 2001), increased performance (Hobbs and Andersen, 2001; Skaates, Tikkanen, and Lindblom, 2002; Soda et al., 2004), and the ability to successfully employ contracting strategies that are alternative to competitive bidding (Crespin-Mazet and Ghauri, 2007; Soudain, Deshayes, and Tikkanen, 2009). Söderlund and Andersson (1998) argue that the lack of long-term IORs between project participants can effectively reduce the probability of project success and Dubois and Gadde (2000) argue that the lack of long-term IORs may reduce efficiency and innovation in project-based industries. Andrew, Briscoe, and Millett (2001) have argued how subcontractors, in particular may be skeptical towards developing long-term IORs with their clients and Berggren et al. (2001) discuss how the outsourcing of project management and control by the client of a project may complicate inter-organizational relationships between actors participating to the project. Several studies have also highlighted how IORs between project network actors are often rather permanent, often outlasting the duration of individual projects (Bengtson et al., 2001; Sydow and Staber, 2002). While most studies have focused on identifying and describing the effects that IORs have on projects, effects can also have the opposite direction. Kadefors (2004) discovered that contractual arrangements used in projects may affect the characteristics of IORs between participating project actors. For example, strict contractual incentives may promote opportunistic behavior in projects. Further, Artto et al. (2008) have demonstrated how IORs may function as source of risk in a project network context. Table 2 below summarizes articles discussing inter-organizational relationships in a project context.

**Table 2 – Studies discussing inter-organizational relationships in a project context**

Study	Central contribution or argument
Eccles, 1981	Contractors tend to favor firms that have demonstrated a high level of performance in the past when selecting subcontractors for a given project.
Hellgren and Stjernberg, 1995	Actors of the project network continuously balance between their short-term interest and long-term interests.
Hadjikhani, 1996	The periodic nature of project business creates difficulties in maintaining IORs between contractor and its client.
Söderlund and Andersson, 1998	Lack of long-term IORs may increase the probability of project failure.
Dubois and Gadde, 2000 & 2001	Lack of long-term IORs may reduce efficiency and innovation in project-based industries.
Bresnen and Marshall, 2000	Elaborate several challenges related to development of IORs in the construction industry.
Bengtson et al., 2001	IORs may outlast individual projects.
Berggren et al., 2001	Lack of a long-term perspective can pose a threat to the existence of a project-based firm. Outsourcing of project management and control may complicate inter-organizational relationships between project actors.
Dainty et al., 2001	Small firms may be reluctant towards developing IORs to large firms.
Hobbs and Andersen, 2001	The nature of IOR between client and contractor may affect project execution.
Windeler and Sydow, 2001	Actors participating in projects are linked by IORs which facilitate the creation of a shared understanding of task requirements.
Skaates et al., 2002	IORs may play an important role in several phases of the project life cycle.
Sydow and Staber, 2002	IORs may outlast individual projects.
Cova et al., 2002	IORs have a central role in the marketing of projects.
Grabher, 2002a	Long-term IORs may facilitate learning and innovation.
Zaghoul and Hartman, 2003	Trust-based IORs between contracting parties may reduce the contractor's risk premium.
Kadefors, 2004	Contractual arrangements in a project may affect the characteristics of IORs between firms participating in a project.
Soda et al., 2004	IORs may affect the performance of a project.
Ahola et al., 2006	Development of long-term IORs may be leveraged to establish a strong presence in new market area.

Bourne and Walker, 2006	Present a tool to support the development of IORs between project actors.
Karim et al, 2006	Discusses how to systematically identify and solve problems hindering the development of IORs.
Eloranta, 2007	Periodic nature of project business creates difficulties for firms to develop IORs characterized by trust and commitment.
Crespin-Mazet and Ghauri, 2007	IORs characterized by trust, commitment, and congruent objectives, between contracting parties may enable the successful use of alternative contracting strategies to competitive bidding.
Larson and Wikström, 2007	Characteristics of IORs affect interaction processes in projects.
Manning, 2007	IORs between firms simultaneously facilitate and constrain project organizing.
Artto et al., 2008	IORs may function as sources of risk in projects.
Soudain et al., 2009	Long-term IOR between a client and a supplier may enable co-designing, i.e. an approach where the value created for both parties increases.

Despite the considerable importance of inter-organizational relationships for projects, there apparently exists no documented construct which could be directly applied for empirically studying inter-organizational relationships between project network actors in a manner that would produce a multidimensional and rich description of studied IORs. Existing constructs such as *relationship quality* (e.g. Naudé and Buttle, 2000; Walter et al., 2003), *relationship atmosphere* (e.g. IMP, 1982; Ritter and Gemünden, 2003), or *relational contracting* (e.g. Poppo and Zenger, 2002) focus attention towards inter-organizational relationships, but none of the aforementioned constructs are defined, and in particular, operationalized, in a manner that could be described as ‘standardized’<sup>30</sup>, in literature. On the other hand, network-level measures which are often utilized in studies focusing on networks encompassing a high amount of actors, such as structural holes (Burt, 1992), or centrality and density (e.g. Rowley, 1997), are of limited value when a multidimensional understanding of the nature of inter-organizational relationships connecting project network actors is required.

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<sup>30</sup> From these constructs, relational contracting is probably the one that has been defined most consistently across different empirical studies. Compare Anderson & Narus (1990) and Poppo & Zenger (2002) for an example of empirical applications.

As stated earlier, inter-organizational relationships are viewed in this study as inherently multidimensional. For example, most inter-organizational relationships in one project network may be characterized by high degrees of both trust and commitment, while most IORs in another project network may be characterized by a low degree of dependency and a high need for monitoring compliance. Similarly, all inter-organizational relationships between actors of a specific project network may be characterized by a high degree of dependence, or the project network may encompass both relationships characterized by a high degree of dependence, and relationships characterized by a low degree of dependence. The primary goal for the construct *inter-organizational relationships between project network actors*, developed for the purposes of this study is to provide a multi-dimensional<sup>31</sup> description of inter-organizational relationships that exist between actors of a studied project network. Furthermore, the intention is that the construct focuses on *multiple* dimensions of IORs that have been argued as important in literature on project business and literature on inter-organizational relationships. Furthermore, the construct is to be applicable to IORs both at the level of dyadic relationships within a project network and at the broader the level of an entire project network.

As previously discussed, there is an abundance of dimensions in literature which have been used to describe inter-organizational relationships and no universally accepted definitions for these dimensions have been provided in literature<sup>32</sup>. Furthermore, these dimensions can be considered as partially interdependent and even overlapping. Nohria (1992, p.14) has condensed this problem in the following: “While there is a growing recognition about the importance of different types of network ties, we are nowhere near having a systematic framework or theory for predicting what kinds of ties matter under what kinds of circumstances in what ways.” As mentioned earlier in section 2.3.1, dimensions often argued as relevant in literature include: *trust, commitment, frequency of interaction, interdependence, sharing of fine-grained information, opportunism, power/control, persistence, goal congruence, investments in relationship, stability, conflict, presence of social bonds, contractual coordination mechanisms, legitimacy, and adaptation*. In addition to the lack of knowledge about the relevance of different dimensions

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<sup>31</sup> In terms of different *dimensions* of IORs.

<sup>32</sup> See section 2.3.1 for a review.



of IORs under different circumstances, research focusing on the causal relations that exist between dimensions is both scarce and conflicting. For example, in the case of the dimension of trust it is not generally agreed whether trust is a result of prior history (shadow of the past) shared by two actors, a result of expectations of continuity (shadow of the future) or a combination of the above (see Poppo, Zhou, and Ryu, 2008 for an elaborate analysis of this problem). In practice, many IOR dimensions are considered as antecedents by some authors and as outcomes by others (see e.g. Oliver and Ebers, 1998). Further, the directions and strength of causal links between various dimensions are under ongoing debate. As stated earlier, the author does not aim to contribute to the discussions concerning individual dimensions of IORs or discussion concerning the interrelatedness of dimensions this study. Instead, it is acknowledged that both the readers of this study and the informants<sup>33</sup> that were interviewed in the empirical part of this study could hold differ in their views concerning the dimensions included in the construct (e.g. sharing of fine-grained information). Finally, deciding upon the number of dimensions to include in a construct was not trivial. Including additional dimensions increases the richness of information that is obtained, and simultaneously increases the amount of labor that is required for collecting the data – potentially leading to a reduction in the practical validity of the construct. Based on the considerations above, the selection of the nine dimensions included in the construct *inter-organizational relationships between project network actors* was based on the following logic<sup>34</sup>:

- ❖ A dimension often argued as central in *literature focusing on inter-organizational relationships* was more likely to be included in the construct than a dimension not argued as central.
- ❖ A dimension argued as central in a *project context* was more likely to be included than a dimension not argued as central.

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<sup>33</sup> See APPENDIX A for the operationalization of the dimensions included in the construct.

<sup>34</sup> This logic is not entirely objective, but partially affected by what the dimensions the author *expects* to be relevant. This is consistent with Eisenhardt (1989) who argues that in qualitative research the development of constructs can often be characterized as an inductive process between theory and empirical observation.

The nine dimensions describing inter-organizational relationships included in the construct are listed in the following Table 3.

**Table 3 – Dimensions included in construct inter-organizational relationships between project network actors**

Dimension (see APPENDIX A for operationalization)	Examples of studies where emphasized
Length (duration)	Johanson and Mattsson, 1987; Gulati, 1995a, 1995b; Pilling, Crosby, and Jackson, 1994; Ring and Van de Ven, 1994; Dyer and Singh, 1998; Uzzi and Gillespie, 2002; Buvik and Andersen, 2002
Trust	Eccles, 1981; Thorelli, 1986; Johanson and Mattsson, 1987; Jarillo, 1988; Bradach and Eccles, 1989; Powell, 1990; Larson, 1992; Ring and Van de Ven, 1992; Dyer, 1997; Uzzi, 1997; Zaheer et al., 1998; Gulati, 1995a; Naudé and Buttle, 2000; Winch, 2001; Sydow and Staber, 2002; Walter et al., 2003; Kadefors, 2004; Crespín-Mazet and Ghauri, 2007; Eloranta, 2007; Artto et al., 2008; Poppo, Zhou, and Ryu, 2008
Opportunism	Williamson 1975, 1985; Powell, 1990 <sup>35</sup> ; Pilling et al., 1994; Uzzi, 1997
Commitment	IMP, 1982; Johanson and Mattsson, 1987; Powell, 1990; Heide and Miner, 1992; Larson, 1992; Dyer, 1997; Naudé and Buttle, 2000; Sydow and Staber, 2002; Walter et al., 2003; Eloranta, 2007; Crespín-Mazet and Ghauri, 2007; Artto et al., 2008
Dependence	Pfeffer and Salancik, 1978; Johanson and Mattsson, 1987; Powell, 1990; Larson, 1992; Sriram, Krapfel, and Spekman, 1992; Zajac and Olsen, 1993; Grandori and Soda, 1995; Dubois and Gadde, 2000; Poppo et al., 2008
Monitoring need	Noordewier et al., 1990; Leffler and Rucker, 1991; Sriram et al., 1992; Pilling et al., 1994
Transfer of fine-grained information	Johanson and Mattsson, 1987; Powell, 1990; Noordewier et al., 1990; Larson, 1992; Pilling et al., 1994; Uzzi 1997; Dyer, 1997; Naudé and Buttle, 2000; Poppo et al., 2008

<sup>35</sup> According to Powell (1990: 303), parties to a network agree to forego the right for opportunistic behavior.

Strength of inter-personal relationships	Macaulay, 1963; Macneil, 1978; 1985; Granovetter, 1985; Johanson and Mattsson, 1987; Bradach and Eccles, 1989; Powell, 1990; Larson, 1992; Naudé and Buttle, 2000; Holmlund and Törnroos, 2003
Expectation of continuity (shadow of the future)	Noordewier et al., 1990; Heide and Miner, 1992; Parkhe, 1993; Popo et al., 2008

Marsden (1990, p. 437-438) has categorized measures used in network research as *descriptions* and *indicators*. The goal of descriptions is to provide precise and rich information concerning actors and relationships between them, while indicators reflect either differences between individual units in a network or differences across networks. The construct *inter-organizational relationships between project network actors* consists can be seen to fulfill both objectives. More specifically, the dimensions included in Table 3 above are measured by focusing individually on each inter-organizational relationship present in the studied project network. This requires that empirical data is collected from each (organizational) node of the network. The measurement of IORs results in a set of unidirectional dyadic data covering all inter-organizational relationships in the observed project network. Based on this data, network-level indicators consisting of descriptive statistics (i.e. means and standard deviations; Reagans and McEvily, 2003; Soda et al., 2004), are derived for each dimension included in Table 3 above to facilitate comparison across studied project networks. The operationalization of the construct is discussed in APPENDIX A and the validity of the construct is discussed in section 5.6.

### 2.3.3 Research on transaction cost economics

Carrying out any kind of economic transaction, including the delivery of a project which can be considered as a system of interdependent transactions between participating actors, always incurs some costs that do not add value for any party. These kinds of costs manifest, for example, as a need to monitor the performance or compliance of the supplier. Such costs, generally referred to as *transaction costs*, have a negative effect on the *efficiency* of economic exchange. The transaction cost economics (TCE) framework provides an empirically validated lens for evaluating the efficiency of task completion under alternative governance structures. In the present study, the theoretical lens of TCE is directed towards project networks. It is generally accepted that efficiency is an impor-

tant concern in the study of project organizing (see e.g. Morris and Hough 1987; Pinto and Mantel, 1990; Dvir and Lechler, 2004; Artto and Wikström, 2005). In addition, efficiency is considered as a central antecedent or dimension of *project success* and *project performance* (see e.g. Morris and Hough 1987; Pinto and Mantel, 1990; Shenhar et al., 2001).

The primary consideration of transaction cost economics (TCE), outlined primarily by the publications of Ronald Coase (1937) and Oliver Williamson (1975, 1981, 1985) building on literature on economics, organization theory, and contract law, is on “the comparative costs of planning, adapting, and monitoring task completion under alternative governance structures” (Williamson, 1985: p. 2). Originally, Williamson (1975) presented market and hierarchy as two alternate, and opposing forms of governance, but later augmented the TCE framework with an intermediate hybrid form (Williamson, 1985). On a conceptual market-hierarchy continuum, hybrids lie between the two polar extremes. Following Williamson (1979), TCE assumes that a leading purpose of firms is economizing, i.e. firms attempt to minimize the sum of production costs and transaction costs, and thus, similarly to economic approaches to the study of organization in general, TCE focuses primarily on efficiency.

The make-or-buy decision, that is, the decision that concerns under which circumstances should production be carried out within the boundaries of the firm, i.e. within a hierarchy, and when is it preferable to purchase products and services across a market interface, is a central concern for economic actors. Within the boundaries of the firm, the entrepreneur-co-ordinator directs production, and when market governance is utilized, production is directed by price movements (Coase, 1937).

Utilizing the market mechanism always incurs *transaction costs*, related to the exchange at hand, such as the costs of negotiating, the costs of drafting contracts, and the costs of discovering what the relevant prices are. According to Williamson (1981, p. 552, italics added) “*a transaction occurs when a good or service is transferred across a technologi-*

*cally separable interface*". These transfers incur transaction costs which may be considered as the economic counterpart of physical friction<sup>36</sup>.

On the other hand, the production of a good or a service internally within a firm incurs *production costs* that result from the need to secure inputs, including e.g. labor, materials and utilities for the production process (Walker and Weber, 1984). The amount of production costs is dependent of, for example, the suitability of capabilities possessed by the firm for the task at hand (Madhok, 1996). Furthermore, it is commonplace that a part of the inputs for the production process need to be purchased from the market, relating production costs to additional transaction costs. Furthermore, significant transaction costs may also incur internally to a firm, due to the presence of various internal mechanisms, such as profit centers or transfer pricing policies (see e.g. Eccles and White, 1988; Masten, Meehan, and Snyder, 1991). As a result, whether the firm decides to make or buy, both transaction costs and production costs will incur and, the optimal choice is dependent on the *sum* of these two types of costs (Williamson, 1979)<sup>37</sup>.

It has been argued that no clear distinction between transaction costs and production costs has been provided (Demsetz, 1988) and that that there exists no consensus concerning the operationalization of these constructs (see e.g. Geyskens et al. 2006). The focus of this study is limited exclusively to transaction costs, which are here considered to consist of *all costs, both ex ante and ex post, that are related to purchasing a good or a service from the market*. Furthermore, *ex ante* transaction costs are related to issues such as selecting exchange partners and drafting and negotiating contracts with them, whereas *ex post* transaction costs are related to monitoring and enforcing agreements after they have been put in place (Rindfleisch and Heide 1997). As mentioned earlier in

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<sup>36</sup> Williamson has been criticized for not explicitly specifying what transaction costs consist of and how they are to be operationalized. (see e.g. Blois, 1990; David and Han, 2004)

<sup>37</sup> Finally, some authors have suggested a third type of costs, *management costs* (Demsetz, 1988) or *governance costs* (Williamson, 1981) to play a role in determining the optimal governance structure for a given transaction. As compared to transaction costs and production costs, management costs have received less attention in TCE related literature and are also not addressed in the present study.

section 1.2, the related issue of production costs, despite its considerable importance from the viewpoint of efficiency, is not addressed in this study.

The analysis of transactions and their underlying characteristics has a central role in determining the circumstances in which they should be integrated and in which they should be disintegrated. According to Williamson (1979, 1981), *asset specificity*, the *frequency* with which transactions reoccur, and *uncertainty* are three critical dimensions on which transactions differ. From these three dimensions, asset specificity is considered as most significant (Williamson, 1981). Asset specificity gives rise to switching costs as it relates to the extent to which an asset can be redeployed to alternative uses without loss of its productive value and can manifest in the form of site specificity, physical asset specificity, and human asset specificity. The frequency of transactions is another critical dimension affecting how they should be organized. Typically in studies adopting the TCE framework, frequent transactions are assumed, but Laumann, Galaskiewicz, and Marsden (1978) and Williamson (1979) have elaborated how the organization of occasional transactions differs from the organization of recurrent transactions. Uncertainty is the third dimension affecting the organization of transactions and can be categorized as environmental and behavioral uncertainty (Jones et al., 1997; Rindfleisch and Heide, 1997). The former relates to contingencies of exchange too unpredictable to be specified *ex ante* in contracts, and the latter relates to inherent difficulties in verifying the *ex post* performance of transacting parties (Geyskens et al., 2006). In addition to the dimensions characterizing transactions, two behavioral assumptions central to the TCE framework are bounded rationality and opportunism (Williamson, 1975). Bounded rationality affects the organization of transactions because if rationality of economic actors were not bounded, perfect contracts taking into consideration all potential events could be drafted. However, the capacity of humans to solve complex problems and process information has been demonstrated as limited, making humans “intendedly rational, but only limitedly so” (Simon, 1961, p. 24). Bounded rationality leads to opportunities for economic gain as well as risks of economic loss. Following this logic, Williamson (1981, p. 571) characterizes organizations as devices by which to economize on bounded rationality. In addition to bounded rationality, another behavioral assumption TCE builds on is the assumption that at least some economic actors are given to oppor-

tunism, defined by Williamson (1985, p. 47) as “self-interest seeking with guile”. In the absence of opportunism the need for safeguarding transactions would be reduced because economic actors could be expected to cooperatively solve all unexpected problems and events that occur. In order to protect themselves from the risks of opportunism, rational actors include safeguards and incentives in their contracts to promote appropriate behavior by the other party.

### *Application and critique of transaction cost economics*

During the course of the last three decades the transaction cost economics framework has been extensively empirically tested and several amendments to it have been suggested. Boerner and Macher (2002) identified more than 600 articles focusing on some aspect of TCE and Geyskens et al. (2006) found substantial support for the normative implications of TCE in their quantitative meta-analysis of 200 articles published in leading academic journals across various disciplines. Additionally, in an extensive review of studies applying the TCE framework Shelanski and Klein (1995) found strong support for the TCE framework.

In addition to support, TCE has also received strong criticism from several scholars. Demsetz (1988) criticized TCE it for its lack of ability to explain the reasons why some firms succeed. The dichotomous view of markets and hierarchies as alternate and opposing forms of governance has also been criticized<sup>38</sup>. Perrow (1986), Hennart (1993), and Zenger and Hesterly (1997) have argued that most existing governance structures cannot be accurately categorized as either form but actually contain elements of both. In this view, both market and hierarchy are considered as theoretical concepts which do not exist in their pure forms. Powell (1990) has further argued that this intermediate hybrid, or *network*<sup>39</sup> form of governance is characterized by its own salient features, such as reciprocal norms leading to mutually supportive actions present neither in markets

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<sup>38</sup> It needs to be noted here that, Williamson has amended the original dichotomous TCE framework with the hybrid governance mode. For a discussion on the characteristics of this hybrid, or *network* form of governance see e.g. Thorelli (1986), Bradach & Eccles (1989), Powell (1990), and Hennart (1993).

<sup>39</sup> In TCE literature, the term *hybrid* mode is used to refer to governance structures that are neither pure market nor pure hierarchy.

nor in hierarchies. Also the practical validity of the TCE framework with its primary focus on efficiency has also been questioned. Johanson and Mattsson (1987), Zajac and Olsen (1993), and Dyer (1997) have argued that the exclusive focus on single-party cost minimization in the framework provides little insight into relational governance, potentially limiting opportunities for joint value maximization by transacting parties. As such, TCE does not direct attention towards considering opportunities for mutual gain in organizing transactions. Ghoshal and Moran (1996) have presented strong skepticism for the normative implications of TCE by arguing that the assumption of opportunism<sup>40</sup> can become a self-fulfilling prophecy whereby opportunistic behavior will increase when hierarchical controls are imposed. The assumption of opportunism has also received further criticism from many academics who argue that social control mechanisms and norms of reciprocity may reduce or substitute opportunism (Larson, 1992; Uzzi, 1997; Jones et al., 1997; Adler, 2001). Doz and Prahalad (1991), Rindfleisch and Heide (1997) and Gulati (1998) have criticized TCE for treating transactions as independent of the inter-organizational relations formed as a result of previous interaction between the transacting parties<sup>41</sup>. In addition, Heide and Miner (1992) have demonstrated that the governance of transactions may be affected by anticipated future transactions, i.e. the *shadow of the future*, with the same counterpart and Rindfleisch and Heide (1997) have argued that transaction frequency has not received adequate attention in empirical applications of TCE. To summarize, apart from the notion of asset specificity, TCE does not attempt to explain why or how inter-organizational relationships between transacting actors might affect the choice of governance form. Finally, the clarity and operationalization of central TCE concepts has been questioned. In their review of sixty three TCE related articles David and Han (2004) discovered significant disagreement on how to operationalize several of TCE's central constructs.

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<sup>40</sup> It is important to note here that as discussed, earlier Williamson does not assume opportunistic behavior in all conditions or by all transacting parties.

<sup>41</sup> This argument is supported by Coase (1998) who is considered as the 'founding father' of new institutional economics. He argues for the importance of considering the institutions that surround and interact with the economic system, such as the political system, legal system, social system, educational system, and culture.



### 2.3.4 Construct: efficiency of project implementation

Relying on the TCE framework, this section develops a construct for empirically measuring *ex post* transaction costs during the implementation phase of the project life cycle in project network contexts. Transaction costs that incur during the project implementation phase can be expected to be predominantly *ex post* as in this phase the majority of contracts are already in place. First, the concept of efficiency and the dimensions on which transactions differ are discussed in a project context. Second, literature applying or discussing the TCE framework in the context of projects is reviewed. Third, existing related constructs are reviewed and the need for developing a novel construct discussed. Finally, the construct *efficiency of project implementation* is defined and its application in this study is discussed.

Efficiency provides a means for comparing firms and their governance structures and is the primary focus in transaction cost economics (Williamson, 1975). A gain in efficiency results in lower production or transaction costs.” In a project context, several contributions have discussed *efficiency* as an important dimension or antecedent of project success (e.g. Morris and Hough 1987; Pinto and Mantel, 1990; Shenhar et al., 2001; Artto and Dietrich, 2004). For example, Pinto and Mantel (1990) have argued that efficiency is a key concern for the *project implementation process*. Furthermore, in project context, efficiency is often operationalized with two measures (1) meeting schedule goal and (2) meeting budget goal (see e.g. Pinto and Mantel, 1990; Shenhar et al., 2001; Dvir and Lecher, 2004).

Even though it is not a goal of this study to empirically test the transaction cost economics framework<sup>42</sup>, it is important to discuss key TCE variables in a project context<sup>43</sup>. Williamson (1975) has argued that there are three important dimensions on which transactions differ: asset specificity, uncertainty, and frequency. While research on transaction cost economics has generally assumed recurrent transactions and focused on the two former dimensions, all three dimensions are relevant in the context of project busi-

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<sup>42</sup> Refer to Geyskens et al. 2006 for an extensive review of studies that have tested the TCE framework.

<sup>43</sup> This discussion may facilitate the comparison of results obtained in this study to results obtained in other studies applying the TCE framework.

ness, characterized by discontinuity, uniqueness, and complexity (Hadjikhani, 1996; Mandják and Veres, 1998; Cova et al., 2002). First, the degree of asset specificity characterizing project networks may be considerable, as it has been shown that main contractors may rely on a stable set of subcontractors, based on specific geographical locations, in carrying out subsequent projects (Eccles, 1981). Further, project network actors often re-use designs and working methods developed during a specific project in their subsequent projects (Barlow and Jashapara, 1998; Barlow, 2000; Dubois and Gadde, 2001). These working methods may be actor specific, i.e. a method developed for a certain actor may not be applicable when working with another actor. In Williamson's terms, the aforementioned conditions can be referred to as *physical*, *site*, and *human asset specificity*. Second, it is common that project network actors do not receive any guarantees for inclusion in forthcoming projects (Hellgren and Stjernberg, 1995), and it may be difficult for project network actors to verify the compliance of other actors *ex post*, during project implementation. In transaction cost economics terms, these conditions may be labeled as *volume* and *behavioral uncertainty*. Third, frequency of transactions is a dimension on which projects have been shown to differ considerably as it is typical in many industries that after the delivery of a project, the main contractor may not be able to secure another delivery to the same client for a period of several years (Hadjikhani, 1996). Simultaneously, the main contractor and several of its subcontractors may continue to work together on a continuous basis, albeit for different clients (Eccles, 1981). Based on these characteristics, the *frequency* of transactions between actors participating to project networks actors may differ considerably.

Several studies have applied the TCE framework in a project context. In the much cited study of the Massachusetts construction industry Eccles (1981) relied on the TCE framework to argue for the existence of the *quasifirm*, a permanent organizational unit formed by a main contractor and several of its trade subcontractors. In their study of the construction industry, Reve and Levitt (1984) focused on triadic arrangements involving the client, an engineering consultant, and contractors; they argued that the relationship between the client and the consultant differed considerably in character from the relationship between the consultant and contractors. Winch (1989) also applied TCE to explain the functioning of the construction industry and found the framework compatible

with many of the practices empirically observed in the industry. Masten et al. (1991) applied TCE to measure costs of organizing production internally with empirical data from the shipbuilding industry and found these internal costs to account for about 14 per cent of total costs of building a sea vessel. Jones et al. (1997) extended TCE by integrating task complexity and structural embeddedness into the framework. Furthermore, they highlighted the importance of social mechanisms, such as macroculture and collective sanctions, for coordinating exchanges. Cox and Thompson (1997) applied TCE to discuss contractual relations within the construction industry and provided a framework for drafting contracts according to the characteristics of the relationship between the buyer and the supplier. Malinen (1998) utilized TCE to analyze change in the shipbuilding industry. Walker and Wing (2000) elaborated on the relationship between project management in minimizing transaction and production costs. Turner and Keegan (2001) and Turner and Simister (2001) both focused on the relatedness of uncertainty and transaction costs in projects. Lai (2001) described subcontracting in the construction industry as a nexus of firms. Winch (2001) presented a framework, based on TCE logic, for understanding governance across the life cycle of a project. Zaghoul and Hartman (2003) demonstrated, also relying on the TCE framework, how lack of trust can lead to an increase in the transaction costs in a project context. Dvir and Lechler (2004) discussed the impacts of project changes on efficiency and success in projects. Håkansson and Jahre (2004) analyzed the construction industry from several theoretical perspectives, including TCE, concluding that the industry appears to follow a hybrid logic that combines features of both markets and hierarchies. Lindkvist (2004), drawing from TCE logic discussed the governance of project-based firms, and pointed out various mechanisms top managers can apply when designing a governance mode for their project-based firms. Finally, Jensen et al. (2006) draw from TCE logic to explain interactional uncertainty in projects. Table 4 below summarizes studies either drawing from or applying the TCE framework in a project context.

**Table 4 – Studies drawing from or applying the TCE framework in a project context**

Study	Central contribution or argument
Eccles, 1981	Utilizes TCE logic to argue for the existence of quasifirm, a stable organizational form in the construction industry.
Reve and Levitt, 1984	Applies TCE logic to explain trilateral governance of transactions involving a client, an engineering consultant, and contractors, common in construction projects.
Winch, 1989	Applies TCE to explain both intra-firm and inter-firm relations in the construction industry. Views project as temporary coalition of firms with divergent interests. Argues that TCE framework cannot explain the dominance of market governance in construction.
Masten et al., 1991	Applies TCE logic to measure costs organizing production internally. Results are based on a survey conducted in the project-based shipbuilding industry.
Jones et al., 1997	Extends TCE by integrating task complexity and structural embeddedness into the framework. Discusses examples from the project-based film industry.
Cox and Thompson, 1997	Applies the TCE framework to discuss contractual arrangements in projects that foster collaboration.
Malinen, 1998	Applies the TCE framework to analyze change in the shipbuilding industry.
Walker and Wing, 1999	Argues that role of project management in construction projects is to minimize the sum of transaction costs and production costs.
Lai, 2000	Describes subcontracting in the construction industry as a nexus of firms.
Turner and Keegan, 2001	Discusses governance of projects from a TCE viewpoint. Displays evidence of hybrid governance forms in projects.
Turner and Simister, 2001	Uses the TCE perspective to predict how risk and uncertainty affect contractual arrangements in projects.
Winch, 2001	Building on TCE, develops a conceptual framework for understanding the governance of projects across their life cycle.
Zaghloul and Hartman, 2003	Applies TCE logic to explain how lack of trust may lead to an increase in transaction costs in construction projects.
Dvir and Lechler, 2004	Drawing from TCE logic and research on project planning, studies the impact of project changes on efficiency and success in projects.

Håkansson and Jahre, 2004	Reviews literature discussing the construction industry from the TCE perspective (in addition to other theoretical perspectives). Argues that the construction industry follows a hybrid economic logic.
Lindkvist, 2004	Drawing from TCE logic discusses the governance of project-based firms, and points out various mechanisms that can be used by top managers to design a governance mode for their firms.
Olsen et al., 2005	Discusses the use of contracts and other governance mechanisms in complex project deliveries. Argues for the use of authority, incentives, and trust for governing complex projects.
Jensen et al., 2006	Drawing from TCE logic and principal-agent theory, analyzes interactional uncertainty in projects.

Outside the context of projects, a number of empirical studies building on the TCE framework have developed measures for ex ante as well as ex post transaction costs (Leffler and Rucker, 1991; Walker and Poppo, 1991; Sriram et al., 1992; Pilling et al., 1994; Dahlström and Nygaard, 1999; Artz and Brush, 2000; Buvik and Andersen, 2002). The operationalization of transaction costs in these studies varies greatly as summarized in Table 5 below.

**Table 5 – Studies that have empirically measured transaction costs**

<b>Study</b>	<b>Constructs / measures for transaction costs</b>
Leffler and Rucker, 1991	<ul style="list-style-type: none"> <li>❖ presale measurement costs (multiple item measure)</li> <li>❖ contract monitoring &amp; enforcement costs (multiple item measure)</li> </ul>
Walker and Poppo, 1991	<ul style="list-style-type: none"> <li>❖ the difficulty of agreement with the supplier on the allocation of costs due to engineering changes for the part (single item measure, 7-point Likert-type scale)</li> <li>❖ the difficulty of agreement with the supplier on the allocation of costs due to changes in material costs for the part (single item measure, 7-point Likert-type scale)</li> </ul>
Sriram et al., 1992	<ul style="list-style-type: none"> <li>❖ contract negotiation concerns (single item measure, 5-point Likert-type scale)</li> <li>❖ need for contract monitoring (single item measure, 5-point Likert-type scale)</li> </ul>

Pilling et al., 1994	<ul style="list-style-type: none"> <li>❖ developing and setting up an exchange relationship (multiple item measure, 7-point Likert-type scale)</li> <li>❖ monitoring supplier performance (multiple item measure, 7-point Likert-type scale)</li> <li>❖ dealing with opportunistic behavior (multiple item measure, 7-point Likert-type scale)</li> </ul>
Dahlström and Nygaard, 1999 <i>(note that study focuses exclusively on ex post transaction costs)</i>	<ul style="list-style-type: none"> <li>❖ bargaining costs (multiple item measure, Likert-type scale)</li> <li>❖ monitoring costs (multiple item measure, Likert-type scale)</li> <li>❖ maladaptation costs (multiple item measure, Likert-type scale)</li> </ul>
Artz and Brush, 2000 <i>(note study limits to costs of negotiation)</i>	<ul style="list-style-type: none"> <li>❖ negotiation costs (multiple item measure, 5-point Likert-type scale)</li> </ul>
Buvik and Andersen, 2002 <i>(note that study focuses exclusively on ex post transaction costs)</i>	<ul style="list-style-type: none"> <li>❖ ex post transaction costs (including measurement costs, performance evaluation costs, adjustment costs, and bargaining costs) (multiple item measure, 7-point Likert-type scale)</li> </ul>

Measures for transaction costs summarized in the table above have been developed for use with quantitative research methods, and as such they are not directly applicable in this mainly qualitative study. Further, while the measures for *efficiency* in project contexts discussed earlier are without doubt relevant and have been applied in several studies, they suffer from several limitations. First, these measures, by focusing on adherence to budget and schedule, implicitly assume that project schedule and budget are defined and remain stable during the life cycle of the project; however, this may not always be the case in practice. Second, these measures assume that both budget and schedule are accurate and proportionate to another. There may be a variety of reasons why project schedule or budget may be purposefully defined as either overly optimistic or overly pessimistic<sup>44</sup>. Third, these existing measures do not provide information that could be used for identifying the antecedents or specific categories of inefficiency in projects. Based on the above observations, this study adopts an alternative strategy for measuring efficiency during the implementation phase of the project life cycle via the

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<sup>44</sup> There are a variety of reasons or motives which may lead to the adjustment of project budget and schedule to allow inefficient execution of work. For a trivial example, consider how industrial production was organized and carried out in the Soviet Union.

construct *efficiency of project implementation*<sup>45</sup>. In this study a project network is treated as a complex system of transactions between multiple organizational actors. Further, ex post transaction costs, occurring during the implementation phase of the project, are assumed to reduce the efficiency of project implementation. The following three categories of ex post transaction costs, often emphasized in literature, are included in the construct *efficiency of project implementation* developed for this study:

- ❖ **costs of monitoring transactions** (e.g. verifying the progress of another project network actor)
- ❖ **costs of planning transactions** (e.g. revisions to project plan or schedule involving another project network actor)
- ❖ **costs of adapting transactions** (e.g. changing working practices so that they are more compatible with the practices of another project network actor)

In this study, these three types of ex post transaction costs were measured empirically in the studied four project networks by collecting information that describes critical incidents that occurred during the implementation phase of the project life cycle. Any critical incident occurring during the implementation phase of the project life cycle that led to either an increase or decrease in *ex post* transaction costs was assumed to have affected the efficiency of project implementation.

## **2.4 Research on critical incidents**

In his seminal treatise on the requirements for a successful project manager, written almost half a century ago, Gaddis (1959, p. 91-92) argued that in projects “success or failure may well hinge on the manager’s ability to discern fine variations in emphasis

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<sup>45</sup> As it is not the goal of the present study to test the TCE framework, the construct *efficiency of project implementation* focuses exclusively on transaction costs, excluding e.g. asset specificity, uncertainty, frequency, and governance mode.

among performance, budget, and time schedule needs and to resolve the *continuous apparent conflicts* which occur between them.” (emphasis added by author). This argument supports the widely held view that during the life cycle of a project, unplanned or unexpected events often occur and have to be dealt with by the project manager and other persons working on the project. The importance of these unexpected events for projects ranges from negligible to highly critical and there exist several bodies of literature including, literature on critical incidents in projects, literature on deviations in projects, and literature on project risks all of which emphasize the need to focus on these issues or events that are typically not considered in the project plan. In addition to being important from the viewpoint of efficient and effective execution of projects, this *unexpected* also provides a perspective for studying projects that is adopted in this study.

The critical incident technique (CIT), introduced by Flanagan in 1954, originally consisted of a set of procedures for collecting direct observations of both exceptional and sub-par human behavior<sup>46</sup>. The technique was primarily intended for solving practical problems and developing broad psychological principles. An example of such an application of this technique was a study conducted with the United States Air Force aviation psychology program initiated during the Second World War, directed at discovering the factors prohibiting certain individuals from learning to fly aircraft. During the program, students were observed by their instructors who documented any obstacles hindering the learning process. In early studies relying on CIT conducted in the 1940’s and 1950’s, empirical evidence of critical incidents was typically collected by trained psychologists, but the technique has later been successfully applied in combination with other research methods allowing indirect observation, such as interviews that focus on past critical incidents (Miles and Huberman, 1994). A key strength of CIT, when combining it with interviews, is that people can often recall highly influential events from their past with considerable accuracy. As such, CIT provides a natural way to treat history as a sequence of critical incidents that have contributed, either favorably or unfavorably, to later outcomes. Individuals are much more likely to recall critical incidents that have

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<sup>46</sup> Refer to section 1.3.6 for definitions for terms *critical incident technique* and *critical incident*.



occurred in their past in contrast to routine activities. Often data collected with CIT can also be visually displayed to facilitate the communication of the studied phenomenon to others (Miles and Huberman, 1994). CIT is also considered an inductive research method, which can be a benefit when the studied phenomenon is scarcely documented (Grove and Fisk, 1997)<sup>47</sup>.

CIT has been successfully applied in a wide variety of empirical studies conducted in various fields of research such as sociology, psychology, and medicine (Stiegelbauer et al., 1982; Miles and Huberman, 1994; Gremler, 2004; Butterfield et al., 2005). CIT has proven to be a very versatile technique, and it has been continuously experimented with and tested in different empirical settings. For example, data on critical incidents has been successfully collected via observations, analysis of documents and interviewing the subjects themselves (Butterfield et al., 2005). CIT has also several inherent weaknesses. First, the ability of individuals to recall historical events is limited and varies considerably (Flanagan, 1954; Golden, 1992; Yin, 1994). Second, individuals may be unwilling to discuss some critical incidents which have occurred in the past (ibid.), for example, because they have made mistakes or because the incidents have had a negative influence on their personal status or career. Third, the relative importance of critical incidents is very difficult to evaluate objectively (Stauss and Weinlich, 1997). An event that has been important for one individual may have been indifferent or routine for another. Fourth, CIT has been criticized for neglecting the importance of day-to-day (routine) activity (Johnston, 1995; Stauss and Weinlich, 1997). Finally, the inherent flexibility of the technique may lead to a lack of methodological rigor and inconsistent findings (Butterfield et al., 2005).

### ***Critical incidents in project network contexts***

Literature discussing critical incidents in project contexts is now reviewed to develop an understanding of the role critical incidents may play in project networks. There are a number of empirical studies on projects and their management that either focus on criti-

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<sup>47</sup> As is essentially the case with the concept of a *project network* focused on in this study.

cal incidents or apply the critical incident technique<sup>48</sup>. Thamhain and Wilemon (1975) empirically studied the occurrence of conflict related critical incidents in different phases of the project cycle and found out that different types of critical incidents tend to characterize different phases of the project life cycle. Tähtinen (2001) demonstrated how critical incidents may function as a trigger for relationship dissolution. Dvir and Lechler (2004) illustrate how critical incidents can contribute unfavorably towards project success. Hällgren and Maaninen-Olsson (2005) discuss critical incidents that occurred in a mill upgrade project, while Alsakini, Wikström, and Kiiras (2004) focus on the occurrence of critical incidents in a power plant project delivered to a developing country. Ahola et al. (2006) used the critical incident technique to collect empirical data describing how a project supplier managed leverage its inter-organizational relationships to establish a position in a new market area. Kaulio (2007) applied the technique to study the challenges of multi-project leadership, and Artto et al. (2008) applied the technique to identify risks arising from subcontractors' inter-organizational relationships. Finally, there are a few studies that have focused on how companies or project managers handle, or respond to, critical incidents that occur during projects. Hällgren (2007) discusses how critical incidents were managed in a power plant project and Söderholm (2008) presents three categories of critical incidents: re-openings, revisions, and fine tuning; he also discusses how project managers often have to deal with them. Pavlak (2004) suggests the formation of specific teams for managing critical incidents and Hällgren and Maaninen-Olsson (2005) discuss different tactics that can be used to respond to critical incidents. These aforementioned authors stress the point that, while critical incidents cannot be completely avoided, project actors can prepare for them and, in some cases, even use them to their benefit by improvising solutions that are more efficient than initially planned. Table 6 below lists empirical studies focusing on critical incidents in a project context:

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<sup>48</sup> Several of these studies refer to the unexpected in projects with somewhat differing terminology. For example, Hällgren and Maaninen-Olsson (2005) refer to 'deviations', instead of 'critical incidents' while Söderholm (2008) discusses 'unexpected events'. For simplicity the term *critical incident* is used in the present study as synonym for all notions that refer to *unexpected* (as opposite to something that is planned or expected to happen) and *significant* events in projects.

**Table 6 – Studies discussing critical incidents or applying the critical incident technique in a project context**

Study	Central contribution or argument
Thamhain and Wilemon, 1975	Critical incidents are typical to all phases of the project life cycle. Different types of critical incidents categorize different phases of the project life cycle.
Tähtinen, 2001	Argues that a critical incident may function as a trigger for relationship dissolution.
Alsakini et. al, 2004	Discusses both critical incidents encountered during a power plant project delivered to a developing country and the effects of these incidents on project planning and steering.
Dvir and Lechler, 2004	Shows that critical incidents (more specifically project goal changes and project plan changes) may have an unfavorable effect on project success.
Pavlak, 2004	Argues that critical incidents are common in projects. Suggests the formation of specific teams for responding to critical incidents.
Hällgren and Maaninen-Olsson (2005)	Analyzes critical incidents in an automation project with emphasis on how they were managed. Discusses tactics for managing critical incidents in projects.
Ahola et al., 2006	Applies CIT to study how an automation system provider managed to establish a strong presence in a new market area.
Kaulio, 2007	Applies CIT to study multi-project leadership.
Hällgren, 2007	Discusses the management of critical incidents that occurred in a diesel power plant project.
Artto et al., 2008	Applies CIT to identify and describe risks arising from subcontractors' inter-organizational relationships.
Söderholm, 2008	Presents three categories of critical incidents project managers often have to deal with.

A critical incident occurs unexpectedly to (at least some) project actors and as such requires a *proactive* management response, while a risk can often be identified or managed *a priori* (Hällgren and Maaninen-Olsson, 2005). Despite this difference, the concept of a risk and the literature focusing on risk management can provide valuable insights into understanding the nature and characteristics of critical incidents, i.e. the unexpected, in projects. In addition, similarly to critical incidents, risks can have a significant effect on transaction costs incurring during the life cycle of project (Turner and

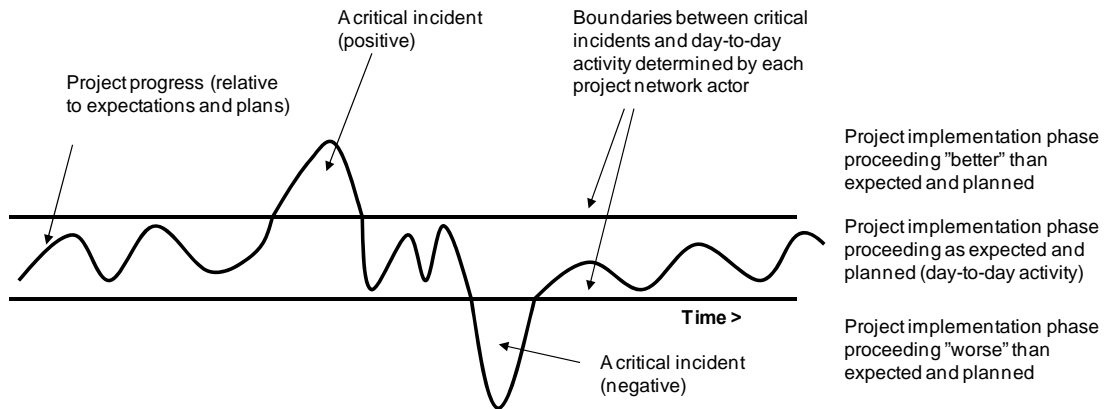
Keegan, 2001; Turner and Simister, 2001). Risk management is understood to consist of three high-level <sup>49</sup> phases: risk identification, risk estimation, and risk response execution (Artto, Kähkönen, and Pitkänen, 2000). In addition to risks, which are inherently *unfavorable* for the project, there are also opportunities, which are inherently *favorable* for the project (Turner and Simister, 2001; Ward and Chapman, 2003). Several studies have presented categorizations of project risks. Pinto (2002) discusses risks related to technical problems, incompetent staff, regulatory changes, changes in project actors, actions of competitors, environmental traumas, and poor time and cost estimates. Miller and Lessard (2001) categorize project risks as market-related, completion-related, and institutional-related. Ward and Chapman (2003) discuss risks related to variability and uncertainty in estimates, uncertainty in logistics, uncertainty about objectives and priorities, and uncertainty about relationships between parties. Project risks have also been described as dynamic in the sense that risks differ across the project life cycle (Ward and Chapman, 1995).

Based on the literature reviewed in the previous paragraphs, critical incidents appear to occur frequently during many projects. Further, based on the increased complexity of projects involving several organizations as compared to projects carried out by single firms, one could expect critical incidents to play an even more significant role in project networks. As earlier identified, there are a number of studies that focus on critical incidents that occur during the life cycle of major projects but similarly to existing categorizations of project risks discussed in the previous paragraph, an extensive understanding of the role or roles that critical incidents can play in project network contexts does not exist. Finally, the critical incident technique is considered as an appropriate method for studying critical incidents in project network contexts. Therefore, in this study, the following definition is adopted: *a critical incident occurring during project implementation is any highly significant event (from the viewpoint of any project network actor) that occurs during the implementation phase of the project and is either favorable or unfavorable for the project as a whole*. Following this definition, critical incidents are differentiated, for example, from minor changes often necessary during project imple-

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<sup>49</sup> Other authors have suggested approaches with more phases (cf. Chapman and Ward, 1997; Kähkönen, 1998)

mentation. Critical incidents are considered as events significantly deviating from standard project routines or progress. Finally, critical incidents often create a need for some kind of action or response from at least one of the project network actors. Figure 5 below illustrates how critical incidents are distinct from day-to-day project activities.



**Figure 5 – The boundaries between critical incidents and day-to-day activity**

The following Table 7 presents a categorization of different types of critical incidents developed based on the review of literature discussing critical incidents and risks in a project context. Thus, based on the literature reviewed, a researcher can expect to encounter these kinds of critical incidents when empirically studying project networks.

**Table 7 – Categorization of critical incidents expected to occur during project implementation**

<b>Incident category</b>	<b>An example of a critical incident representing this category</b>	<b>Examples of studies or articles where critical incidents are emphasized</b>
Scope related incidents	A project network actor suddenly makes a major change in the delivery scope	Pinto, 2002; Ward and Chapman, 2003; Alsakini et al., 2004; Dvir and Lechler, 2004; Hällgren and Maaninen-Olsson, 2005; Ahola et al., 2006; Söderholm, 2008
Materials related incidents	A project network actor does not receive the correct materials required for proceeding with project work	Miller and Lessard, 2001; Ward and Chapman, 2003; Hällgren, 2007
Delay in progress	A project network actor fails to maintain agreed schedule	Pinto, 2002; Alsakini et al., 2004; Ahola et al., 2006; Hällgren, 2007
Human resources related incidents	A project network actor suffers from lack of competent personnel	Miller and Lessard, 2001; Pinto, 2002; Alsakini et al., 2004; Hällgren and Maaninen-Olsson, 2005; Ahola et al., 2006; Hällgren, 2007; Kaulio, 2007
Communication related incidents	A project network actor does not receive information concerning a change in project schedule	Ward and Chapman, 2003; Hällgren and Maaninen-Olsson, 2005; Ahola et al., 2006; Artto et al., 2008
Process or schedule synchronization related incidents	A project network actor has difficulties synchronizing working schedules with another actor	Dahlgren and Söderlund, 2001; Ward and Chapman, 2003
Stakeholder or environment related incidents	A stakeholder external to the project network, such as non-profit organization suddenly affects project progress	Miller and Lessard, 2001; Pinto, 2002; Alsakini et al., 2004; Dvir and Lechler, 2004; Pavlak, 2004; Ahola et al., 2006; Kaulio, 2007; Artto et al., 2008; Söderholm, 2008

## **2.5 The conceptual framework for the study**

The purpose of this section is to develop a conceptual framework that connects the two constructs developed earlier by the findings from the literature review. According to Miles and Huberman (1994, p. 28): “A conceptual framework explains, either graphically or in narrative form, the main dimensions to be studied – the key factors, or variables – and the presumed relationships among them.”

The importance of inter-organizational relationships for organizing and carrying out economic exchange has been elaborated in several studies. For example, trust, one dimension describing inter-organizational relationships, between two parties may be considered as an important control mechanism; it is “an important lubricant of a social system. It is extremely efficient; it saves people a lot of trouble to have a fair degree of reliance on other people's word”. (Arrow, 1974, p. 23) Later, several studies have demonstrated how inter-organizational relationships can play a highly significant role in inter-actor coordination (e.g. Jarillo, 1988; Larson, 1992; Ring and Van de Ven, 1992; Adler, 2001)<sup>50</sup>. In addition, several studies conducted in project contexts have also emphasized the importance of IORs for project execution (Hobbs and Andersen, 2001; Skaates et al., 2002; Larson and Wikström, 2007), and there are a number of studies that have identified specific effects or outcomes of IORs. More specifically, IORs in a project context can affect the probability of project success (Söderlund and Andersson, 1998), creation of a shared understanding of task requirements (Windeler and Sydow, 2001), efficiency and innovation (Dubois and Gadde, 2000), learning (Grabher, 2002a), and project performance (Soda et al., 2004). Further Ahola et al. (2006) have discussed how IORs can lead to a variety of benefits for a project supplier and Arto et al. (2008) showed how IORs may function as sources of risk<sup>51</sup> in projects. Based on this discussion, inter-organizational relationships between project network actors may relate to the efficiency of work carried out by participating actors.

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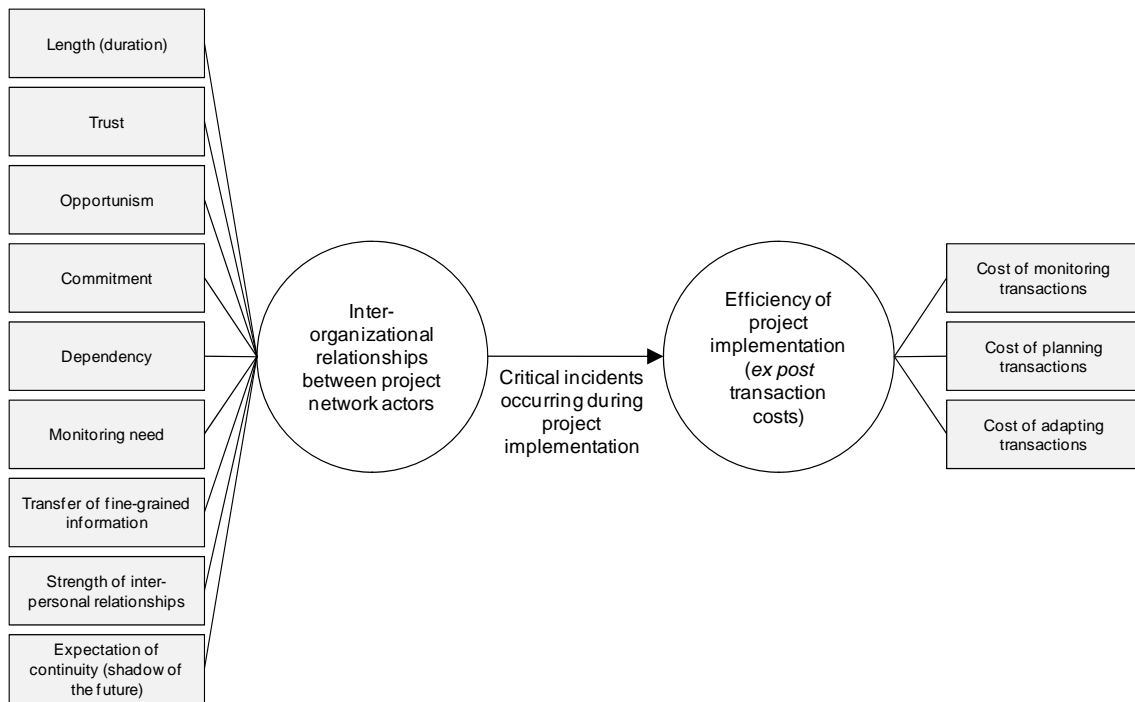
<sup>50</sup> See section 2.3.1 for additional references.

<sup>51</sup> The connection of project risk and critical incidents occurring in projects was discussed in section 2.4.

The role of critical incidents has been emphasized in several contributions and it can be expected that they can play an important role in the relation between inter-organizational relationships and efficiency of economic exchange in project network contexts. Critical incidents occurring during project implementation often require immediate action from one or several project network actors (Hällgren and Maaninen-Olsson, 2005; Söderholm, 2008). As a number of studies have indicated, some of these actions affect to the efficiency of work. Turner and Simister (2001) discuss how uncertainty and risks contribute to transaction costs incurred during construction projects. Al-sakini et al. (2004) demonstrated how critical incidents that occur during a project can lead to increased need for project planning and steering. Following the definition of the construct efficiency of project implementation, an increase in either planning or steering leads to a decrease in efficiency. Dvir and Lechler (2004) have empirically demonstrated a connection between critical incidents and project success. Finally, Hällgren and Maaninen-Olsson (2005) have discussed different tactics that were used to respond to deviations in a mill upgrade project. These tactics included increased communication, searching for information, and even pressuring the supplier but also importantly increased coordination efforts. Based on this discussion, critical incidents that occur during project implementation in a project network context may lead to increases in different types of transaction costs, unfavorably affecting the efficiency of project implementation.

Figure 6 below illustrates the conceptual framework of this study developed in the previous discussion. Circles represent the two constructs introduced earlier in sections 2.3.2 and 2.3.4 and the grey rectangles represent variables used to operationalize the constructs. Finally, critical incidents occurring during project implementation are presented as a potential mechanism linking the two constructs.





**Figure 6 – Conceptual framework for the study**

The secondary research question of this study concerns whether the development of inter-organizational relationships between project network actors may be substantially affected by project implementation, as opposed to being an incremental and slower paced process requiring several consecutive projects. The empirical case study described in the following chapter presented the opportunity to observe the development of inter-organizational relationships between project network actors over a period of six months. Inter-organizational relationships between project network actors have generally been viewed as a byproduct of collaboration (Bengtson et al., 2001; Sydow and Staber, 2002). However, there are both studies that either explicitly or implicitly assume that, in a project context, the development of strong IORs may require multiple consequent projects between involved organizational actors, and studies which argue that IORs may develop significantly within the period of time required to implement a single project. For example, Hadjikhani (1996) has argued that project business is characterized by inherent discontinuity which reduces the possibilities to develop strong inter-organizational relationships between project actors, and Grabher (2002b) and Sydow & Staber (2002) have discussed how *recurrent* collaboration in the form of projects may foster the development of strong relationships between individuals and between organi-

zations. On the other hand, Tähtinen (2001) has discussed how critical incidents occurring during a single project may trigger relationship dissolution. She claims that performance failures, such as the inability to maintain schedule, stay on budget, or deliver acceptable quality, may have detrimental effects towards an IOR. Kadefors (2004) has discussed how excessive monitoring during a single project may increase the level of opportunism or start vicious circles between participating actors. Finally, Hällgren (2007) discussed a project where a critical incident involving a delay caused by a subcontractor resulted in the contractor “pushing” the subcontractor. Based on this discussion, the execution of work and critical incidents that occur during this time may affect the development of inter-organizational relationships between project network actors.

### 3 RESEARCH DESIGN

After the review of relevant literature and development of a conceptual framework to focus and direct the collection of empirical data, this chapter discusses the choice of research approach and describes the industry context from which empirical data was collected. Finally, the processes of case selection, data collection and data analysis are discussed.

#### 3.1 Choice of research approach

According to Yin (1994, p. 4) the selection of a research approach should be based on the type of the research question, whether the study focuses on contemporary or historical phenomena, and the extent of control or influence the researcher has on the events subject to observation.

The research approach adopted in this study can be described as a *mainly qualitative multiple case study*<sup>52</sup>. There are several reasons supporting this choice. First, the two research questions introduced earlier in section 1.2 can be characterized as both descriptive and explanatory. They are descriptive because an attempt to answer them should be able to *describe* project network as a form of project organization and to *depict* a causal mechanism relating inter-organizational relationships between project network actors to the efficiency of project implementation. The research questions are explanatory because answering them requires an *explanation* of how this causal mechanism functions. The nature of the research questions motivates adopting a qualitative research approach as qualitative data is generally considered richer in descriptive power at the expense of generalizability<sup>53</sup>. Second, for practical reasons and the author's own personal preferences, this study focuses on historical as opposed to contemporary events<sup>54</sup>. Third, it

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<sup>52</sup> "Mainly qualitative" refers to the use of empirical data in this study. Both qualitative and quantitative data are used, but the emphasis lies significantly more on the use of qualitative data.

<sup>53</sup> As opposed to quantitative data.

<sup>54</sup> This was primarily a matter of choice as another researcher focusing on the same phenomena and guided by the same research questions might have chosen to focus on contemporary events. Yin (1994, p.

would have been highly difficult to successfully carry out two consequent rounds of data collection required for answering the research questions while relying primarily on quantitative, e.g. survey-based, methodologies. In this study, several multi-actor project networks were studied for a period of one year and in this research setting, the continuous participation of a very high percentage of organizational actors was mandatory for ensuring the validity and reliability of research results. Quantitative methods tend to suffer from lower response rates and would thus have been considerably more difficult to apply in this research setup. Fourth, the decision to study multiple cases as opposed to a single case was based on the need to attain some degree of generalizability of the research findings. Fifth, the ability to control events subject to empirical observation was very limited in this study, which provides support for conducting a case study as opposed to, for example, an experiment. Finally, a mainly qualitative research approach is highly compatible with both the nature of the (partially social) phenomena to be explored in the present study (see Morgan and Smircich, 1980) and the assumptions concerning epistemology, ontology, and human nature held by the author<sup>55</sup>.

### **3.2 Empirical context: the Finnish shipbuilding industry**

The empirical data for this study was collected from the context of the Finnish shipbuilding industry. Shipbuilding is a global business characterized by intense competition between regional shipbuilding industries. An individual regional industry, e.g. in Finland, Japan, Italy, or China, does not typically offer a full variety of ship types to their customers but rather specializes in specific types of vessels. The Finnish shipbuilding industry is specialized in delivering highly demanding sea vessel types, such as the world's largest cruise ships and special purpose vessels for arctic use, while, for example Korean or Chinese shipbuilders are currently very strong in the container vessel market. The nature of demand for sea vessels can more accurately be characterized as

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8) does argue that case studies are particularly suitable for analyzing contemporary events, because of the method's abilities in dealing with a wide variety of evidence and the use of systematic interviewing. Yin does not, however, argue that the case study method would be poorly suited for all studies focusing on historical events.

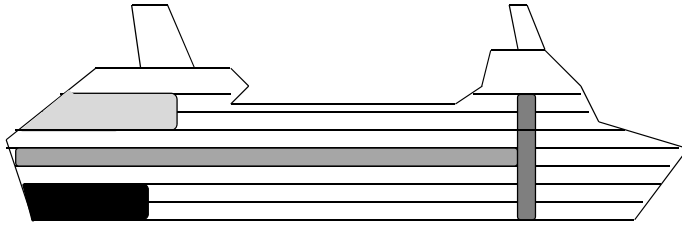
<sup>55</sup> See section 1.4.

volatile than stable. For example, the demand for cruise vessels is highly dependent on both the interests and possibilities of individuals to spend their available holidays on a cruise. These interests are further dependent, among many other factors, on the prevailing economic situation. Historically, the demand for most ship types has been cyclical in nature, characterized by a number of strong years during which the demand for sea vessels is high, followed by a number of weak years during which the demand for sea vessels is much lower.

Sea vessels produced by the Finnish shipbuilding industry are highly complex products. For example, the Oasis Class cruise vessel named Oasis of The Seas, currently under construction at the Turku shipyard, scheduled to be delivered late 2009 to its customer Royal Caribbean International, will feature, for example, the largest and deepest freshwater pool at sea, a carousel handcrafted from poplar wood, the first moving bar at sea, a central park complete with drainage and irrigation systems, 16 decks, and loft suites. In addition to carrying up to 5400 guests, it will encompass a wide variety of complex systems such as power and propulsion systems, and HVAC, navigation, emergency, and communication systems. Most of these systems are interrelated with several others, creating additional challenges for both the design and the implementation phase of the shipbuilding project. The complexity of sea vessels produced by the Finnish shipbuilding industry is further increased by a strong demand for novelty. For example in the cruise vessel market, relying on existing and proven technologies and solutions is not sufficient to satisfy the needs of either cruise line operators or their customers. Every new generation of cruise vessels needs something innovative to finalize the sale and successfully attract its share of passengers. Furthermore, the lengths of the production series for both cruise and special purpose vessels are relatively short, severely reducing possibilities for achieving economies of scale. For example, in the cruise ship market, it is typical that just two or three similar vessels are built before the next generation of ship class is introduced to the market.

In the Finnish shipbuilding industry, the production of sea vessels is organized as projects. A shipbuilding project is managed by the shipyard, which is also responsible for producing the ship hull and providing the facilities and services required for assem-

bling the vessel (Toivonen, 2000). The shipbuilding project is further broken down into several subprojects, many of which encompass the delivery of a fully functional ship area, as illustrated in Figure 7 below.



**Figure 7 – Fully functional ship areas are delivered as projects**

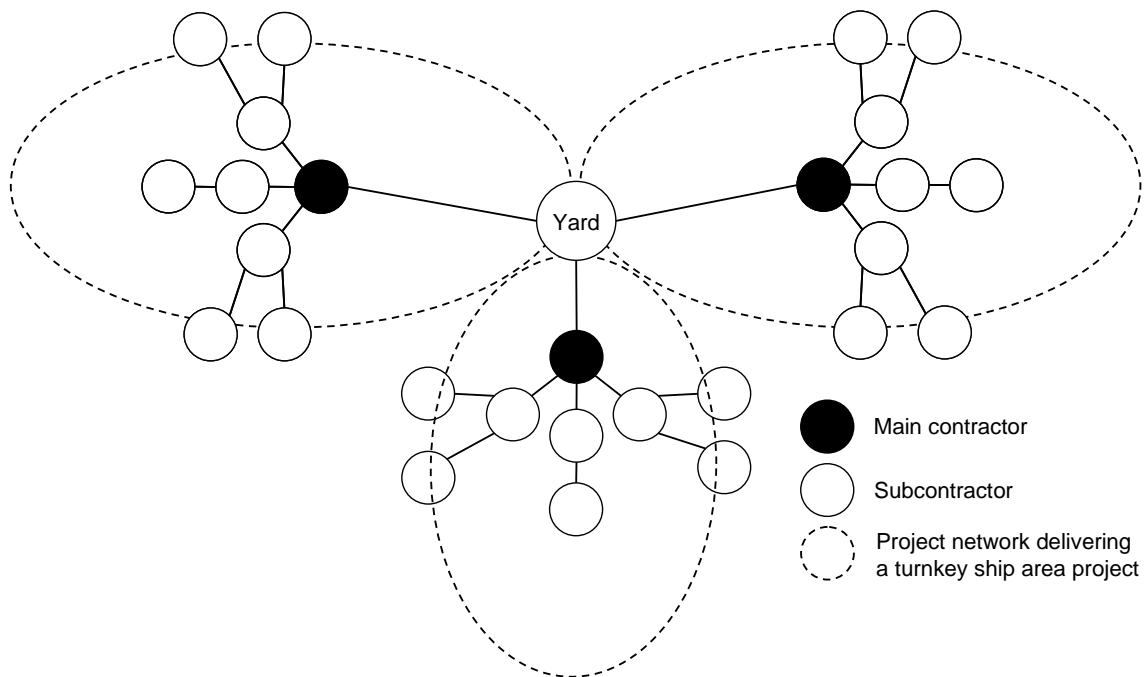
Typical ship area subprojects include: *stairway areas, cabin areas, engine areas, restaurant areas, public areas, kitchen areas, technical areas* and *car decks*. Cova et al. (2002) refer to these types of projects as turnkey projects. In the Finnish shipbuilding industry, *project networks* involving the shipyard, a main contractor, and several subcontractors constitute the *predominant* form of organizing these turnkey subprojects<sup>56</sup>. The shipyard purchases fully functional ship areas from its network of first-tier main contractors; there exist approximately 25-40 firms that have developed the capabilities, knowledge, and subcontractor networks required for successfully setting up and coordinating project networks for delivering turnkey subprojects<sup>57</sup>. These main contractors are a highly heterogeneous group of organizations; some of them are characterized by a high degree of vertical integration while others rely extensively on subcontracting and focus on creating value primarily through their project management capabilities. In addition, all main contractors have specialized to specific ship areas and, as a result, there are only a few main contractors able to set up and coordinate a project network for delivering any given type of area. In transaction cost economics terms, this condition of the

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<sup>56</sup> Whereas in China and Korea, shipyard companies are more vertically integrated and the sea vessel production logic is somewhat closer to a hierarchy.

<sup>57</sup> Actually, based on the characteristics of project networks discussed in section 2.2, the main contractor is not in total control of the formation of the network. For example, second-tier subcontractors used by the main contractor often choose to add new third-tier subcontractors to the project network. In addition, even though the main contractors are described to *coordinate* project networks, their power to influence other firms in the network is always limited.

Finnish shipbuilding industry is labeled as *small numbers bargaining*. A typical main contractor in the Finnish shipbuilding industry employs between 40 and 300 individuals. In addition to the first-tier main contractors directly employed by the one major shipyard company that operates in Finland, the main contractors subcontract work further to second, third, and even fourth tier subcontractors. Figure 8 below illustrates the production logic of the Finnish shipbuilding industry.



**Figure 8 – The operation logic of the Finnish shipbuilding industry**

Different subprojects contributing to the construction of a sea vessel are often highly interdependent. For example, air conditioning and various safety systems are present in almost all ship areas. As a result, there are complicated interfaces between ship areas, leading to additional complexity for task coordination within each subproject, as a delivery to a specific area may be dependent on the progress of work (e.g. piping) in several neighboring areas. The importance of cross-area coordination has been discussed elsewhere and is not examined further in this study. For a more detailed elaboration on the interdependencies that exist in shipbuilding and how they can be managed in practice, see Hellström & Wikström (2005) and Hellström (2005). Furthermore, various components and subassemblies used in the production of sea vessels are highly customized,

making buffer inventories an unpractical safeguard for holdups in production (Masten et al., 1991). In addition, the specifications for sea vessels are routinely modified by clients during the design and production phases, creating the need for flexibility in organizing production. When changes occur, the production process may not be crippled or halted, but skilled professionals need to be able to make the correct modifications on site, and often at a moment's notice. This requirement poses considerable demands for both practical and theoretical knowledge possessed by the individuals working in the shipbuilding industry. Practical tools for helping individuals deal with these challenges are few in number. One solution that may help companies cope with some of these challenges has been suggested by Tikkanen (1997) who demonstrated how some of these difficulties inherent in shipbuilding can be analyzed by treating delivery projects as business processes. Overall, shipbuilding can be characterized as a highly labor-intensive industry in which a lot of relatively low-technology, labor-intensive activities, related predominantly to the assembly of the final product, are required.

There are a number of characteristics affecting the organization of production in the Finnish shipbuilding industry. First, the frequency of transactions between the yard company and its first-tier subcontractors can be characterized as relatively high as there tends to be continuous exchange between the yard and its main contractors. In a case where a main contractor would not be able to deliver anything for the yard for a period lasting several years, it would be highly likely that this firm would either exit the industry or fail. Generally, both parties are also quite dependent on each other. From the viewpoint of the shipyard, there are a very limited number of main contractors able to set up and coordinate the delivery of subprojects for any given type of ship area and from the viewpoint of the main contractors, the shipyard often represents a very considerable portion of annual turnover, in many cases exceeding fifty per cent. In addition to the high degree of demand uncertainty discussed earlier in this section, the industry is also characterized by a moderate degree of behavioral uncertainty. Malinen (1998) and Toivonen (2000) have discussed how in the Finnish shipbuilding industry, both the yard and the first-tier main contractors have occasionally resorted to opportunistic behavior. In addition, during the past two years (2007-2008), the industry has been struggling to keep up with highly optimistic schedules promised to its customers. As a part of this



process, both the yard and many of its suppliers have failed to keep some of the promises they made to other industry actors. Shipbuilding involves a lot of highly specific, and often tacit, knowledge that is difficult to transfer or apply outside the specific industry context. For example, designers specialized in optimizing ship hull or bulb designs are virtually tied to the industry. In addition, many executives leading the first-tier main contractor firms often possess a lengthy background in the industry, and in many cases they are former employees of the yard company<sup>58</sup>. As a result, and in accordance to Masten et al. (1991), the shipbuilding industry is characterized by a fairly high degree of human asset specificity. On the other hand, fewer industry-specific production technologies, tools or processes are used, resulting in a fairly low degree of physical asset specificity.

During the recent years until fall 2008, during which the global economic situation weakened dramatically, the Finnish shipbuilding industry has been receiving a generous amount of new ship orders, but despite this, several firms have reported very low or even negative profitability. In addition, the ownership of the only major yard company operating in Finland has changed twice, and currently its largest shareholder is a Korean shipbuilding group. As the industry is global and competition between shipbuilding groups is intense, the Finnish shipbuilding industry is currently under significant pressure to shorten its delivery times and increase its efficiency. To meet these demands, in 2004, key industry actors jointly developed a shared strategy in which turnkey ship area projects delivered by project networks set up by the first-tier main contractors play a central role. Currently, it is estimated that more than 60 per cent of a ship's value is purchased as such turnkey projects by the yard and the number is predicted to increase further. As a result, the future of the Finnish shipbuilding industry is highly dependent on the degree of success of this transition. In addition, due to relatively high costs of labor in Finland, industry actors are highly committed to reducing the amount of work that needs to be carried out on site and to increasing the application of advanced production technologies. Significant investments have recently been directed towards standardizing

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<sup>58</sup> This is partially explained by the fact that many of the first-tier main contractors are spinoffs of the yard company.

and modularizing components of the ship to achieve economies of scale (Hellström, 2005).

### **3.3 Selection of cases**

When selecting cases for a multiple case study, theoretical sampling is generally considered preferable to random sampling; this is because the former strategy enables cases to be selected so that they either replicate previous cases or extend emergent theory (Eisenhardt, 1989; Yin, 1994). Yin (1994) argues that individual cases are to be selected similarly as a laboratory investigator selects experiments and under these circumstances, the method of generalization is “analytic generalization” as opposite to “statistic generalization”. Further, multiple cases can be considered as multiple experiments and, if several cases are shown to support a theory, replication may be claimed (ibid.). Whenever possible, it should be ensured that the selected cases do not differ dramatically in very many of their defining characteristics; similarity among cases improves possibilities for conducting cross-case comparisons and evaluating the generalizability of research results (Miles and Huberman, 1994).

Following a theoretical sampling logic, four project networks from the Finnish shipbuilding industry were selected as cases for this study. The following defining characteristics were similar across cases:

- ❖ Each project network was delivering a turnkey subproject to the same client, from now on referred to as the *yard*.
- ❖ Each subproject consisted of design, manufacture, installation, and handover of a fully functional ship area to the yard.
- ❖ The duration of each subproject lasted between one and two years from the start of design phase to handover to the yard.
- ❖ Each subproject was in the implementation phase during the period of data collection.

Due to practical limitations related to access to empirical data, both the effort and the resources required to collect the data, and due to the unique nature of turnkey subproject deliveries in the Finnish shipbuilding industry, there were also several differences between the selected four cases. The existence of these differences is not inherently unfavorable for the present study, as they provide increased potential for evaluating the generalizability of obtained research results, and also because they may provide opportunities for explaining why results obtained in one case might differ from results obtained in another. These differences will now be discussed in as much detail as possible without revealing the identities of the individual firms and persons that participated in this study<sup>59</sup>. First, each studied project network (hereafter named *alpha*, *beta*, *gamma*, and *delta*) was coordinated by a different first-tier main contractor. Second, the studied project networks were delivering subprojects to three different shipbuilding sites in Finland operated by the yard (referred to as *Red*, *Green*, and *Blue*). There are three shipyards in Finland that are all owned by the client. They are located in the cities of Turku, Rauma, and Helsinki. Of these shipyards, the Turku shipyard is the largest while Rauma and Helsinki are notably smaller. Further, in two of the studied cases, *alpha* and *gamma*, the sea vessel under construction was moved from one site to another during the implementation phase of the project. Third, one of the four project networks, *alpha*, was responsible for delivering a ship area that was highly visible to end user customers, while three project networks were delivering technical ship areas which were either partially or completely concealed from end user customers under normal circumstances. Ship areas visible to end users have higher standards for visual finishing than areas not visible to end users. Fourth, during the first round of interviews conducted for this study, two studied project networks were in the early implementation phase and two in the late implementation phase of the project. As the second round of interviews was carried out, two projects had been completed and handed out to the yard while the remain-

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<sup>59</sup> The 22 individuals interviewed for the present study very openly discussed issues related to collaboration with their customers and subcontractors (at the level of individual persons they work with on a daily basis). During the interviews, many highly difficult problems hindering collaboration in the studied project networks were also openly discussed. Due to the highly sensitive nature of the collected data it was agreed that neither the businesses nor personal relationships of the interviewed persons may be revealed. As a result, neither the interviewed individuals nor the organizations they represent can be named.

ing two were nearly completed. Fifth, the degree of novelty varied slightly across cases. A high degree of novelty indicates that a delivery was highly unique and characterized by very limited possibilities in re-using diagrams and other material from past projects, while a low degree of novelty indicates that a ship area with somewhat similar specifications had previously been delivered to the yard. Sixth, all deliveries involved a different kind of ship area. As all areas were built for a different purpose, different issues such as technical reliability or customer experience were placed differing emphasis. However, each project network responsible for the delivery of an area was free to organize work within that area as it saw fit, as long as agreements concerning the predetermined interfaces to other areas were respected. As a result, two area deliveries of the same type (e.g. a restaurant area) could be built following several rather different approaches. Due to the scope of this thesis, the technical organization of work is not addressed further here<sup>60</sup>. Table 8 below highlights the key differences between the four studied project networks.

**Table 8 – Key differences between studied project networks**

Project network	Alpha	Beta	Gamma	Delta
Shipbuilding site (all operated by yard)	Red, Green	Blue	Red, Green	Red
Project type	Visible turnkey ship area subproject	Technical turnkey ship area subproject	Technical turnkey ship area subproject	Technical turnkey ship area subproject
Phase of project during first interview round	Late implementation	Early implementation	Late implementation	Early implementation
Phase of project during second interview round	Delivered to yard	Late implementation	Delivered to yard	Late implementation
Novelty of project	Low to moderate	Moderate	Moderate	Moderate to high

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<sup>60</sup> A future study could focus, for example, on studying what are the different approaches to organizing tasks within different ship area types and the efficiency implications of these approaches.

### **3.4 Selection of organizational actors**

Following the selection of the four case project networks to study empirically, there was a further need to select organizational actors as sources of empirical data in each studied case. As this study focuses on inter-organizational networks involving several organizational actors, the use of multiple organizations as sources of data (as opposed to a single organization) was considered as a mandatory requirement for obtaining data of acceptable validity.

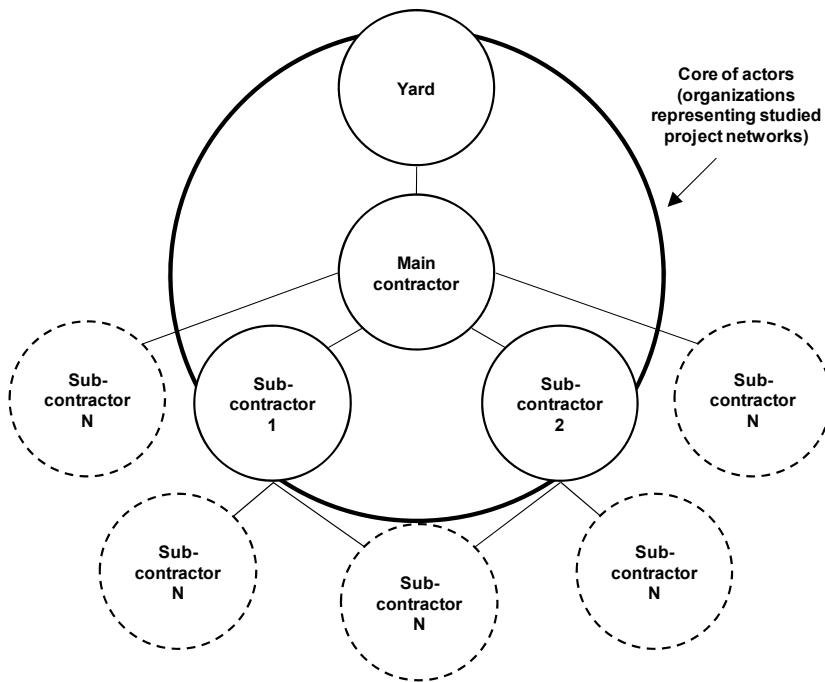
As discussed earlier, the boundaries of project networks are dynamic and cannot be determined by any individual organization<sup>61</sup>. Further, all four case project networks included more organizations than it would have been practical to empirically observe during the course of this study. In a typical case, the main contractor employed more than ten different subcontractors. In addition, these subcontractors often subcontracted work further down to third tier subcontractors. In addition to subcontracting work, several dozens of materials suppliers were used in each project network. Thus, it can be concluded that when including all individual organizations participating to the studied project networks with even a minor role or contribution, each of the studied four project networks encompassed in excess of a hundred individual firms. Due to practical reasons related primarily to the use of interviews as the main method for collecting empirical data, all of these organizations could not be included as sources of empirical data.

The selection of individual organizational actors to represent the four case project networks was based on the concept of a *core of actors* discussed by Hellgren and Stjernberg (1995). The core of actors consists of central actors, interconnected by inter-organizational relationships. Core actors make a highly significant contribution to achieving the shared task of the project network, which, in the studied cases, is the delivery of a turnkey ship area subproject to the yard. Based on the concept, four organizations representing each of the studied four project networks were selected as sources of empirical data. Further, three inter-organizational relationships, one between the yard and the main contractor and two between the main contractor and each of the two sub-

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<sup>61</sup> See section 2.2 for details.

contractors were included. Prior to the studied subprojects, some of the studied subcontractors had also worked directly for the client. However, in the studied four project networks, the amount of direct contact between the client and the subcontractors was very limited. For this reason, inter-organizational relationships between the client and the subcontractors were excluded from analysis. Figure 9 below illustrates the structure of the studied project networks.



**Figure 9 – Selection of organizations to represent studied project networks**

*The yard* acted as the client for all four turnkey ship area subprojects under delivery by the studied project networks. The primary role and interest of the yard was to ensure that its several active shipbuilding projects would be delivered on time and according to their predetermined cost and quality objectives. An important part of this role was the monitoring and coordination of several turnkey ship area subprojects which were being delivered to vessels under construction in the yard’s three shipbuilding sites in Finland. The yard constantly monitored the progress of the deliveries from the perspective of the owner, taking whatever corrective action considered to be necessary if progress was short of what was expected. As a result, depending on how work in the project network

was proceeding, the role of the yard could be characterized as anything between a passive observer to an active participant with considerable authority.

The *main contractor* in each project network was ultimately responsible for delivering the turnkey ship area subproject to the yard. As such, its primary role was to set up and coordinate the project network<sup>62</sup>; including activities such as creating master schedules and ensuring that sufficient resources were available for delivering them. In addition, the main contractor actively monitored the progress of its subcontractors<sup>63</sup>. All four studied main contractors also possessed significant production resources.

*Subcontractors* were firms with a highly significant stake in the realization of the studied turnkey ship area subprojects. The two, included subcontractors from each of the studied project networks were selected by the main contractors of their respective networks<sup>64</sup>.

To summarize, the total number of organizations acting as sources of empirical data in this study was 13, including:

- ❖ 1 yard (all four subprojects were delivered to the same client)
- ❖ 4 main contractors (one in each project network studied)
- ❖ 8 subcontractors (two in each project network studied)

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<sup>62</sup> As the present study focuses on the implementation phase of project life cycle, the set-up of project networks is not discussed further.

<sup>63</sup> This was similar to how the yard monitored the progress of the main contractor.

<sup>64</sup> The main contractors are responsible for setting up the project networks and, as a result, have detailed knowledge of different subcontractors in the network.

### 3.5 Selection of informants

Following the selection of organizations to study empirically, there was a further need to choose the individual persons to represent the organizations previously selected. The goal for the selection of informants was to include individuals that possessed the most extensive and accurate information concerning<sup>65</sup>:

- ❖ Inter-organizational relationships in the studied four project networks
- ❖ Critical incidents that had occurred during the implementation phase in the studied four project networks

From each of the 13 organizations representing the four studied project networks, it was ensured that at least one person was interviewed. Thus, data from multiple informants were used to study each project network (Golden, 1992; Kumar, Stern, and Anderson, 1993).

From the yard's organization, the four interviewed persons were *area managers*, responsible for overseeing the progress of the four turnkey ship area subprojects. All these area managers were highly involved in the project networks examined and were frequently in contact with representatives of the main contractors. In project network delta, one *designer* working with the project was also interviewed.

From the four main contractors' organizations, individuals with two specific roles were selected as informants. First, individuals responsible for the delivery of the turnkey ship area subprojects to the yard were interviewed. These individuals were typically either *project managers* or *managing directors*. Second, individuals responsible for selecting and planning collaboration with subcontractors included in this study were also interviewed. These individuals were *project managers*, *managing directors* or *purchasing managers*. In three (alpha, beta, gamma) out of four studied project networks the aforementioned two roles were somewhat overlapping as there were two or even three per-

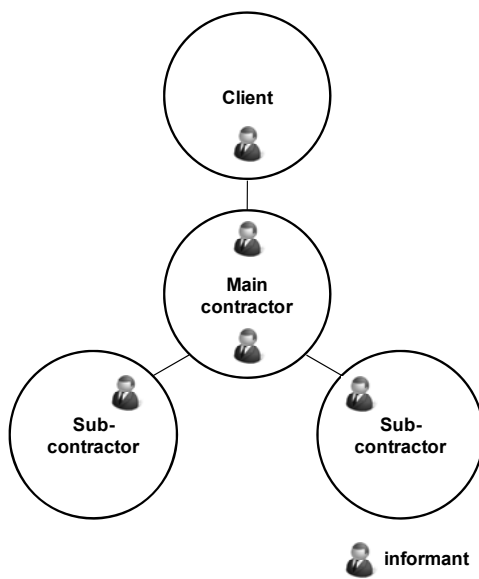
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<sup>65</sup> Based on the conceptual framework developed in chapter 2.



sons that actively participated in collaboration with both the yard and the subcontractors.

Of the eight subcontractors' organizations, individuals that were highly involved in the studied projects were interviewed. These persons were *project managers, managing directors, department managers* or *designers*<sup>66</sup>. Figure 10 below illustrates the positions of individual informants in the four studied project networks and Table 9 summarizes their roles.



**Figure 10 – Positions of informants in the studied project networks**

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<sup>66</sup> This was highly dependent on the size of the subcontractor firm.

**Table 9 – Informants in studied project networks**

<b>Project network</b>	<b>Alpha</b>	<b>Beta</b>	<b>Gamma</b>	<b>Delta</b>
<b>Individual(s) representing yard</b>	Area manager	Area manager	Area manager	Area manager, designer
<b>Individual(s) representing main contractor (towards yard)</b>	Head of project department, project manager	Managing director, project manager, designer	Managing director, project manager	Project manager
<b>Individual(s) representing main contractor (towards subcontractors)</b>	Head of project department, project manager	Managing director, project manager, designer	Managing director, project manager	Purchasing manager
<b>Individual(s) representing subcontractors</b>	Managing director, project manager	Managing director (two individuals), designer	Managing director, project manager	Managing director, department manager, project manager

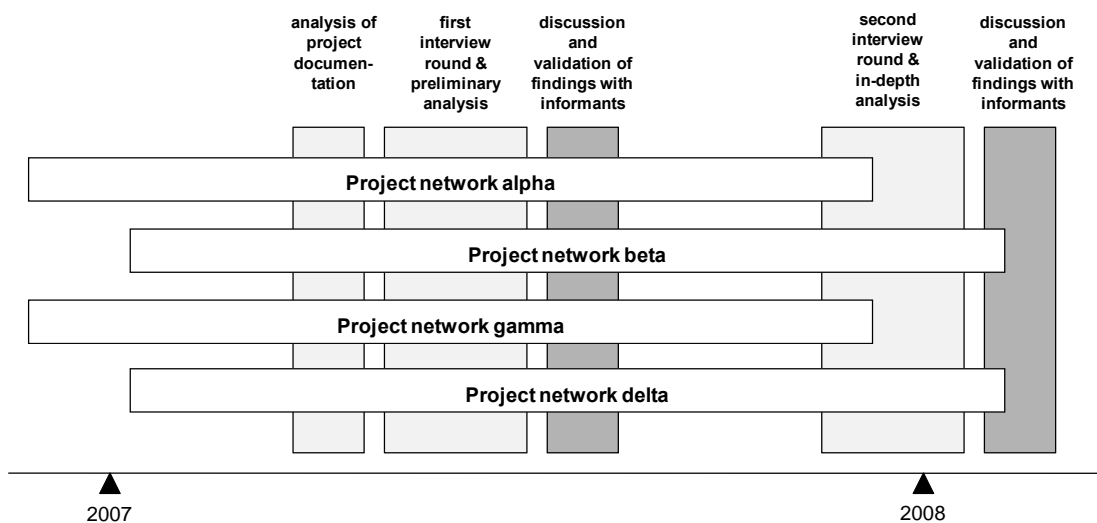
### **3.6 Data collection**

This section describes the process and methods used to collect the empirical data examined in this study.

#### **3.6.1 Overview**

The empirical data examined in this study was collected during approximately a one year period by the author and another researcher. The data consists of semi-structured interviews and project documentation. Figure 11 illustrates the process of collecting the research data. Following Yin (1994), the collection of data was guided by the two constructs and the conceptual framework of the study introduced earlier in Chapter 2. First, project documentation related to the four studied project networks was obtained and analyzed to provide an initial understanding of each of the four project networks and the turnkey ship area subprojects they were delivering to the yard. After this, the first round of 22 personal interviews was conducted during spring 2007. The interviews were transcribed and analyzed and the results of the analysis were reviewed with several infor-

ments to ensure their validity. Starting fall 2007 and ending early 2008 when two out of four studied projects had been delivered to the yard and the remaining two were being finalized, a second round of 18 personal interviews was conducted to document how inter-organizational relationships in the studied project networks had evolved and what critical incidents had occurred during the six months that had passed since the first round of interviews.



**Figure 11 – Collection of research data**

As summarized in Table 10 below and discussed in detail in the following paragraphs, this study combines multiple sources of empirical data in order to achieve methodological triangulation, considered to increase the validity of research results (Jick, 1979).

**Table 10 – Summary of empirical data collected for this study**

	<b>Project network alpha</b>	<b>Project network beta</b>	<b>Project network gamma</b>	<b>Project network delta</b>
<b>Project documentation</b>				
	Project meeting memos, project schedules, contract documents	Project meeting memos, project schedules, contract documents, technical diagrams, component lists	Project meeting memos, project schedules, contract documents	Project meeting memos, project schedules, contract documents, project organization chart, project planning documents
<b>Personal interviews</b>				
First interview round	5	6	5	6
Second interview round	3	6	3	6

### **3.6.2 Project documentation**

Early in 2007, a wide variety of documentation related to the four project networks under examination was obtained (see Table 10 above for details). This documentation provided a starting point rich in detail for the empirical part of this study. By reviewing the various documents it was possible to develop an a priori understanding of several important characteristics of the four project networks, including the scopes of their respective turnkey ship area subprojects. Memorandums of meetings been held between the yard and the main contractors in the preceding design phases of the projects were particularly helpful in shedding light on the progress of the four projects, including difficulties experienced during the early phases of their life cycles. Contracts and project plans provided further insight into the scope and technical details of the deliveries. Overall, based on a review of the documentation the two researchers involved in the empirical part of the present study were adequately prepared to begin the first round of personal interviews that followed the analysis of documents. In particular, as the documentation included a considerable amount of detailed information concerning the projects under study, less time needed to be allocated for discussing various kinds of background in-

formation with the informants, leaving more time to focus on the two topics of primary interest: inter-organizational relationships and critical incidents.

### **3.6.3 Personal interviews**

Altogether 40 interviews were conducted in-person on the premises of the participating 13 organizations representing the four studied project networks. In order to finalize the interview guide and to ensure that all further interviews would be carried out with a standardized structure, the first four interviews were conducted with a team of two researchers. After that, the remaining 36 interviews were conducted by a single researcher. All interviews were carried out between April 2007 and February 2008. To increase the reliability of gathered data, the interviews were recorded and transcribed. A single informant declined the use of a recorder and of his interviews (on both interview rounds) were not recorded. In this case, detailed written notes were taken during the interviews. In each interview, written notes were taken by the interviewers. Each interview produced a transcript of about 10-20 pages in length<sup>67</sup>.

The duration of the interviews varied between 35 minutes and two hours. Each interview consisted of two distinct and sequential phases. The first phase focused on the inter-organizational relationships in the studied project network and included both a semi-structured qualitative discussion and a structured quantitative description of the inter-organizational relationships. The second phase focused on identifying and documenting critical incidents that had occurred during the implementation of the project in question. The structure of the interviews is presented in Table 11 below and further elaborated on in the following paragraphs.

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<sup>67</sup> A4 size, 12 pp font, 1.5 line spacing

**Table 11 – Structure of personal interviews**

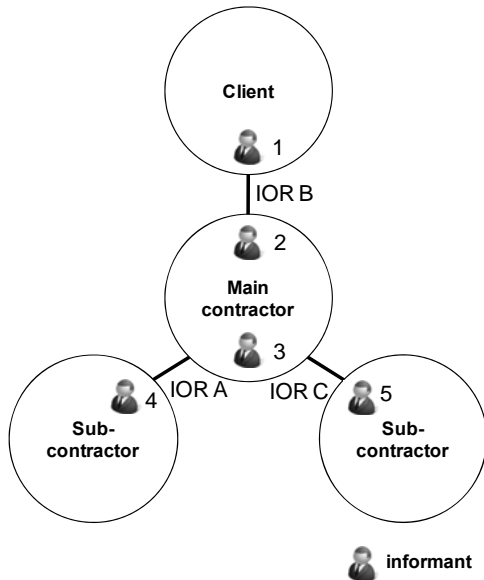
Phase one: Inter-organizational relationships in studied project network		Phase two: Critical incidents in studied project network
Qualitative description of IORs	Quantitative description of IORs	Identification and documentation of critical incidents that had occurred during last six months

***Interview phase one: inter-organizational relationships in the project network***

The goal of phase one was to collect information of the inter-organizational relationships of the organization that the interviewee represented had with other organizations in the project network being studied. The content of the interview guide was based on the construct *inter-organizational relationships between project network actors* developed earlier in section 2.3.2 and it is presented in APPENDIX A.

Each informant was asked to describe only those inter-organizational relationships in the project network she or he was personally involved with as illustrated in Figure 12 below. Thus, for example, informants 1 and 2 both described only IOR B, informant 3 described both IOR A and IOR C, and informant 4 described only IOR A. Thus, individual IORs were described by two informants representing different organizational actors. The two informants representing these actors described the IOR in question as they perceived it. These descriptions were then combined in the later analysis phase as discussed in section 3.7.3. Phase one of the interview was organized into two parts. In the first part, several factors related to the history, current state and future plans regarding the IOR were discussed, resulting in qualitative descriptions of the IORs rich in detail. In the second part, eight IOR dimensions included in the construct *inter-organizational relationships between project network actors* were quantitatively measured with a questionnaire to collect information that could be compared across both individual informants and cases. A 7-point Likert-type scale was used (See APPENDIX A for details). Finally, it is possible that in some of four the studied project networks, there may have existed additional inter-organizational relationships in addition to those three illustrated in Figure 12 below. For example, it is possible that two subcontractors may have

worked previously in a joint project, and as a result, developed an inter-organizational relationship. However, as discussed in the first chapter of this study, such additional ties (if they existed), were not focused on in this study.



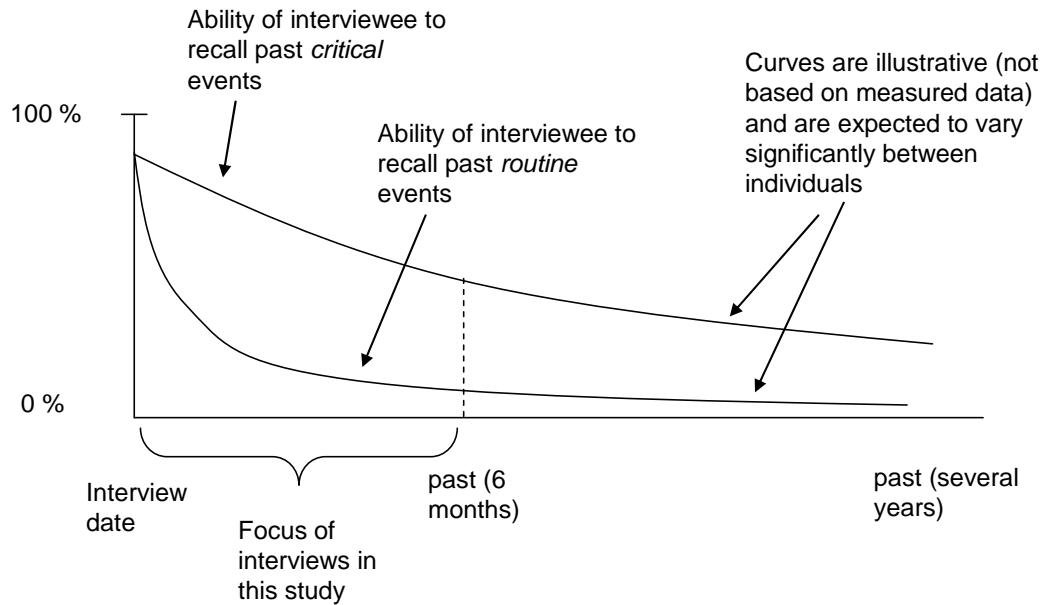
**Figure 12 – Collecting data on inter-organizational relationships in studied project networks**

***Interview phase two: critical incidents occurring during project implementation***

In the second phase of each interview, the goal was to identify and document critical incidents that had occurred in the project network the organization represented by the informant was a part of. In accordance with the discussion in section 2.4, the term “critical incident” was defined for the informants as “*any highly significant event (from the viewpoint of the informant) that occurred during the implementation phase of the project and was either favorable or unfavorable for the project as a whole.*”

As discussed earlier in section 2.4, the ability of any individual to recall historical events is inherently limited (Flanagan, 1954; Golden, 1992; Yin, 1994). To improve the reliability of collected data, informants were asked to focus on critical incidents that had occurred during the last six months preceding the interview date. Figure 13 below illustrates how informants are more likely to be able to recall recent incidents than incidents

that have occurred further in history, and how it is more likely that an individual recalls critical incidents than events she considers as routine.



**Figure 13 – Using interviews to collect data of historical critical incidents**

All critical incidents were identified and documented using a standardized structure presented in APPENDIX B. More specifically, regarding each individual identified incident, the following elements were discussed and documented:

- ❖ Time of critical incident (when did the incident occur)
- ❖ Description of critical incident (what happened)
- ❖ Cause for critical incident (what was the reason or reasons leading to the occurrence of the incident)
- ❖ Result of critical incident (what was the outcome of the incident)

### **3.7 Data analysis**

The analysis of data in this study can be characterized as an iterative process that involved a constant moving back and forth between the raw data and the various ways to categorize, describe and characterize it. As a whole, the process was consistent with



Miles and Huberman (1994), who divide analysis of data into partially overlapping processes of data reduction, data display, and conclusion drawing and verification.

Data reduction involved the coding and categorizing of empirical data. Information that was more or less scattered in dozens of interview transcripts and other documents had to be extracted and arranged into more easily manageable formats. Data reduction consisted primarily of coding specific elements contained in the documents into a spreadsheet with standardized columns to facilitate further categorization and comparison.

Data displays, which played a highly central role in data analysis, are organized assemblies of information that facilitate the drawing of conclusions (Miles and Huberman, 1994). In addition, displays are often highly efficient in communicating research results to others. Qualitative research typically involves the collection of a substantial amount of field data. As a result, in studies such as this one, displays have a central role in verifying that the conclusions that are drawn are based on a systematic analysis of the collected data, as opposed to emphasizing interesting peculiarities that might raise the researcher's interest when browsing through field notes. The central displays used during the analysis of the data for this study were tables, charts, visual timelines, and direct quotations. Tables were used for condensing information to a compact and more manageable form. For example, for each of the four project networks examined, a table summarizing the essential features of the inter-organizational relationships in these networks was created. The use of charts was also particularly helpful during the analysis of data concerning critical incidents. For example, displays summarizing different characteristics describing the 197 critical incidents collected for this study resulted in a holistic view of the data that was essential to categorizing the incidents (discussed in section 3.7.2). Charts also functioned as a valuable tool when comparing data obtained from the first round of interviews to data obtained from the second round of interviews, and for comparison of results across cases. Visual timelines, similar to the one presented in APPENDIX B but with additional detail, were also created to develop an understanding of what had occurred in the studied project networks over time. Finally, direct quotations were used to highlight issues raised by the informants.

Conclusion drawing is essentially about finding regularities, patterns, and causal relationships using empirical data (Miles and Huberman, 1994). Drawing conclusions is an iterative process that continues for the duration of the entire study and is tightly coupled with the process of verification. In this study, tables highlighting central features of critical incidents combined with quotes from interview transcripts were particularly important for identifying regularities in the empirical data. Initial conclusions were verified as the analysis proceeded. Verification was based on a rigorous re-examination of the empirical data, testing it and any related findings for inconsistencies or flaws, comparing the findings to existing theories, and discussing the findings with informants and fellow researchers. Even though the analysis of data was iterative and partially overlapping in nature, it is possible to make a distinction between eight analytical phases which are discussed in the following sections. For sake of clarity, it was not feasible in this study to entirely separate analysis from the presentation of results, and as a result, the discussion that now follows, quite briefly introduces the analysis of data to the reader. This introduction is then complemented by the discussion of results in Chapter 4.

### **3.7.1 Phase one: coding of critical incidents**

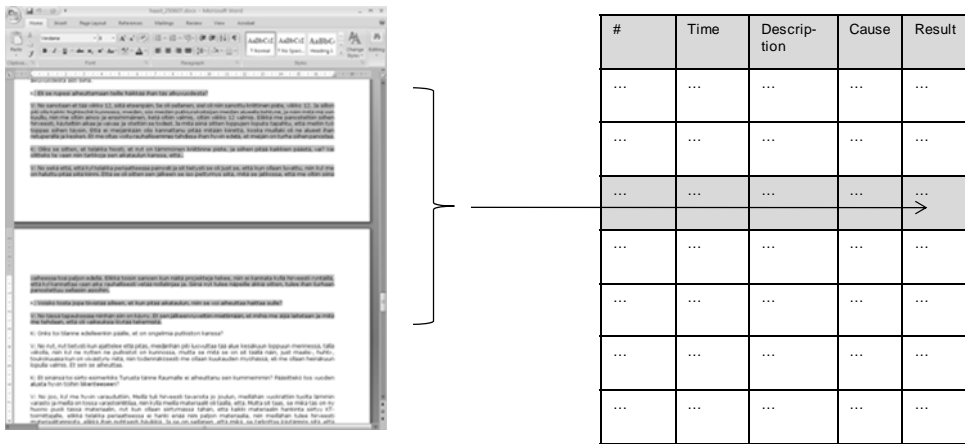
The collection of data discussed in the preceding section resulted in excess of 400 pages- of interview transcripts and project documentation. These documents formed the raw empirical data used in this study. Due to the well known limitations of humans to process large amounts of information, this collection of data needed to be focused, summarized, simplified, and abstracted before it could be used to create tables, figures, case summaries, or any kind of conclusions (Miles and Huberman, 1994). After getting acquainted with the empirical data as a whole, the goal was to code all 197 critical incidents that had been identified and discussed during the 40 personal interviews into a format which would facilitate the categorization and further analysis of the incidents.

Each coded critical incident included an *identifying number*, time when the incident had occurred, a *description* of the incident, the *cause* for the incident as stated by the informant (why the incident occurred) the *time* the incident occurred, and the stated *result* of the incident (what was the outcome of the incident), if known. Incidents were coded by reading through the interview transcripts and entering these details concerning each in-

dividual critical incident into a spreadsheet. Figure 14 below illustrates the process of coding critical incidents.

**Analysis phase one: coding of critical incidents**

Each of the 197 identified critical incidents identified and documented during the interviews was coded into a spreadsheet to facilitate further analysis.



**Figure 14 – Analysis phase one: coding of critical incidents**

An excerpt from an interview transcript is used to illustrate the coding an actual incident from empirical data collected for this study. This particular incident occurred in one of the studied four project networks (alpha, beta, gamma, and delta) and involved actors *subcontractor X*, *subcontractor Y*, and *main contractor*. Due to the highly sensitive and often business critical nature of critical incidents for the organizations the informants were employed by the identity of this project network cannot be revealed here. Before each interview, it was agreed that the informant could discuss difficulties related to inter-organizational collaboration openly as this information would not be disclosed to individuals representing other involved organizations.

Quote from interview with the informant representing *subcontractor X* (translated from Finnish by the author):

*...well, we waited to get this junk cleared up and then we had to make a certain solution, I think it was around week 12, with the main contractor ... the main contractor took a few cleaning persons, moved away some of the material in that area, just enough so that we could move there with a special cart. We managed to do all the connections there. And then we moved the same junk back, that is, unnecessary work was done at that area.*

This critical incident, marked with the identifying number # 107, was coded as demonstrated in Table 12 below:

**Table 12 – Coding of critical incident # 107**

#	Time	Description	Cause	Result
107	Week 12, year 2007	The <i>subcontractor X</i> had to wait for the working area in the sea vessel under production to be cleared. Before this was done <i>subcontractor X</i> was unable to continue working due to materials obstructing passage in the area.	<i>Subcontractor Y</i> , involved in another delivery for the yard, had not cleaned up in the area. Despite repeated requests by <i>subcontractor X</i> , <i>subcontractor Y</i> did not clean the area. ( <i>this information was obtained from a previous section of the same interview</i> )	The progress of <i>subcontractor X</i> was delayed because, for a period lasting several days, work could not be carried out in the area. In addition, repeatedly contacting <i>subcontractor Y</i> consumed <i>subcontractor X</i> 's resources. Eventually, the <i>main contractor</i> decided to use its own resources to clean up the area. Further, <i>subcontractor X</i> and the <i>main contractor</i> also needed to do extra work at the area (to move back <i>subcontractor Y</i> 's materials).

### 3.7.2 Phase two: categorization of critical incidents

After coding all of the 197 critical incidents, incidents were categorized based on their content. First, incidents were categorized based on the seven categories identified earlier from existing literature<sup>68</sup>:

- Scope related incidents
- Materials related incidents
- Delay in progress
- Human resources related incidents
- Communication related incidents
- Process or schedule synchronization related incidents
- Stakeholder or environment related incidents

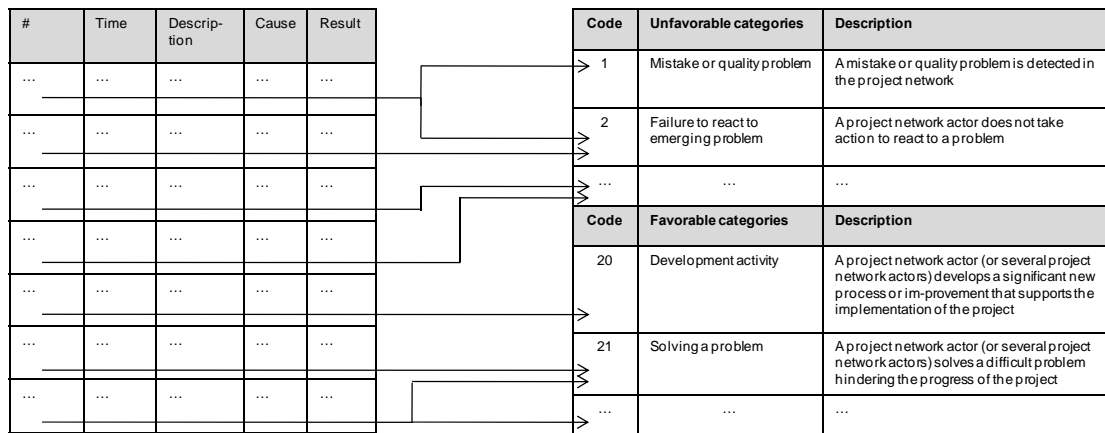
After all 197 critical incidents had been categorized into the seven categories listed above, it soon became evident that this categorization structure suffered from two shortcomings. First, some of the incidents identified and documented during the interviews did not fit into any of these seven categories; this created the need to develop additional categories. Second, by examining the content of the critical incidents, it was evident there were both *favorable* and *unfavorable* incidents for the involved projects, while the original categorization structure did not make a distinction between favorable and unfavorable incidents. To overcome these shortcomings, the development of an improved categorization structure was considered necessary, which highlighted the iterative and somewhat intuitive nature of analyzing qualitative data discussed in several case study articles and textbooks (see e.g. Eisenhardt, 1989; Miles and Huberman, 1994). Figure 15 below illustrates the process of categorizing critical incidents. The revised and final categorization structure consisted of ten favorable and six unfavorable categories. Several examples illustrating its application in this study are presented later in section 4.1.1. Note that as discussed in section 4.1.1, a portion of critical incidents were categorized into more than one category.

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<sup>68</sup> See section 2.4, in particular Table 6.

**Analysis phase two: categorization of critical incidents**

Based on the content of the 197 critical incidents, a categorization structure consisting of 10 favorable and 6 unfavorable incident categories was developed.



**Figure 15 – Analysis phase two: categorization of critical incidents**

**3.7.3 Phase three: examination of inter-organizational relationships**

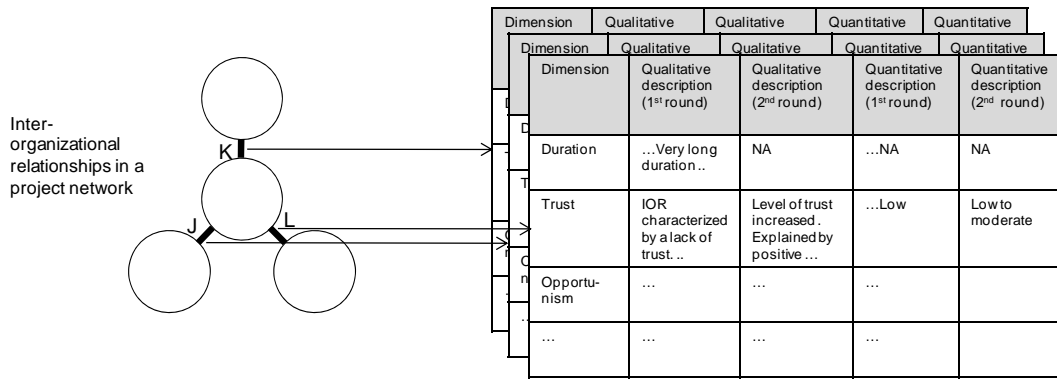
Information describing the altogether twelve inter-organizational relationships between actors of the four project networks studied was examined to develop a rich and multidimensional understanding of each individual relationship (marked with a unique letter in the range A-L). As discussed in 3.6.3, each interview carried out for this study contained a phase during which the interviewee was asked to provide both a qualitative and a quantitative description of those inter-organizational relationships he or she was personally involved in<sup>69</sup>. This information was examined to develop an understanding of the nature of each individual IOR as illustrated in Figure 16 below. As two rounds of interviews, separated by a period of six months, were carried out, all twelve inter-organizational relationships were evaluated twice and, as a result, changes could be observed. To facilitate consequent analytical phases, in particular, phase four (see section 3.7.4) in which the relatedness of inter-organizational relationships between project network actors and individual critical incidents was examined, and phase six (see section 3.7.6), in which summaries of all four project networks were produced, a rich and

<sup>69</sup> See Figure 12 on p. 87

multidimensional understanding of each of the 12 IORs in the studied project networks was required.

**Analysis phase three: examination of inter-organizational relationships**

Both qualitative and quantitative data describing each of the 12 inter-organizational relationships (three per studied project network) was examined to develop a rich and multidimensional understanding of the nature of each IOR.



**Figure 16 – Analysis phase three: examination of inter-organizational relationships**

To illustrate the rich and multidimensional nature of inter-organizational relationships in the studied project networks, information describing the inter-organizational relationship, coded as *relationship L*, between the *main contractor* and *subcontractor X*, involved in the critical incident # 107 (discussed earlier in section 3.7.1) is summarized in Table 13 below<sup>70</sup>. As can be observed, the relationship in question had formed between the two actors over a period of time exceeding 15 years, and based on the data obtained during the first round of interviews, was characterized by, for example, rather high degrees of *trust* and *commitment*. However, as can be noted, information obtained during the second interview round portrays a different image of the IOR in question, as several dimensions, such as *expectation of continuity* and *transfer of fine-grained information*, had clearly decreased between the two interview rounds.

<sup>70</sup> Dimension age (duration) was not measured quantitatively. Further, in *quantitative description*, an average of 1-2.5 is considered low, 2.6-3.5 as low to moderate, 3.6-4.5 as moderate, 4.6-5.4 as moderate to high, and 5.5-7.0 as high.

**Table 13 – Description inter-organizational relationship L**

<b>Dimension</b>	<b>Qualitative description (1<sup>st</sup> interview round)</b>	<b>Qualitative description (2<sup>nd</sup> interview round)</b>	<b>Quantitative description (1<sup>st</sup> round)</b>	<b>Quantitative description (2<sup>nd</sup> round)</b>
Age (duration)	The two firms had collaborated in about twenty projects over a period of more than 15 years.	NA	NA	NA
Trust	The involved actors trusted each other to a considerable extent. No significant problems negatively affecting trust were mentioned by either involved actor.	The level of trust had decreased. This was explained by problems during project implementation and a lack of openness in the relationship.	Moderate to high	Low to moderate
Opportunism	Neither actor reported a readiness to resort to opportunistic behavior towards other actor. Further, opportunistic behavior was not expected from the behalf of the other actor.	Actors stated that in this situation, they needed to prioritize their interest over the interests of the other actor. A quote representing the increased level of opportunism: <i>“recently we have had to make some effort to ensure that we get what was agreed on”</i> .	Low	High
Commitment	Both actors displayed commitment to continue developing their collaboration by being highly open for mutual development activities.	Involved actors were less willing to develop their collaboration at this point of time.	High	Moderate
Dependence	One of the actors was somewhat dependent on the other actor, while vice versa, dependence very low.	Involved actors did not consider themselves to be dependent on the other party.	Low to moderate	Low



Monitoring need	One of the two actors had a high need to monitor the other actor, while vice versa the need for monitoring was much lower. One informant explained the high need for monitoring by providing examples related to meeting schedules.	The need to monitor the compliance of work was considered to be extremely high. Informants explained this change by providing examples of several difficulties in project implementation.	Moderate to high	High
Transfer of fine-grained information	The involved actors were very open towards sharing confidential and business critical information with each other.	Transfer of fine-grained information reduced.	High	Moderate
Strength of inter-personal relationships	Individuals representing involved organizations knew each other well on a personal level and were open to discuss all project related matters.	Despite problems at the inter-organizational level, individuals representing both organizations were described with positive terms.	Moderate to high	Moderate to high
Expectation of continuity (shadow of the future)	Both actors expressed that collaboration is highly likely to continue after the current project has been delivered to the customer.	Expectation of continuity dramatically reduced. A quote representing expectation of continuity: <i>“this is difficult, but we do not want to throw a good relationship into a waste bin”</i>	High	Low to moderate

### 3.7.4 Phase four: linking inter-organizational relationships between project network actors and critical incidents

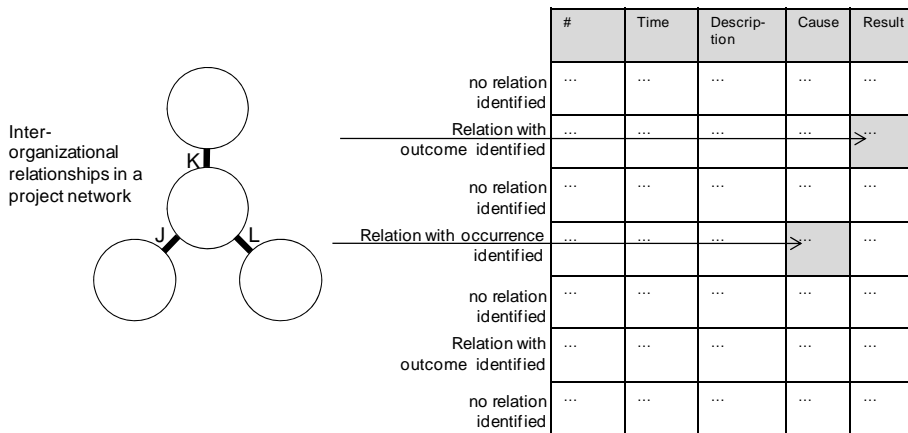
The fourth analysis phase focused on identifying linkages among inter-organizational relationships between project network actors and specific critical incidents. Two types of information were utilized in this phase of analysis. First, qualitative descriptions of inter-organizational relationships were examined as discussed earlier in section 3.7.3. In addition, information describing the content of each of the 197 critical incidents coded earlier was utilized in this phase. During this phase, the author examined, incident by

incident, whether the nine dimensions describing IORs between project network actors had constituted either a *strength* or a *weakness* that was related to the examined critical incident. In cases in which the relation between inter-organizational relationships between project network actors and the examined critical incident was *favorable*, a *strength* in IORs between project network actors was identified, and in those cases in which the relation was *unfavorable*, a *weakness* in IORs between project network actors was identified.

As information describing inter-organizational relationships in the studied four project networks provided a rich and multidimensional understanding of the nature of each IOR, *relatedness of each of the individual nine dimensions used to describe the inter-organizational relationships and identified critical incidents could not be analyzed separately*. For example, it could not be determined whether the degree of trust played a role in the development of weakness that was related to a specific critical incident, but it was clear that the degree of commitment did not. However, as illustrated in the following example, relations between *inter-organizational relationships, characterized by all nine dimensions used to describe them*, and critical incidents were, in many cases, identifiable. Essentially, the process of analyzing the relatedness of inter-organizational relationships in the project networks and identified critical incidents consisted of reviewing 197 holistic cases, each involving a considerable amount of rich and multidimensional information as empirical evidence. Then, based on this evidence as a whole, it was determined *whether the nine dimensions characterizing inter-organizational relationships between project actors had constituted either a strength or a weakness that was related to the critical incident in question*. This analysis is illustrated in Figure 17 below.

**Analysis phase four: linking inter-organizational relationships and critical incidents**

Data describing inter-organizational relationships in the four studied project networks and data describing the 197 critical incidents was examined together to identify relations.



**Figure 17 – Analysis phase four: linking inter-organizational relationships and critical incidents**

Finally, in cases in which a relation between either a strength or weakness in IORs between project network actors and a specific critical incident was identified, the author examined whether IORs between project network actors had been related to the *cause* of the incident or the *result* of the incident, or both.

In Table 14 below, critical incident # 107 is utilized to illustrate the logic used in this phase of analysis. The empirical evidence in this case consists primarily of the description of critical incident # 107 provided earlier in section 3.7.1 and Table 12, and the description of the inter-organizational *relationship L* between the *main contractor* and *subcontractor X* provided earlier in Table 13<sup>71</sup>. The results of this phase of analysis along with the discussion of further incidents are presented section 4.1.2.

<sup>71</sup> As the incident occurred early in the implementation phase, the reader should refer to information collected during the first interview round as opposed to information collected during the second round.

**Table 14 – Analysis of a relation between inter-organizational relationships between project networks and critical incident # 107**

<b>Analysis phase four: critical incident # 107</b>	
Is critical incident related to either a <b>strength</b> or a <b>weakness</b> in IORs between project network actors	<b>Relation identified between a strength in IORs between project network actors and critical incident # 107.</b> Based on the nature of the inter-organizational <i>relationship L</i> between <i>main contractor</i> and <i>subcontractor X</i> , characterized by long temporal duration, a high degrees of commitment, trust, sharing of fine-grained information, and expectation of continuity, it is evident that these dimensions constituted a strength in the IOR that positively contributed to the <i>main contractor</i> 's willingness to help <i>subcontractor X</i> by clearing out the materials that obstructed passage in the area.
If a relation between either a strength or a weakness in IORs between project network is identified, is this strength or weakness related to the <b>cause</b> of the incident, <b>result</b> of the incident, or both.	<b>Relation identified between strength of IORs between project network actors and result of critical incident # 107.</b> According to the interviews, <i>subcontractor Y</i> was experiencing difficulties with securing personnel resources and this (as opposed to, for example, a weakness or strength in IORs between project network actors) was considered by the informants as a likely <b>cause</b> of the incident. However, according to analysis as discussed earlier, the <b>result</b> (materials that obstructed passage were cleared) was related to a strength in the IOR between the <i>main contractor</i> and <i>subcontractor X</i> .

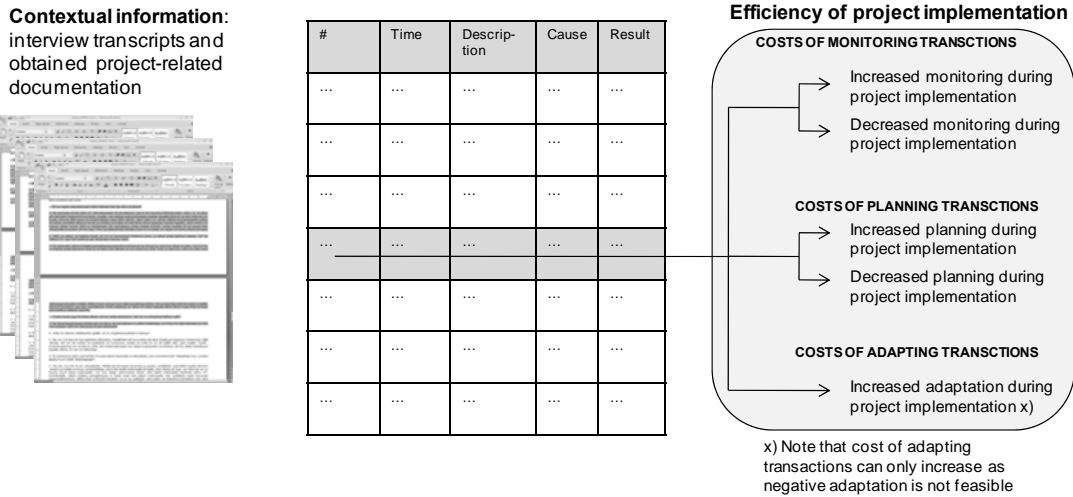
### **3.7.5 Phase five: linking critical incidents and the efficiency of project implementation**

The fifth analysis phase focused on identifying linkages between critical incidents and the efficiency of project implementation. The content of each specific critical incident was examined in light of contextual information available in each case. More specifically, contextual information encompassed all interview transcripts and obtained project documentation. In this analysis phase, the author examined whether as a result of each specific critical incident, *ex post transaction costs* incurring to involved project network actors had either *increased* or *decreased*. Note that as clarified later in section 4.1.3, the cost of monitoring or planning transactions could either increase or decrease, but the costs of adapting transactions could only increase. Figure 18 below illustrates how lin-

kages between critical incidents and the efficiency of project implementation were examined.

**Analysis phase five: linking critical incidents and the efficiency of project implementation**

The content of each of the critical incident and other contextual information was examined to identify effects on the efficiency of project implementation.



**Figure 18 – Analysis phase five: linking critical incidents and the efficiency of project implementation**

As a result of analysis phase five, each critical incident was related to a maximum of three effects either increasing or decreasing ex post transaction costs. In Table 15, critical incident # 107 introduced earlier in section 3.7.1 is provided as an example illustrating the logic used in this analysis phase. The treatment of further critical incidents is discussed in section 4.1.3.

**Table 15 – Analysis of the effects of critical incident # 107 on the efficiency of project implementation**

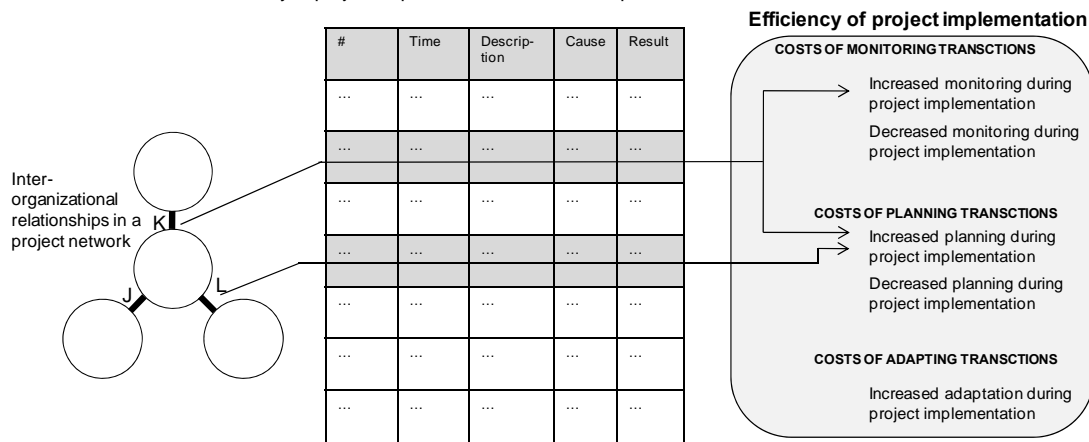
<b>Analysis phase five: critical incident # 107</b>	
Effect on costs of monitoring transactions	<b>No identified effect</b>
Effect on costs of planning transactions	<p><b>Identified increase in costs of planning transactions</b></p> <p>Based on the content of the critical incident it is evident that <i>sub-contractor X</i> had to modify its original working schedule and commit resources towards solving the problem (increased planning of transactions)</p>
Effect on adapting transactions	<b>No identified effect</b>

**3.7.6 Phase six: describing critical incidents as a mechanism that links inter-organizational relationships between project network actors with the efficiency of project implementation**

Building on the results of prior phases of analysis, this phase of analysis was limited only to those critical incidents that were related *both* to inter-organizational relationships between project network actors *and* to efficiency of project implementation. Building on this subset of all identified critical incidents, a description of critical incidents occurring during project implementation as a mechanism linking inter-organizational relationships between project network actors and the efficiency of project implementation was developed as described in detail in section 4.1.4.

**Analysis phase six: describing critical incidents occurring during project implementation as a mechanism linking inter-organizational relationships between project network actors with the efficiency of project implementation**

Based on prior analysis a description of a mechanism that links inter-organizational relationships between project network actors with the efficiency of project implementation was developed.



**Figure 19 – Analysis phase six: describing critical incidents as a mechanism that links inter-organizational relationships between project network actors with the efficiency of project implementation**

**3.7.7 Phase seven: case specific analyses**

In phase seven, case specific analyses of each of the four studied project networks were carried out. The aim of this phase of analysis was to develop an understanding of the salient characteristics of each studied project network at a somewhat higher level of abstraction, including information describing inter-organizational relationships between project network actors and information describing both the nature and frequency of critical incidents that had occurred during project implementation. In addition, during this phase the author examined how the twelve inter-organizational relationships had been related to the efficiency of project implementation in each specific project network and how they had developed in between the two interview rounds.

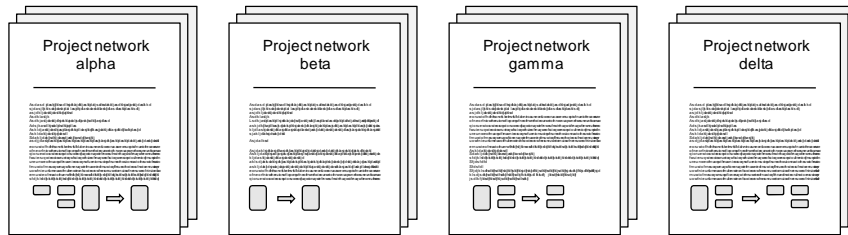
The case summaries also functioned as a tool for verification; included elements were discussed with informants representing each network to confirm the validity of findings and obtain further ideas for analysis. The case summaries focused on a concise statement of the central information concerning the four project networks, or to put it in

another way, they focused on describing each of the project networks as a whole. Figure 20 below illustrates the output of the seventh analysis phase.

#### Analysis phase seven: case specific analyses

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The results of this phase focused on identifying and discussing the salient features of each project network. In addition, the relatedness of inter-organizational relationships between project network actors and efficiency of project implementation in each project network was examined. Obtained results were discussed with informants to verify the validity of findings.



**Figure 20 – Analysis phase seven: production of case summaries**

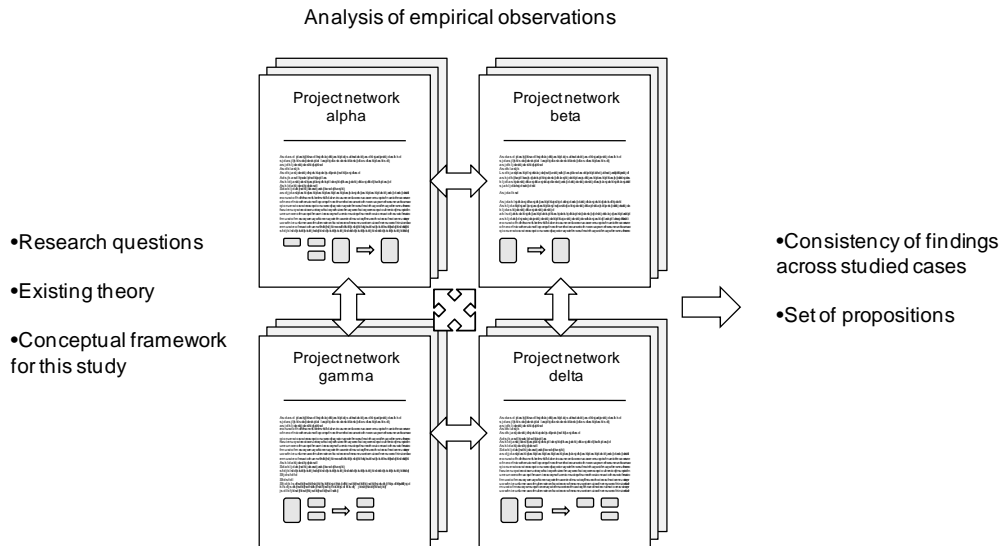
### 3.7.8 Phase eight: cross case analysis and formulation of propositions

During the final and highly iterative phase of analysis, the focus was on identifying similarities and differences between the four project networks that had been subject to empirical observation. This comparison was necessary for evaluating to which extent the results of this study were consistent across cases, and as result, might be possess potential for generalization to a broader context. Finally, a set of *propositions* that join together the constructs developed in the second chapter of this dissertation were formulated based on the combined results of all prior phases of analysis. Figure 21 below illustrates the eighth and final phase of analysis. The propositions resulting from the analysis are presented in Chapter 5.



### Analysis phase eight: cross case analysis and formulation of propositions

In this final iterative and holistic phase of analysis, the four case summaries were compared to highlight similarities and differences between the studied four project networks. Then, based on results of all prior phases of analysis, a set of theoretical propositions encompassing key contributions of this study were formulated.



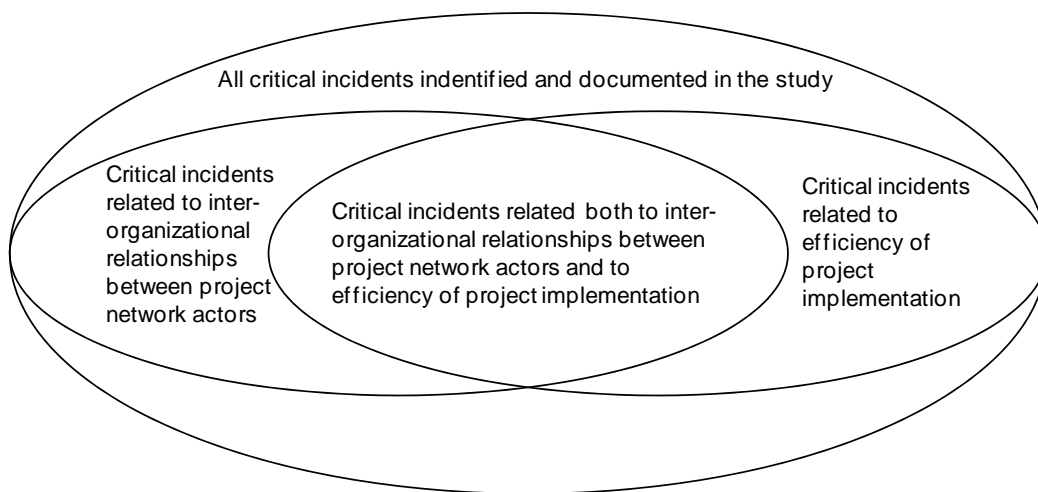
**Figure 21 – Analysis phase eight: cross case analysis and formulation of propositions**

## 4 RESULTS

This chapter presents the empirical results of this study. First, section 4.1 approaches the results at a fine-grained level, focusing on the relation between inter-organizational relationships and efficiency of project implementation. The 197 critical incidents identified in this study are grouped into three sub-groups based on their attributes, and a description of critical incidents as a mechanism relating inter-organizational relationships with the efficiency of project implementation is provided. The latter section 4.2 presents results of the empirical study at a more holistic project network –level. Results relating to the four project networks alpha, beta, gamma, and delta are first discussed separately. Finally, differences in results obtained from the two interview rounds are highlighted and the results of cross-case analysis are discussed.

### 4.1 *Critical incidents in project networks*

This section presents the empirical results of this study at a fine-grained level, focusing on the 197 critical incidents identified and twelve inter-organizational relationships examined, as opposed to results discussed later in section 4.2 that focus on the more holistic project network -level. In this section, three sub-groups of critical incidents illustrated in Figure 22 below are discussed.



**Figure 22 – Sub-groups of critical incidents discussed in section 4.1**

First, section 4.1.1 presents a categorization of all 197 critical incidents identified and documented in project networks alpha, beta, gamma, and delta examination in this study. This categorization is, essentially, a description of both the nature and frequency of critical incidents that occurred during project implementation. Second, section 4.1.2 focuses on the relatedness of critical incidents and inter-organizational relationships between project network actors. More specifically, it describes how 108 critical incidents out of the total of 197 were related to inter-organizational relationships between actors of project network alpha, beta, gamma, or delta. Third, section 4.1.3 explores the relatedness of critical incidents and the efficiency of project implementation. It discusses how 134 critical incidents out 197 had affected the efficiency of project implementation in the four project networks examined in this study. Finally, section 4.1.4 discusses how a group of 57 critical incidents that were related both to inter-organizational relationships between project network actors and to the efficiency of project implementation functioned as a mechanism relating inter-organizational relationships with the efficiency of project implementation in project networks alpha, beta, gamma, and delta. There was a fourth sub-group of 31 critical incidents that were neither related to inter-organizational relationships between project network actors nor to efficiency of project implementation<sup>72</sup>. Due to the objective and scope of this study discussed in the first chapter, this fourth group is not discussed further in this report. Table 16 below summarizes the sub-groups of critical incidents discussed in detail in the following sections.

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<sup>72</sup> As discussed in APPENDIX B, the *informants* defined which historical events they considered as critical incidents.

**Table 16 – Grouping of critical incidents identified in this study**

	Amount	Per cent of all identified critical incidents	Discussed in section
	N	%	
All critical incidents identified and documented during this study	197	100	4.1.1
Sub-group of critical incidents related to inter-organizational relationships between project network actors	108	55	4.1.2
Sub-group of critical incidents related to efficiency of project implementation	134	68	4.1.3
Sub-group of critical incidents related both to inter-organizational relationships between project network actors and to efficiency of project implementation	57	29	4.1.4
Sub-group of critical incidents related neither to inter-organizational relationships between project network actors nor to efficiency of project implementation	31	16	Not discussed further

#### 4.1.1 Categorization of critical incidents

A total of 197 critical incidents were identified and documented during the 40 personal interviews carried out during this study. As discussed earlier in section 3.7.2, after it became evident that the seven categories of critical incidents identified in the literature<sup>73</sup> could not be used to accurately categorize critical incidents observed in the studied project networks, a novel categorization structure was developed to gain an understanding of both the characteristics and frequency of different types of critical incidents that had occurred in project networks alpha, beta, gamma, and delta. The formation of the categorization structure was an iterative process in which the content of the 197 identified critical incidents had a central role. The developed structure consists of ten categories *favorable* for the project as a whole and six categories *unfavorable* for the project as a whole; it is presented in Table 17 below. Each of the 197 critical incidents identified

<sup>73</sup> See section 2.4, in particular Table 6 on page 59.

and documented during the 40 personal interviews were categorized, depending on their specific content, into one, two, or three categories, resulting in a total of 320 categorizations, from which 249 were unfavorable, and 71 favorable for the involved project as a whole.

**Table 17 – Categorization of critical incidents**

Code	Unfavorable categories	Description	Number of categorizations
1	Mistake or quality problem	A mistake or quality problem is detected in the project network	19
2	Failure to react to an emerging problem	A project network actor does not promptly take action to react to a problem (as a result, the problem needs to be solved later and may even worsen)	16
3	Making a demand	A project network actor unexpectedly demands something from another project network actor	23
4	Incompatibility of processes	The processes of two or more project network actors are incompatible	16
5	Failure to keep schedule	A project network actor fails to maintain the agreed schedule	48
6	Lack of management capability	A project network actor displays a lack of management capability (e.g., failure to create a viable project schedule, failure to negotiate in a demanding situation, inability to coordinate work, or inability to supervise progress of work)	47
7	Lack of materials	Materials required by a project network actor are either unavailable or cannot be used for any reason (e.g. defective materials)	19
8	Lack of personnel	Personnel required by a project network actor are unavailable (e.g. holidays, sick leaves, strikes, or persons allocated to other projects)	26
9	Deviation from project plan	A project network actor deviates from the agreed project plan	17
10	Argument	Two or more project network actors have an argument over a project related matter	18
<b>Total</b>			<b>249</b>

Code	Favorable categories	Description	Number of categorizations
20	Development activity	A project network actor (or several project network actors) develops a significant new process or improvement that supports the implementation of the project	12
21	Solving a problem	A project network actor (or several project network actors) solves a difficult problem hindering the progress of the project	12
22	Flexibility towards another actor	A project network actor displays flexibility towards another project network actor (for example, by using its own resources to help another actor, or displaying flexibility in financial matters)	8
23	Benefit from inter-organizational relationship	A project network actor receives an immediate benefit from its inter-organizational relationships (for example, because of its strong IORs, an actor knows which persons to contact to solve emerging project related problems)	7
24	Exceeding expectations	A project network actor performs exceptionally well in a difficult task, exceeding the expectations of another project network actor	18
25	Transfer of fine-grained information	Project network actors communicate confidential or sensitive information that is vital for either project network actors, or the implementation of the project	14
<b>Total</b>			<b>71</b>

In the following, several critical incidents are discussed in detail both to bring additional clarity to the use of the categorization structure and to illustrate the highly versatile nature of critical incidents that had occurred in studied project networks alpha, beta, gamma, and delta. In the following, an informant discusses a critical incident related to ensuring the progress of the project:

*Then we started to have difficulties with the schedules of the pressurization tests for the piping systems. Taking these difficulties into account in the planning and scheduling of work was somehow dismissed all too lightly. It was not understood*

*what activities are to be carried out on each week.* (# 127, informant representing the yard)

This critical incident # 127, *unfavorable* for the project as a whole, was categorized with code 6, *lack of management capability* as the informant clearly expresses that another project network actor had not performed satisfactorily regarding the planning and management of work. In the following, an informant discusses another critical incident:

*The practices with the materials have changed recently. They are now supplied to the yard by another external firm ... as a result, twenty firms may be using the same materials on board the same vessel. It is much cheaper to just take materials from the neighbor's side of the area. This [theft] will be a major problem.* (# 78, informant representing a main contractor)

This critical incident # 78, also *unfavorable* for the project as a whole, was categorized with code 7, *lack of materials* as the informant describes difficulties in obtaining materials required for performing tasks related to the project. As earlier mentioned, some critical incidents identified and documented during the interviews were categorized with more than one code. The following quote describes such an incident:

*There are more than ten different piping systems going through several areas of the ship. And now recently there has been an issue with the piping for the fire extinguishing system. The pipes are made of about 1.5 inch thick steel pipe and we have tested their tightness with compressed air to see whether they hold or not. We have also put soft soap in the tubes to see where bubbles form to indicate leaks. And ... the pipes have leaked in all our tests. And then we have just had to wait until the leak is repaired by somebody.* (# 130, informant representing the yard)

Here, the informant discusses two interrelated problems related to the project, and as a result, this critical incident # 130 was categorized with two codes, both *unfavorable* for the project as a whole, code 5, *failure to keep schedule*, and code 1, *mistake or quality*

*problem*. The critical incident discussed above illustrates how many of the critical incidents described by the informants were complex and multifaceted in their content, and as a result needed to be categorized with more than one code. The 197 critical incidents identified and documented in this study were categorized with a total of 320 codes, averaging 1.62 codes per critical incident. In addition to the unfavorable categories, informants discussed several incidents that had been favorable for the project as a whole as illustrated by the following quote:

*... well last week the [other project network actor] sent two persons to take exact measurements of our area. I think that this was really positive from them as it indicates that they are taking responsibility that their delivery will fit the area. I do not need to worry about this detail any more... (# 92, informant representing a main contractor)*

In this incident # 92, the informant was clearly impressed, and to some extent surprised, with the performance of another project network actor and, as a result, the incident was categorized as *favorable* for the project as a whole with code 24, *exceeding expectations*. The following quote concerns a further incident categorized as favorable:

*The communication with [an individual representing another project network actor] worked really well. Now we had a concrete situation where we were working on a detail that had already been completed in another block of the ship and the drawings contained some conflicting issues. So, it was unclear how we should proceed. It was really helpful for us that this individual checked this detail from the finished block and informed us about it. And we got the information immediately. (# 21, informant representing a subcontractor)*

This incident # 21, *favorable* for the project, was categorized with code 25, *transfer of fine-grained information*, as it illustrates how information beneficial for the involved actor was obtained from another project network actor. It was somewhat surprising that

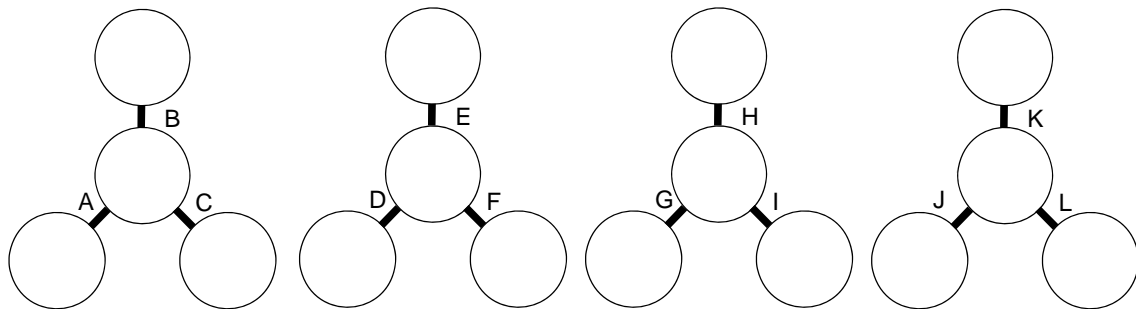


only approximately one in five<sup>74</sup> of the categorized incidents were favorable for the project as a whole. Several informants were asked at the end of their interview why they had discussed so few favorable incidents as compared to unfavorable incidents. The following quote illustrates a typical answer to this question:

*Well ... positive as a word that is kind of incorrect in this line of business [ship-building]. It is just said that somebody has done his or her work. Praises are not typically offered. (informant representing a main contractor)*

#### **4.1.2 Relation between inter-organizational relationships and critical incidents**

As discussed earlier in section 3.7.4, following the categorization of the 197 critical incidents discussed in the previous section, the next phase of analysis focused on identifying which of these 197 critical incidents had been related to inter-organizational relationships between project network actors. As illustrated in Figure 23 below, the four studied project networks alpha, beta, gamma, and delta comprised a total of 12 inter-organizational relationships:



**Figure 23 – Twelve inter-organizational relationships examined in the study**

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<sup>74</sup> 71 categorized critical incidents out of a total of 320

Each of the twelve inter-organizational relationships (A-L) was described twice<sup>75</sup> by between two and three informants representing both of the involved organizations. Due to the highly sensitive nature of collected information, it was agreed before each interview was started, that information describing the IOR would not be disclosed in a manner that would allow the individuals representing the other involved organization to know how the interviewee had described individual dimensions, e.g. the level of trust between the two actors. For this reason, the exact identity of individual relationships A-L, in terms of which specific project network (alpha, beta, gamma, delta) they were a part of, cannot be disclosed here. Two inter-organizational relationships, *relationship A* and *relationship H*, are now discussed in detail to highlight how the examined relationships differed both among each other and how they had developed between the two interview rounds. *Relationship A* existed between the main contractor and a subcontractor in one of the four studied project networks (alpha, beta, gamma, or delta).

At the time this study was carried out, the organizational actors that were connected by *relationship A* were working on their first project together. In addition to the rich, qualitative data obtained during the interviews, eight out of nine dimensions of inter-organizational relationships were quantitatively measured with a 7-point Likert-type scale ranging from (1) “not existing” to (7) “very high” as discussed in APPENDIX A<sup>76</sup>. The characteristics of *relationship A* are summarized in Table 18 below.

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<sup>75</sup> As two rounds of interviews were carried out.

<sup>76</sup> The dimension age (duration) is exceptional as it was not measured quantitatively. Further, *in quantitative description*, an average of 1-2.5 is considered low, 2.6-3.5 as low to moderate, 3.6-4.5 as moderate, 4.6-5.4 as moderate to high, and 5.5-7.0 as high.

**Table 18 – Description of inter-organizational relationship A**

<b>Dimension</b>	<b>Qualitative description (1<sup>st</sup> interview round)</b>	<b>Qualitative description (2<sup>nd</sup> interview round)</b>	<b>Quantitative description (1<sup>st</sup> round)</b>	<b>Quantitative description (2<sup>nd</sup> round)</b>
Age (duration)	The two actors were engaged in their first project together.	NA	NA	NA
Trust	Despite the short temporal duration, the relationship was characterized by a moderate to high degree of trust. However, a comparison of the descriptions provided by the two involved informants reveals that one of the two actors trusted the other actor to a considerable degree more than vice versa.	Trust in the relationship had severely weakened. According to one informant, this was partially explained by severe contractual disagreements between the involved actors that had taken place during the execution of the project.	Moderate to high	Low
Opportunism	Both actors prioritized their interest over the interest of the other party. However, readiness for opportunistic behavior was somewhat unbalanced in the relationship as one of the two actors was clearly more willing to resort to opportunistic behavior than the other actor.	The readiness to resort to opportunistic behavior had increased between the two interview rounds as the readiness of both actors to resort to opportunistic behavior could be characterized as either moderate or high.	Moderate	Moderate to high

Commitment	Overall, the relationship between the two actors was characterized by commitment to develop their collaboration further. However, similarly to as regarding trust in the relationship, one of the two actors was clearly more committed to the relationship, describing activities related to developing more effective ways of working together, while the other actor indicated a lower level of commitment.	Readiness to develop mutual ways of working had decreased between the two interview rounds. In addition, one of the two actors was considerably more willing to develop the collaboration further than the other actor was. One of the informants expressed that the present time was not optimal for developing collaboration further.	High	Moderate
Dependence	Neither actor was dependent on continuous collaboration with the other actor.	Neither actor was dependent on continuous collaboration with the other actor.	Low	Low
Monitoring need	The project had progressed rather well in the start and both actors considered the need to monitor the other party as moderate. One of the informants provided examples related to difficulties in maintaining schedules to elaborate the importance of monitoring and considered that in the beginning of the relationship, it is better to have additional monitoring in place to ensure project progress.	The need to monitor the compliance of the other actor had increased. One informant mentioned difficulties with maintaining schedules and ensuring the availability of adequate personnel as issues that are likely to have contributed to an increase in the need for monitoring in the relationship.	Moderate	High

Transfer of fine-grained information	Overall, readiness to transfer fine-grained information in the relationship could be characterized as moderate to high. However, one of the two involved actors was clearly more willing to discuss confidential matters with the other actor than vice versa.	The two actors were somewhat less open towards sharing fine-grained information. Informants provided examples of arguments that had taken place during project execution to explain the change.	Moderate to high	Moderate
Strength of interpersonal relationships	Despite the fact that this was the first joint project between the two organizations, individuals representing the two organizations stated that they knew each other rather well on a personal level and emphasized that even difficult issues could be discussed openly.	Informants considered the strength of inter-personal relationships as somewhat weaker as compared to the first round of interviews. According to one informant, the difficulties between the two organizations had also some implications on inter-personal level.	High	Moderate
Expectation of continuity (shadow of the future)	Both parties considered it probable that collaboration would continue after the delivery of the current project to the client.	Neither party expected to work with the other party in the near future.	Moderate to high	Low

One notable characteristic of *relationship A* was an exceptionally low degree of dependence between the two organizations as compared to most of the other<sup>77</sup> eleven inter-organizational relationships (B-L) examined in this study. However, despite the fact that the two actors had just recently started implementing their first project together when the first round of interviews was carried out, the level of trust was rather high and actors were rather motivated to develop their collaboration further. The results of the second round of interviews, however, demonstrate that *relationship A* had weakened with re-

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<sup>77</sup> Quantitative descriptions of all twelve inter-organizational relationships (A-L) examined in this study are provided in APPENDIX C.

spect to several dimensions describing it during the six months that separated the two interview rounds.

A further inter-organizational relationship, referred to as *relationship H*, that existed between the yard and a main contractor and had been established over a period of more than a decade is summarized in Table 19 below:

**Table 19 – Description of inter-organizational relationship H**

<b>Dimen- sion</b>	<b>Qualitative description (1<sup>st</sup> interview round)</b>	<b>Qualitative description (2<sup>nd</sup> interview round)</b>	<b>Quantit- ative descrip- tion (1<sup>st</sup> round)</b>	<b>Quantit- ative descrip- tion (2<sup>nd</sup> round)</b>
Age (du- ration)	The two firms had been working together for a period exceeding a decade. During this time, more than ten joint projects had been carried out.	NA	NA	NA
Trust	Trust in the relationship was high as both actors placed a high degree of trust in each other. One informant further emphasized that in this relationship promises made are promises usually kept.	The level of trust had decreased slightly between the two interview rounds. Furthermore, as compared to the first round of interviews, the difference in trust that the two actors placed on each other had increased between the two interview rounds. According to one informant, trust had been negatively affected by difficulties experienced during the intensive and challenging late implementation phase of the project.	High	Moderate to high

Oppor- tunism	Both actors were primarily concerned by their own interests and displayed a highly similar readiness to resort to opportunistic behavior.	The readiness to resort to opportunistic behavior had decreased slightly between the two interview rounds.	High	Moderate to high
Com- mitment	Both actors were highly committed to finding ways to improve their working relationship. They did not, however, come up with practical examples of such activities.	Both parties were highly willing to improve the way they work together.	High	High
Depen- dence	Both actors were rather dependent on the other party as the volume of joint projects carried out together was quite significant for both parties.	As compared to the first round of interviews the difference in dependence expressed by the two actors had increased slightly as one of the two actors considered to be slightly less dependent on the other actor.	Moderate to high	Moderate
Monitor- ing need	The relationship was characterized by a rather high need to monitor compliance. Further, one of the two involved actors indicated a notably higher need to monitor the other actor than vice versa. One form of monitoring mentioned by one informant was continuous personal site visits.	The need for monitoring compliance in the relationship had decreased. One informant considered that positive experiences of collaboration during the execution of the project played a role in explaining this change.	Moderate to high	Moderate

Transfer of fine-grained information	Overall, the actors were not very open towards sharing fine-grained information. However, there was a notable difference between the two actors because one party was concerned that excessive openness could result in opportunistic behavior by the other party, while the other party indicated a higher readiness to share information.	The openness for sharing information had increased slightly between the two interview rounds.	Low to moderate	Moderate
Strength of interpersonal relationships	Individuals representing both organizations were connected on an inter-personal level. Informants described communication as both open and functional.	Individuals representing both organizations knew each other well on a personal level.	Moderate to high	Moderate to high
Expectation of continuity (shadow of the future)	Both parties expected their collaboration to continue in one form or another after the current project had been delivered	Both parties looked forward to collaborating with each other in the near future.	Moderate to high	High

A comparison of the two inter-organizational relationships *A* and *H* illustrates how each of the twelve IORs (A-L) examined in this study had its own unique nature. As opposed to the emerging *relationship A*, in which the two actors were delivering their first project together, *relationship H* had gradually developed over a period exceeding a decade and was much more established in its nature. Further, according to the interviewees describing *relationship H*, the two involved organizations had developed rather stable routines of working together. A further factor that differentiated the two relationships *A* and *H* at the time the first interview round was carried out was that while the degree of dependence in *relationship A* was low as the actors were not dependent on each other, in *relationship H* the level of dependence was much higher. Further, while the two actors



involved in *relationship A* were rather open to sharing fine-grained, confidential, information with each other, the two actors involved in *relationship H* reported a very limited readiness for similar information sharing. Finally, a comparison of the results of the two interview rounds points out much subtler differences in the development of *relationship H* as compared to *relationship A*. As a whole, the two inter-organizational relationships *A* and *H* presented above illustrate how each of the twelve IORs examined in this study was rich in its characteristics and, to a degree, unique, somewhat analogously to how relationships between individuals are. Further, the two interview rounds carried out in this study made it possible to identify changes in their descriptive dimensions<sup>78</sup>. Full quantitative descriptions of all twelve inter-organizational relationships (A-L) examined in the four project networks alpha, beta, gamma, and delta are provided in APPENDIX C.

After the examination of the twelve inter-organizational relationships, the author examined on a case-by-case basis which of the 197 critical incidents identified in this study had been related to these twelve IORs. More specifically, as described earlier in section 3.7.4, the author examined whether inter-organizational relationships between project network actors had contributed favorably to each of the critical incidents considered, by constituting a *strength*, or unfavorably by constituting a *weakness*. Due to the rich and multidimensional nature of the inter-organizational relationships examined, the relatedness of an individual dimension, such as trust or dependence to a specific critical incident could not be isolated, but on the other hand, as illustrated with several critical incidents that follow, it could often be observed that incidents were related to inter-organizational relationships between project network actors as a whole, either favorably via their strengths, or unfavorably via their weaknesses.

During an interview, critical incident # 61 involving the main contractor and subcontractor connected by *relationship A* was identified and documented. In this incident the main contractor experienced difficulties with meeting schedules and coordinating tasks in the project. As the work carried out by the main contractor was highly interdependent

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<sup>78</sup> For a discussion of the development of the inter-organizational relationships, see section 4.2.5.

from work carried out by the subcontractor, these difficulties made it increasingly difficult for the subcontractor to coordinate and execute its own tasks. The main contractor and subcontractor discussed these difficulties and managed to jointly develop a strategy to respond to the difficult situation. A central element of this strategy was that the main contractor gave the subcontractor substantially more authority and responsibility to coordinate work, resulting in the subcontractor being able to solve many problems that had been hindering progress for both actors. In the following, an informant describes this strategy:

*A positive aspect in this project was that, – well I am not certain if this is relevant or not but – they [the main contractor] under this distressing situation had the courage to give as a great deal of authority and responsibility concerning how to carry on with the delivery. (# 61, informant representing a subcontractor)*

As discussed earlier, *relationship A* between the two actors was characterized by a rather high degree of trust at the time of the incident<sup>79</sup>. In addition, the need for monitoring compliance was moderate and inter-personal relationships between individuals representing the two organizations could more accurately be characterized as strong rather than weak. At that time, both actors also considered it quite likely that their collaboration would continue after the current project had been delivered and were committed to finding ways of improving their working practices. Based on this information, it can be concluded that these characteristics played a central role in the constitution of a *strength* in *relationship A* that affected the outcome of the incident by allowing the actors to develop a positive response to the problem they encountered. For example, a total lack of trust or a very high need for monitoring between the two actors would have made it less attractive for the main contractor to transfer authority and responsibility to the subcontractor.

In addition to the constitution of strengths related to critical incidents, *relationship A*, in a manner parallel to all other eleven IORs examined in this study constituted weak-

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<sup>79</sup> It can be observed from 0 that this high degree of trust later decreased substantially as the project proceeded to a later phase of implementation.

nesses were related to critical incidents. Critical incident # 165 that had occurred during the late implementation phase of the project, involved a disagreement between the main contractor and the subcontractor concerning the scope of the contract and certain financial details it contained. Informants representing both organizations argued that the other organization had not fully fulfilled its contractual obligations. This inconsistency in expectations of the two actors later escalated into an argument, which according to the informants affected the development of *relationship A* between the two actors. The following brief quote illustrates the difference in viewpoints between the two actors:

*This contract related conflict was a little bit of a surprise for us because there was a written contract in our systems... (# 165, informant representing a main contractor)*

As the project under examination was the first joint project for the involved two actors, it is evident that this collaboration was characterized by a lack of routines in some areas. This lack of routines and a certain lack of a shared understanding concerning working practices which tends to gradually develop over the course of recurrent collaboration, a somewhat low degree of willingness to share fine-grained information at the time the incident occurred, and rather high readiness towards opportunistic behavior characterizing *relationship A*, are factors that appear central in the constitution of a *weakness* in *relationship A*, that was related to the occurrence of this particular critical incident. Based on the results of the analysis of these two critical incidents # 61 and # 165, it can be concluded that a specific inter-organizational relationship (in this case, *relationship A*) between two project network actors constituted *both* weaknesses and strengths, depending on the context of each individual critical incident.

In the following, an informant discusses a further critical incident # 6 involving the yard and the main contractor, connected by *relationship H*:

*...well this individual had specific, colored blueprints, which enabled us to have a clear view of the work that needed to be done. This individual had also made personal markings on the blueprints, which we obtained. This individual gave us*

*this valuable document that helped us out a great deal.* (# 6, informant representing a main contractor)

*Relationship H*, described earlier in Table 19, had gradually evolved over a period of more than a decade and several consequent joint projects. Based on the interviews, it was characterized by high degrees of trust, commitment, dependence, and expectation of future collaboration. A further characteristic describing *relationship H* was that the informant representing the main contractor and the informant representing the yard stated that they knew and trusted each other on a personal level. In addition, the individual from whom the blueprints (mentioned in the above quote) had been received, was not a person that the main contractor frequently interacted with during the implementation of the project in question. Based on the content of the critical incident and information describing *relationship H*, it can be concluded that an important reason contributing to the main contractor receiving the blueprints in question was the inter-organizational relationship between the two actors and, thus in this case a *strength* in *relationship H* and this critical incident were related.

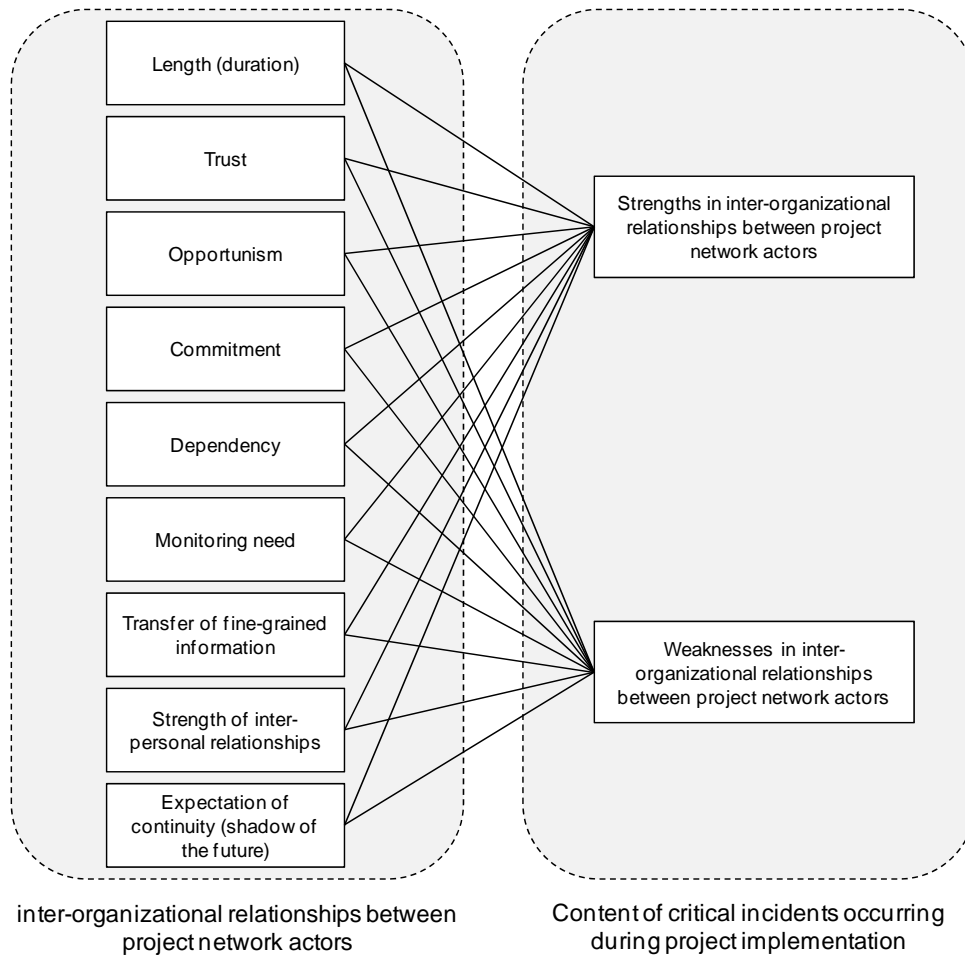
There were also many critical incidents in which no relation to inter-organizational relationships between project network actors could be identified. The following quote, addressing critical incident # 33, illustrates such a case:

*Different information sharing events have been arranged where, for example, [the project network actor] has participated. If I do not remember incorrectly, there was an event arranged at [specific city] where [project network actor] participated. This information can be found on our shared electronic folder...* (# 33, informant representing the client)

No relation between this critical incident and inter-organizational relationships between actors involved in the incident could be identified. According to the informant quoted above, the event was arranged to distribute information concerning changes in working practices. As such, the project network actors participated regardless of whether they

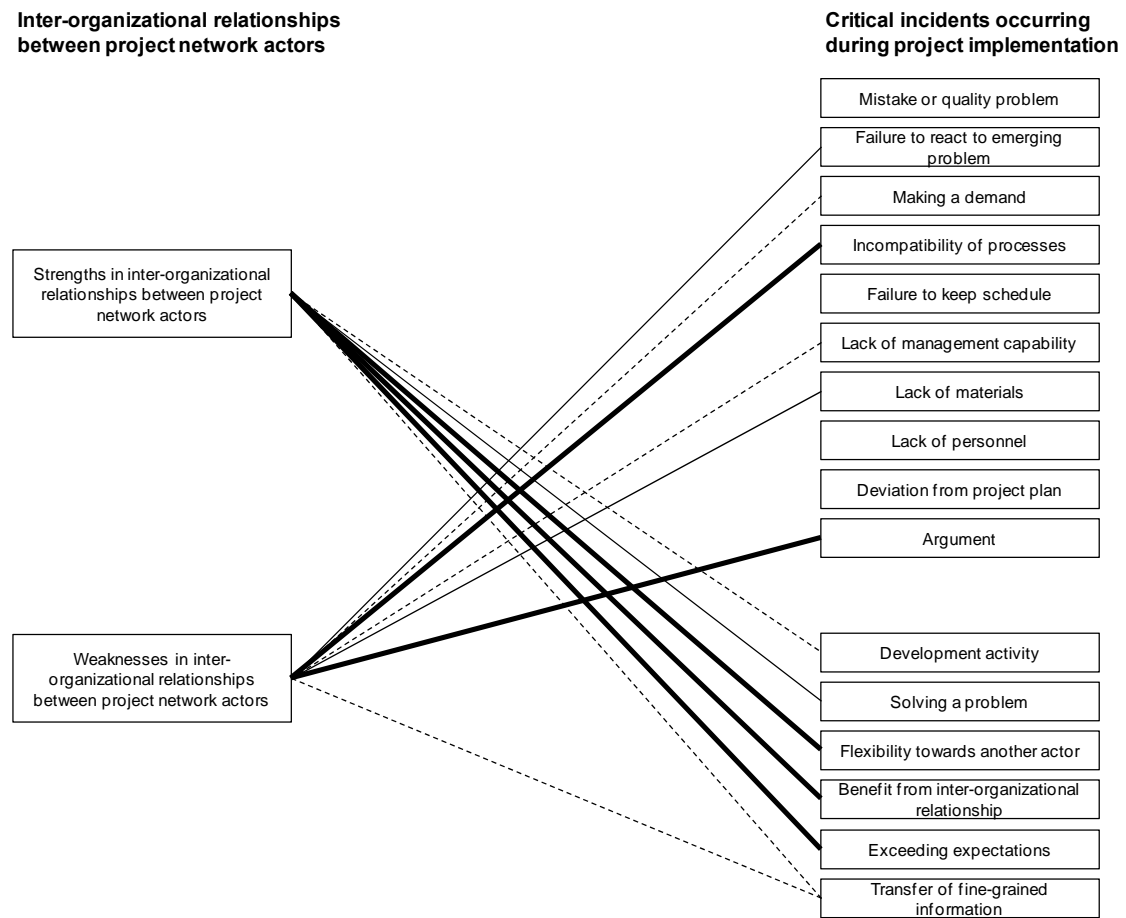
had developed an established inter-organizational relationship to the organization that arranged the event or not.

Based on the prior discussion, inter-organizational relationships between project network actors constituted both strengths and weaknesses related to critical incidents that had occurred in the studied project networks. Depending on the nature of both the IOR in question and the content of a specific critical incident, a strength, or a weakness was identified, multiple dimensions, as opposed to merely one or two, characterizing the IOR appeared as important factors in the constitution of the strength or weakness. Figure 24 below illustrates how the constitution of strengths and weaknesses in inter-organizational relationships was dependent on both the characteristics of inter-organizational relationships and the content of individual critical incidents.



**Figure 24 – Constitution of strengths and weaknesses in inter-organizational relationships between project network actors**

Based on the analysis, 108 critical incidents (55 per cent of all 197 identified incidents) were found to be related to inter-organizational relationships between project network actors. Further, 19 per cent of categorized critical incidents were related to a *strength* and 29 per cent of categorized IORs were related to a *weakness* in inter-organizational relationships between project network actors. Figure 25 below illustrates the relatedness of strengths and weaknesses in inter-organizational relationships between project network actors and individual categories of critical incidents. A dotted line represents a relation in 20 to 40 per cent of cases, a continuous line represents a relation in 40 to 60 per cent of cases, a thickened line represents a relation in excess of 60 per cent of cases, and the absence of a line represents a relation is less than 20 per cent of cases. Detailed percentages in each case are presented in tabular format in APPENDIX D.



**Figure 25 – Relation between inter-organizational relationships between project network actors and critical incidents occurring during project implementation**

From the figure above it can be observed that strengths in inter-organizational relationships between project network actors were frequently related to critical incidents categorized as favorable while weaknesses in IORs between project network actors were frequently related to incidents categorized as unfavorable. Also relations between strengths in IORs between project network actors and incidents unfavorable for the involved project, and relations between IORs between project network actors and incidents favorable for the involved project were identified. While a total of 37 per cent of strengths in IORs between project network actors were related to incidents unfavorable for the project, only 5 per cent of weaknesses in IORs between project network actors were related to incidents favorable for the project. Based on this observation it can be concluded that, while strengths in IORs between project network actors frequently made a favorable contribution to critical incidents, that by their nature were unfavorable for

the involved project, weaknesses in IORs between project network actors rarely displayed any relation to incidents favorable for the project.

#### **4.1.3 Relation between critical incidents and efficiency of project implementation**

As discussed in section 3.7.5, the analysis of critical incidents identified and documented during this study encompassed a phase in which the effects of each the 197 critical incidents identified in this study on the efficiency of project implementation, defined earlier as costs of monitoring, costs of planning, and costs of adapting transactions, were examined. More specifically, it was examined on a case-by-case basis whether, as a result of each individual critical incident, an actor of project network alpha, beta, gamma, or delta had either increased or decreased its resources directed to monitoring another actor, increased or decreased resources directed to project-related planning, increased resources directed to adapting its processes or practices towards the processes or practices of another actor, or any combination of these three types of *ex post* transaction costs. Further while the costs of planning transactions and the costs of monitoring transactions could either increase or decrease, for example, as an actor decided to increase or decrease resources committed towards planning or monitoring. The costs of adapting transactions could only increase as it would not be feasible commit resources to changing practices or processes in a manner that is less compatible with the practices of another project network actor. In the following quote an informant discusses critical incident # 144, categorized as a *mistake or quality problem*, that led to an increase in the *costs of monitoring* another project network actor:

*... yes there is this problem with the quality of the welding. It has received the attention of both the commissioner of the ship and the authorities regulating ship manufacturing practices and safety. As a result, we have to make much more quality tests today than we used to have to ... (# 144, informant representing the yard)*

Based on the content of this critical incident, it is clear that, as a result of this quality problem, the yard had to commit additional resources to monitoring the work of the in-



volved project network actors. This increase in committed resources incurred ex post transaction costs which, as defined earlier in section 2.3.4, decreased the efficiency of project implementation. The following quote illustrates how critical incident # 102, categorized as *failure to keep schedule*, led to an increase in the *costs of planning*:

*Well we really worked hard on meeting the deadline, spent time and effort and really took it seriously. And what happened after all, was that our progress with the project stopped completely there. It is actually so that it would have been better for us if we had not hurried, because others had their areas in an unfinished state. We could have proceeded with our area in a more relaxed pace...*  
(# 102, informant representing a main contractor)

As a consequence of this incident, the involved main contractor needed to commit additional resources to project-related planning as work could not proceed as long as other related areas of the ship were in an unfinished state. The next quote presents critical incident # 98, categorized as *incompatibility of processes* that led to an increase in the *cost of adapting processes* towards the processes of another project network actor:

*... we moved from one shipyard to another and at that point in time, all systems that were in place were changed completely. We no longer received materials from the storage, even though we had been promised so earlier. Everything related to the shipyard is different here than it was there.* (# 98, informant representing a main contractor)

In this case, the main contractor needed to commit resources to change its operating practices so that they would be more compatible with the prevailing situation. Further, the analysis revealed many critical incidents that were not related to transaction costs even though they were considered important by the informants for the project as a whole. In the following, an informant discusses critical incident # 131, categorized as *mistake or quality problem*:

*Well, we have not made many written reclamations, ... there has not been a need for them. But now, we are making one for [a project network] actor regarding the finishing of a small work package, but this is not a major issue... (# 131, informant representing a main contractor)*

The critical incident discussed above regarding the quality of finishing had been sufficiently significant to warrant the preparation of a written reclamation by the project network actor represented by the informant. Despite being unfavorable for the involved project, no immediate effects on transaction costs (planning, monitoring, and adapting transactions) were identified in this case.

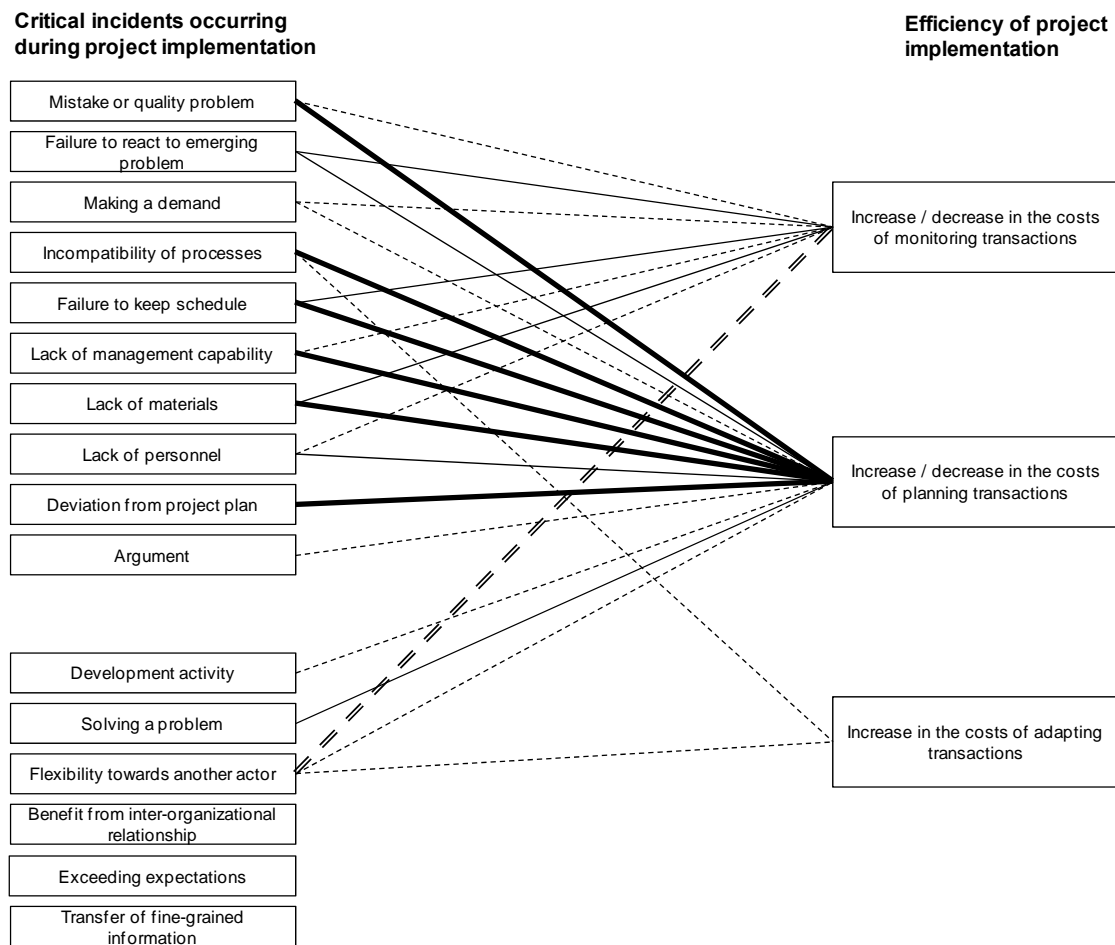
The examination of all 197 critical incidents identified during this study revealed that 134 incidents (68 per cent) had either favorably or unfavorably contributed to at least one category of transaction costs. Further, critical incidents that had led to either an increase or a decrease in transaction costs had often contributed to more than one of the three categories<sup>80</sup>. More specifically, the categorized critical incidents had resulted in an increase in the costs of monitoring a total of 93 times, an increase in the costs of planning a total of 175 times, and an increase in the costs of adapting a total of 28 times<sup>81</sup>. In addition, the examination revealed that critical incidents had resulted in a decrease in the costs of monitoring a total of 9 times and a decrease in the costs of planning a total of 5 times. As there were only 14 positive effects decreasing transaction costs as opposed to a total of 296 effects increasing transaction costs, critical incidents occurring during project implementation were shown to have predominantly negative effect on the efficiency of project implementation in project networks under examination in this study. Figure 26 below illustrates the relation between categorized critical incidents and

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<sup>80</sup> Cost of monitoring transactions, costs of planning transactions, and costs of adapting transactions

<sup>81</sup> As can be noted 175 increases in the costs of planning exceeds the number of critical incidents related to transaction costs (134). As discussed earlier in section 4.1.1 a critical incident identified and documented in the study, based on its content, could be categorized into up to three categories. Further, the relation between each of these categories and transaction costs was considered as identical. Based on this logic, critical incidents categorized multiple times, on average, resulted in a greater number of effects on transaction costs, as opposed to critical incidents categorized a single time.

the efficiency of project implementation. A dotted line represents a relation to an *increase* in transaction costs in 20 to 40 per cent of cases, a continuous line an increase in 40 to 60 per cent of cases, and a thickened continuous line an increase in excess of 60 per cent of cases. The absence of a line represents a relation to either an *increase or decrease* in less than 20 per cent of cases, and finally a dashed double line represents a relation to a *decrease* in transaction costs in 20 to 40 per cent of cases. From the figure a relation between several categories of critical incidents and the efficiency of project implementation can be observed. In particular, incidents categorized as unfavorable for the project frequently led to an increase in both the costs of monitoring and planning transactions. Further the relation between, two categories, *failure to keep schedule* and *lack of materials*, and an increase in the costs of planning transactions was found as particularly frequent, as in more than 75 per cent of cases the incident led to a reduction in the efficiency of project implementation. Based on this observation, these kinds of incidents may be considered particularly harmful to the efficiency of project implementation. Only two categories of critical incidents, *incompatibility of processes* and *flexibility towards another actor* were found to be frequently connected to increases in the costs of adapting transactions. Further, while all categories of critical incidents unfavorable to the project as a whole were found to frequently lead to increases in ex post transaction costs, only three categories of critical incidents favorable for the project as whole were found to frequently lead to an increase in ex post transaction costs. This finding may be considered consistent with inherently undesired and harmful nature of transaction costs portrayed in literature. Finally, incidents categorized as *flexibility towards another actor* were found to be rather frequently connected to a decrease in the costs of monitoring transactions. Detailed percentages in each case are presented in tabular format in APPENDIX E.



**Figure 26 – Relation between critical incidents occurring during project implementation and the efficiency of project implementation**

Finally, it was examined that what portion of identified effects on transaction costs that had been caused by the group of critical incidents related to inter-organizational relationships and what portion had been caused by the group of critical incidents not related to inter-organizational relationships between project network actors. The results of this examination are presented in APPENDIX E and they reveal that, in general, a critical incident related to inter-organizational relationships between project network actors was as likely to contribute to the efficiency of project implementation as a critical incident not related to inter-organizational relationships between project network actors.

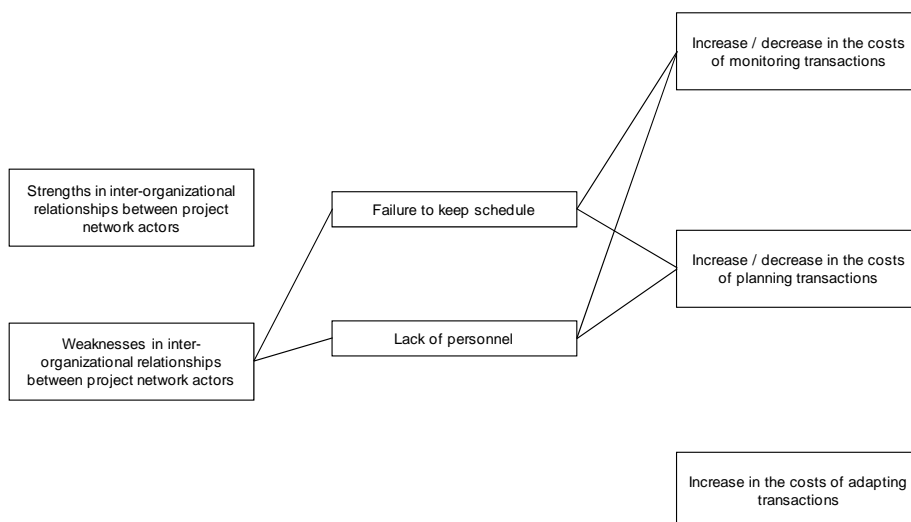
#### 4.1.4 Critical incidents as a mechanism linking inter-organizational relationships with efficiency of project implementation

Following the analysis of relatedness of inter-organizational relationships between project network actors and critical incidents discussed in section 4.1.2, and the analysis of relatedness of critical incidents and the efficiency of project implementation discussed in section 4.1.3, the results obtained from these analyses were combined to provide a comprehensive description of the role of critical incidents as a mechanism that linked inter-organizational relationships between project network actors in studied project networks alpha, beta, gamma, and delta with the efficiency of project implementation. In this phase, exclusively those critical incidents that were both related to inter-organizational relationships between project network actors and had affected the efficiency of project implementation were examined. In addition to the critical incident # 107 discussed extensively in section 3.7, critical incidents # 35, # 73, # 6 are used to illustrate how critical incidents linked inter-organizational relationships between project network actors and the efficiency of project implementation in studied project networks. In the following, an informant discusses critical incident # 35:

*In any case, as a result, was it our sourcing department of... well our management demanded that a plan for catching up to the schedule and ensuring adequate staff had to be created. Well, he [another project network actor's contact person] was the individual who was expected to produce such a plan. This was actually a rather dramatic change in the project, as all our further meetings more or less followed this new plan ... Well around here [pointing at project schedule] week nine is for the skiing holidays. I remember that it was week nine when we discussed it the plan for the first time. And there was this threat from our part that every week we would follow the plan and see how it is being met [by the main contractor]. (# 35, informant representing the client)*

First, a relation between a *weakness* in the inter-organizational *relationship K* between the involved main contractor and the yard and the critical incident, categorized both as *failure to keep schedule* and *lack of personnel*, was identified. At the inter-organizational level, *relationship K* had gradually developed over a period of more than

a decade during which several project deliveries occurred; but due to recent personnel changes influencing both involved organizations, *at the inter-personal level the relationship could not be characterized as strong*. In addition, *relationship K* was characterized by a relatively *low degree of trust*. Combined, these characteristics contributed to the result of the critical incident in question. Furthermore, this critical incident resulted in both an *increase in the costs of monitoring transactions* and an increase in *the costs of planning transactions* as the actors needed to continuously commit resources to updating and following the plan for catching up schedule and ensuring adequate staff. Figure 27 illustrates the relatedness of critical incident # 35 with the two constructs used in this study. A continuous line represents an identified relation. Further, a continuous line between a category of critical incident and transaction costs refers to an increase, as opposed to a decrease, in transaction costs.



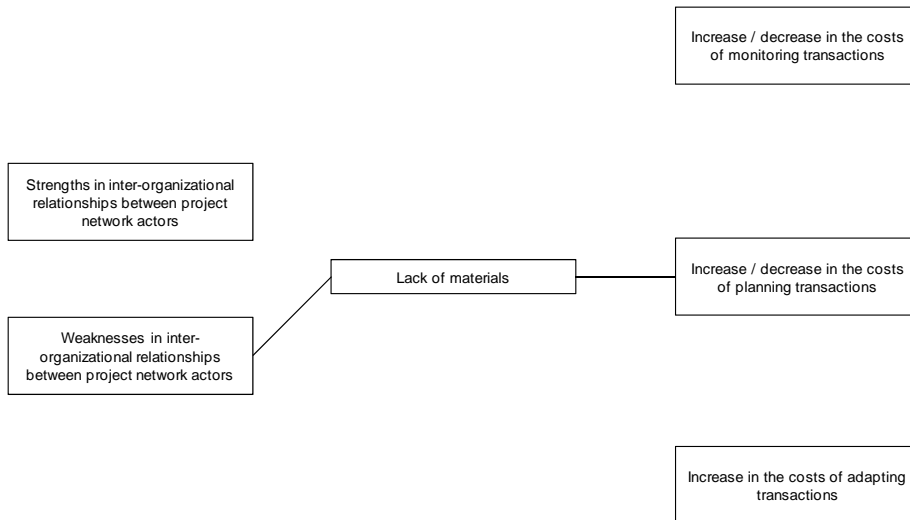
**Figure 27 – Relatedness of critical incident # 35**

In the following, an informant discusses critical incident # 73:

*... well we practically have the summer holiday season, so the issue related to the materials will be left hanging for four weeks. We come back in the beginning of August and start ordering these materials, which may take up to 12 weeks to arrive. This starts to have implications for the project schedule, in particular, during the installation phase, not necessarily before that. But I doubt that the*

*subassemblies will be there when they should be.* (# 73, informant representing the subcontractor, occurrence of incident confirmed during second interview round)

First, the inter-organizational *relationship C* between the subcontractor and the involved main contractor was well established and characterized by both a high degree of *commitment*, and a high degree of *dependence*. In this critical incident, which was categorized as *lack of materials*, the subcontractor was dependent on the main contractor for obtaining the required materials. However, because of the strong inter-organizational relationship between the two actors, and the willingness to ensure its continuity, it was not feasible for the subcontractor to acquire the materials from another source. As a result, a relation between a *weakness* in the inter-organizational *relationship C* between the two actors and the critical incident was identified. The weakness in IORs between project network actors acted as a factor contributing to the occurrence of the incident. Finally, due to not receiving the materials on time, the subcontractor needed to commit additional resources in planning, leading to *increased costs of planning transactions*. A salient feature characterizing this critical incident is that it provides an example of how a high degree of both commitment and dependence, characteristics of an inter-organizational relationship often portrayed as positive in the literature, were found to play a role in the development of a weakness in the inter-organizational relationship between the two actors, that limited freedom of the subcontractor to deal with the incident in an efficient manner. Figure 28 below illustrates the relatedness of critical incident # 73 with the two constructs. A continuous line represents an identified relation. Further, a continuous line between a category of critical incident and transaction costs refers to an increase, as opposed to a decrease, in transaction costs.



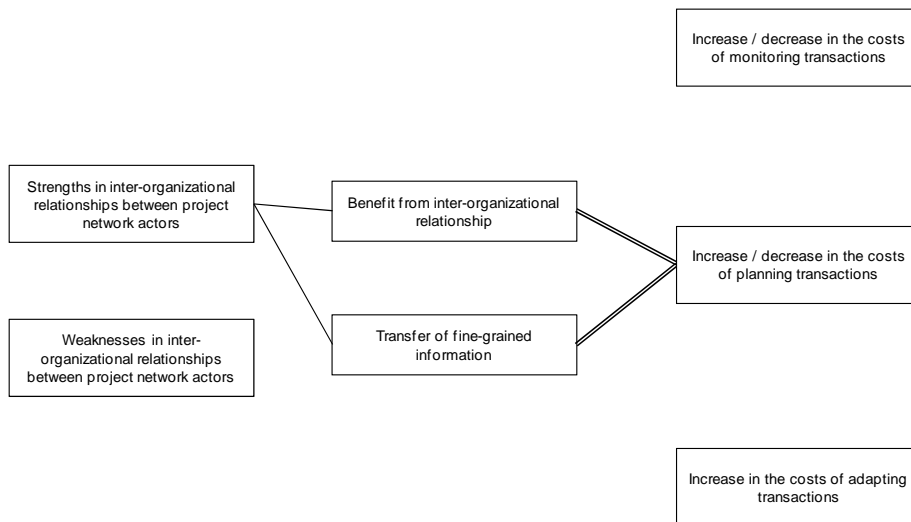
**Figure 28 – Relatedness of critical incident # 73**

Finally, critical incident # 6, discussed earlier in section 4.1.2 is re-visited to illustrate how a strength in inter-organizational relationships between project network actors was related to the efficiency of project implementation. In the following, an informant discusses this incident:

*...well this individual had specific, colored blueprints, which enabled us to have a clear view of the work that needed to be done. This individual had also made personal markings on the blueprints, which we obtained. This individual gave us this valuable document that helped us out a great deal. (# 6, informant representing a main contractor)*

This critical incident, categorized as both *benefit from inter-organizational relationships*, and *transfer of fine-grained information* was related to a *strength* in inter-organizational *relationship H* as discussed in section 4.1.2. Further, incident # 6 also led to a *decrease* in the *costs of planning transactions* as the other project network actor represented by the informant could apply the drawings obtained from the other project network actor to the project as illustrated in Figure 29 below. The doubled lines represent that the critical incident resulted in a *decrease*, as opposed to an increase, *in transaction costs*.



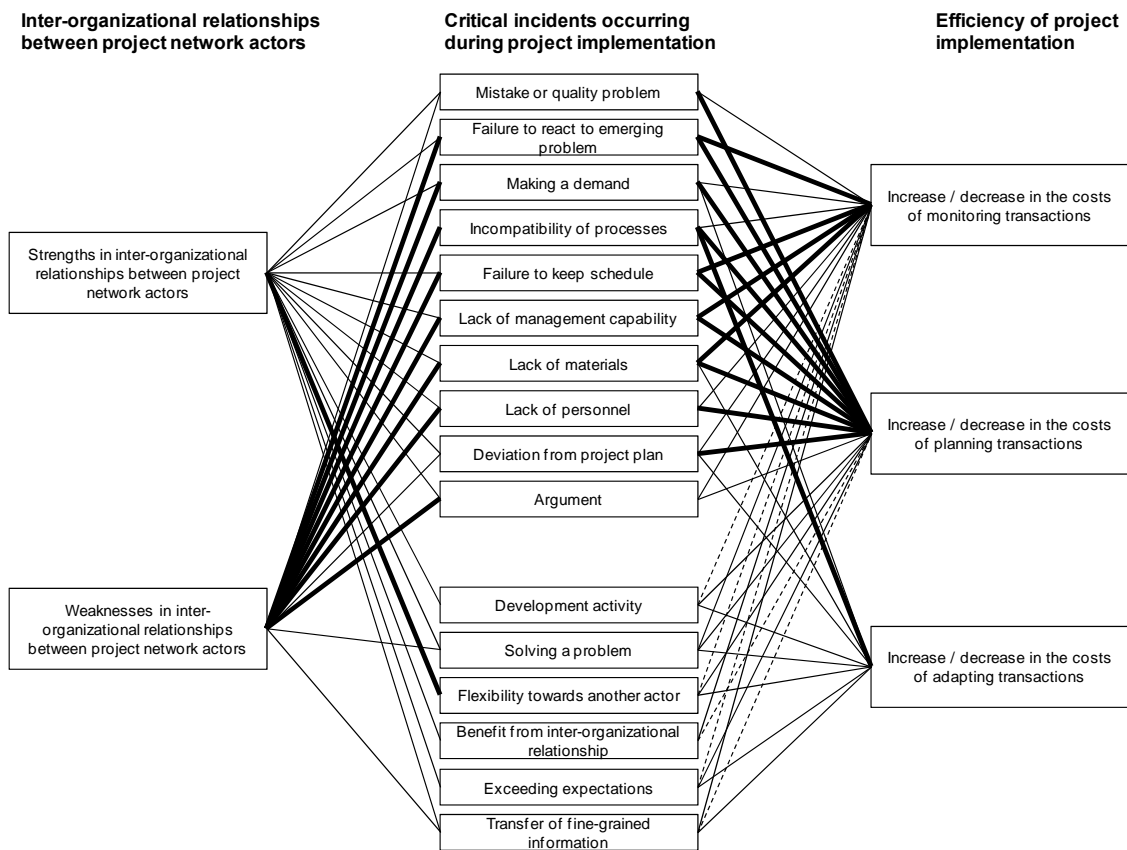


**Figure 29 – Relatedness of critical incident # 6**

Fifty seven critical incidents (29 per cent of all 197 incidents identified) fulfilled the two criteria and were related to inter-organizational relationships between project network actors and had affected to the efficiency of project implementation. The remaining 140 critical incidents were either not related to inter-organizational relationships between project network actors, or had not affected the efficiency or project implementation, or both. By combining the results of the analysis of all 57 critical incidents meeting the aforementioned criteria, a description of critical incidents as a mechanism relating inter-organizational relationships to efficiency of project implementation was derived. Figure 30 illustrates the functioning of this mechanism. A continuous line represents a relation identified empirically in a least a single case. The most frequent 33 per cent of relations are illustrated with a thickened continuous line to highlight their significance for the functioning of the mechanism. Finally, a dotted line connecting a category of critical incidents and a type of ex post transaction costs represents that both a relation leading to an increase in transaction costs, and a relation leading to a decrease in transaction costs were empirically observed.

As a whole, the results demonstrate that weaknesses in inter-organizational relationships between project network actors were frequently and almost exclusively related to critical incidents unfavorable for the project as a whole, leading to an unfavorable contribution to the efficiency of project implementation. On the other hand, strengths in inter-

organizational relationships between project network actors were frequently related to both incidents favorable for the project and incidents unfavorable for the project, frequently limiting their negative effects on the efficiency of project implementation. Overall, despite a few critical incidents, categorized as favorable for the project as a whole, that were observed to increase the efficiency of project implementation, critical incidents identified in this study were found to predominantly decrease the efficiency of project implementation as a total of 130 effects increasing transactions costs as opposite to 7 effects decreasing transaction costs were identified. A table presenting specific details related to each of the sixteen categories of critical incidents is included as APPENDIX F.



**Figure 30 – Critical incidents as a mechanism linking inter-organizational relationships between project network actors to efficiency of project implementation**

## **4.2 Four project networks**

Following the results that focused on the role of inter-organizational relationships between project network actors for the efficiency of project implementation by examining inter-organizational relationships and critical incidents at a fine-grained level, results of the empirical study are now presented at a more holistic project network –level. More specifically, the functioning of critical incidents as a mechanism linking inter-organizational relationships and efficiency of project implementation is described at the level of each of the project networks, alpha, beta, gamma, and delta, to highlight how the functioning of the mechanism was, to an extent, different in each of the four project networks. Then, differences between the two interview rounds are highlighted to illustrate how the progress of time was observed in studied project networks. Finally, the four project networks are compared to highlight both their generic and distinguishing features.

### **4.2.1 Project network alpha: maintaining a safe distance**

#### ***Introduction***

Project network *alpha* was responsible for the delivery of a turnkey ship area subproject for a vessel under construction at the yard's shipbuilding site Red. As the delivery encompassed a visible ship area, demands set for materials and the quality of finishing were very high. Based on the interviews, the main contractor possessed a significant amount of experience of delivering similar ship areas. One further detail characterizing the subproject was that while the implementation phase was started at shipyard Red, the entire unfinished vessel was transported to shipyard Green in the midst of implementation.

#### ***Inter-organizational relationships between actors of project network at the time of the first interview round***

Based on the first round of interviews, the yard and the main contractor shared a long history of working together, but the inter-organizational relationships between the main contractor and the two subcontractors were significantly less established. Some individuals from the subcontractors' organizations had previous experiences of the main con-

tractor, but for both of the subcontractors included in the project network, this was the first major project together with the main contractor, and a high degree of *trust* had not yet developed between the subcontractors and the main contractor. Furthermore, trust in the relationship between the yard and the main contractor was somewhat unidirectional. According to the interviewees, *opportunism* in the project network was characterized as moderate to high; all informants prioritized the interests of their organizations above the interests of other project network actors, but were not willing to commit actions that would seriously hurt other parties. Many interviewees representing the project networks examined here characterized the Finnish shipbuilding industry as open in the sense that, if an actor would resort to highly opportunistic behavior, knowledge of this would spread rapidly. All actors indicated *commitment* to future collaboration and were open to joint development activities with those project network actors they were connected to, but on the other hand, were unaware of any significant development activities in progress. The following quote presents a typical description of *commitment* in inter-organizational relationships within project network alpha<sup>82</sup>:

*I am willing to develop our collaboration further with [the other project network actor]. However, this development needs benefit us both. Not just that their image gets cleaner but also that we as the other involved firm get some benefit. I am ready, definitely. Development is the core of this business. I am not perfect and neither is anybody else, but along one's life it is apparent that there are many new things you have to learn and develop every day.*

On average, *dependence* between project network actors was low as most of the actors were not reliant on future collaboration with other actors. Dependence was particularly low in the relationships between the main contractor and the two subcontractors as illustrated in the following quote:

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<sup>82</sup> For sake of anonymity the organizations represented by informants quoted in this sections 4.2.1, 4.2.2, 4.2.3, and 4.2.4 cannot be revealed.

*It is one firm among many others, so we really are not dependent on them to a significant extent. We can always find another one to work with.*

The *need to monitor* other actors in the project network was somewhat unidirectional and higher towards the main contractor. The yard and the main contractor were rather open to *sharing fine-grained* information with each other, but this readiness was much lower between the main contractor and the subcontractors. On average, *inter-personal relationships* between project network actors were moderately strong, even though the subcontractors and the main contractor had limited experience of working together. The following representative quote illustrates how *inter-personal relationships* were categorized by an informant:

*We get to know them on a personal basis when we work with them. This leads to the development of certain trust, at least, unless you mess up, or things go badly. We can discuss quite openly any issue that needs to be discussed, and the personal relationships develop further as we get to know each other better during the course of the project.*

Most project network actors indicated that they were likely to collaborate with other participating actors after the current project is finished. Table 20 below summarizes the inter-organizational relationships between project network actors in project network alpha after the first round of interviews. In addition to their qualitative description during the personal interviews carried out with informants representing the project network, eight out of nine dimensions of inter-organizational relationships were quantitatively measured with a 7-point Likert-type scale ranging from (1) “not existing” to (7) “very high” as discussed in APPENDIX A<sup>83</sup>. All three inter-organizational relationships in the project network were described by both involved actors (N=6). Based on the both the qualitative descriptions of IORs provided by informants and the rather high standard

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<sup>83</sup> The dimension of *age* (duration) makes an exception as it was not measured quantitatively. Further, in *mean*, 1-2.5 is considered low, 2.6-3.5 as low to moderate, 3.6-4.5 as moderate, 4.6-5.4 as moderate to high, and 5.5-7.0 as high. In *standard deviation*, 0-0.5 is considered low, 0.6-0.8 as low to moderate, 0.9-1.3 as moderate, 1.4-1.6 moderate to high, and over 1.6 as high.

deviations in several dimensions describing IORs between actors of project network alpha, it can be concluded that IORs in project network alpha were rather heterogeneous regarding their descriptive characteristics.

**Table 20 – Summary of inter-organizational relationships between actors of project network alpha after the first round of interviews**

<b>Dimension</b>	<b>Description (1<sup>st</sup> interview round)</b>	<b>Mean (1<sup>st</sup> inter-view round) N=6</b>	<b>Standard deviation (1<sup>st</sup> inter-view round) N=6</b>
Age (duration)	Highly established inter-organizational relationships between yard and main contractor. Emerging inter-organizational relationships between main contractor and the two subcontractors.	NA	NA
Trust	Highly unbalanced trust in the project network. In many cases an actor's (A) trust towards another actor (B) differs from the other actor's (B) trust towards this actor (A).	Moderate to high (5.0)	High (1.7)
Opportunism	Both the main contractor and the yard were somewhat ready to seek their own interests at the cost of the interests of their suppliers. None of the actors reported a high readiness to seek their own interests at the cost of the interest of their customers.	Moderate to high (5.1)	Moderate (1.3)
Commitment	Project network actors reported a high willingness for mutual development with other actors if suitable areas for improvement could be found. However, actors did not report any ongoing improvement initiatives.	High (5.7)	Moderate (1.1)
Dependence	The main contractor and the subcontractors were not dependent on future collaboration. The main contractor was more dependent on future collaboration with the yard than the yard was with the main contractor.	Low (2.5)	Moderate to high (1.5)

Monitoring need	The need for the main contractor to monitor the subcontractors was lower than the need of the subcontractors to monitor the main contractor. Monitoring need was somewhat unidirectional in the yard - main contractor relationship.	Moderate (4.2)	High (1.7)
Transfer of fine-grained information	Readiness to share fine grained information was high between the main contractor and the yard. Between the main contractor and the subcontractors, the readiness was notably lower.	Moderate to high (4.6)	High (1.7)
Strength of inter-personal relationships	Personnel changes and some previous conflicts were reported, but on average, inter-personal relationships between project network actors (firms) were moderately strong.	Moderate (4.4)	High (1.7)
Expectation of continuity (shadow of the future)	Most of the actors indicated that they are likely to work together in the future after the current project is completed.	Moderate to high (5.2)	Moderate to high (1.6)

***Critical incidents that occurred during project implementation***

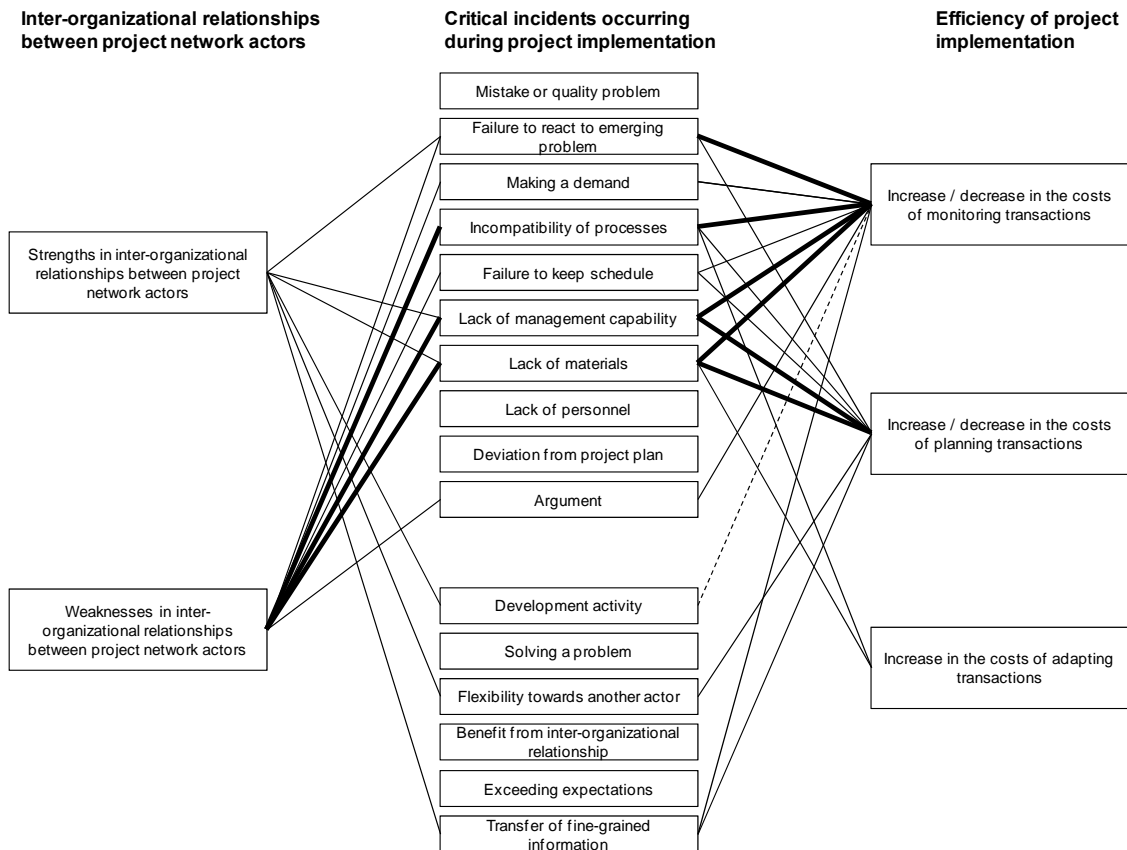
A total of 40 critical incidents were identified and documented during the two rounds of interviews with informants representing project network alpha. Further, the incidents were categorized as unfavorable a total of 52 times and as favorable 11 times. The most frequent categories of critical incidents in the project network alpha were *failure to keep schedule* (12 categorizations), *lack of management capability* (17 categorizations), *lack of materials* (6 categorizations) and *exceeding expectations* (6 categorizations). Frequencies of critical incidents occurred in project network beta are attached as APPENDIX G. The following critical incident # 180, categorized as *lack of management capability* describes difficulties related to organizing work tasks in the project network:

*Well that has been affected by, among other things, by that we have not been able to do all tasks in the order that we had thought. We could not close all walls and ceilings as originally intended. (# 180)*

***Critical incidents as a mechanism linking inter-organizational relationships between project network actors and the efficiency of project implementation in project network alpha***

13 critical incidents out of a total of 40 identified and documented in project network alpha were related both to inter-organizational relationships between project network actors and the efficiency of project implementation. Moreover, strengths in IORs between project network actors were related to 6 categorized incidents, and weaknesses to 15 categorized incidents. Figure 31 illustrates how inter-organizational relationships between project network actors influenced the efficiency of project implementation. A single identified relation is marked with a continuous line, and multiple relations are marked with a thickened continuous line. Finally, a single relation identified in this case, in which a critical incident contributed favorably to the efficiency of project implementation by leading to a decrease in ex post transaction costs is represented by a dotted line. From the figure it can be observed that in project network alpha, weaknesses, rather than strengths in inter-organizational relationships between project network actors were frequently related to critical incidents. Furthermore, weaknesses in IORs between project network actors were often related to incompatibility of processes, lack of management capability, and lack of materials. Characteristic of project network alpha was the generally low degree of dependence between participating actors; this was evident also as a lack of shared practices, routines, and understanding. All of these factors clearly played a role in the constitution of weaknesses in IORs between project network actors that, in several critical incidents resulted in additional costs for planning and monitoring transactions.





**Figure 31 – Link between inter-organizational relationships between project network actors and efficiency of project implementation in project network alpha**

**Summary**

As a whole, despite frequent difficulties with maintaining schedule and difficulties related to a lack of management capability in the project network, the implementation phase of the turnkey ship area subproject delivered by project network alpha can be considered as moderately successful. The area was delivered on schedule and according to the specifications agreed with the yard. Dependence between the main contractor and the two subcontractors was rather low, and in addition, many of the relationships in the network had been established rather recently. A distinguishing feature characterizing project network alpha was that several actors emphasized how they were not dependent on other project network actors and wanted to maintain a certain distance to limit the risk of becoming overly dependent on others. Weaknesses in inter-organizational relationships between project network actors were frequently related to decreases in effi-

ciency of project implementation through incompatibility of processes, lack of management capability and lack of materials.

#### **4.2.2 Project network beta: bound together by dependence**

##### ***Introduction***

Project network *beta* was responsible for the delivery of a turnkey ship area subproject to a vessel under construction at the yard's shipbuilding site, Blue. This project involved the delivery of a technical ship area not intended to be visited by passengers for extended periods of time under normal circumstances; the standards set for the finish were slightly lower as compared to visual ship areas. However, the nature of this specific ship area resulted in high demands for the durability of both materials and equipment. During the first round of interviews, the subproject was in early implementation phase its life cycle, and the finished area was handed out to the yard shortly after the completion of the second round of interviews.

##### ***Inter-organizational relationships between actors of project network beta at the time of the first interview round***

The first round of interviews revealed that the project network encompassing the yard, the main contractor, and the two subcontractors involved inter-organizational relationships that had gradually formed for an extended period of time and were characterized by strong *inter-personal relationships* illustrated in the following quote:

*... we all know our ways of working, we know theirs, and they know ours. It is this long-term collaboration, which in a specific way, drives us to this mode of operation. Further, our collaboration is highly personalized as you know who exactly does what at a personal level.*

All inter-organizational relationships in the project network were also characterized by a moderate to high level of *trust*, which was, according to the informants, however, slightly reduced by the financial situation of one project network actor and constant personnel changes influencing the organization of another actor. Based on the interviews, the level of *opportunism* in the project network can be characterized as moderate. To be

more exact, project network actors in general were quite willing to prioritize their own interest at the expense of interests of other actors, but they were not willing to engage in actions that would significantly hurt other actors. The following quote illustrates the situation:

*Well not me, one cannot think like that, to pull the legs from underneath somebody else. We do not start to cheat or anything like that. We want to make it a fair game.*

The level of *dependence* in the project network could be characterized as moderate to high, especially between the yard and the main contractor. The subcontractors, on the other hand were somewhat less dependent on the main contractor than the main contractor was on them. All project network actors displayed a high level of *commitment* towards other actors. The *need to monitor* other actors varied somewhat as the subcontractors reported a relatively high need to monitor the main contractor while the main contractor indicated a lower need to monitor the subcontractors. The yard and the main contractor, on the other hand shared a moderate need to monitor each other. The *transfer of fine-grained information* in the project network was more open towards the main contractor than it was towards other actors in the network. *Inter-personal relationships* connecting project network actors could be characterized as strong across the entire network and all actors expected to collaborate with other project network actors after the current project was completed, as illustrated by the following quote:

*I am certain that if they will carry on receiving orders out as they currently do, they will also offer us a lot of work in the future.*

Table 21 below summarizes the inter-organizational relationships between project network actors in project network beta after the first round of interviews. In addition to their qualitative description, eight out of nine dimensions of inter-organizational relationships were quantitatively measured with a 7-point Likert-type scale ranging from (1)

“not existing” to (7) “very high” as discussed in APPENDIX A<sup>84</sup>. Two out of three inter-organizational relationships in the project network were quantitatively described by both actors (N=4). All three relationships were qualitatively described. Based on the rather low standard deviations in most dimensions describing IORs between actors of project network beta, it can be concluded that, in general, the IORs between actors of project network beta were rather similar in many of their descriptive characteristics.

**Table 21 – Summary of inter-organizational relationships between actors of project network beta after the first round of interviews**

Dimension	Description (1 <sup>st</sup> interview round)	Mean (1 <sup>st</sup> interview round) (N=4)	Standard deviation (1 <sup>st</sup> interview round) (N=4)
Age (duration)	Established inter-organizational relationships both between the yard and the main contractor and between the main contractor and the two subcontractors.	NA	NA
Trust	Moderate to high average trust in the project network was slightly shadowed by the financial situation of one project network actor and constant personnel changes in the organization of another actor.	Moderate to high (5.3)	Moderate (1.0)
Opportunism	All project network actors were willing to prioritize their interests over the interests of other actors. However, “self interest seeking with guile” was not considered as a viable strategy.	Moderate (4.0)	Low (0.0)

<sup>84</sup> The dimension of *age* (duration) makes an exception as it was not measured quantitatively. Further, in *mean*, 1-2.5 is considered low, 2.6-3.5 as low to moderate, 3.6-4.5 as moderate, 4.6-5.4 as moderate to high, and 5.5-7.0 as high. In *standard deviation*, 0-0.5 is considered low, 0.6-0.8 as low to moderate, 0.9-1.3 as moderate, 1.4-1.6 moderate to high, and over 1.6 as high.

Commitment	Project network actors reported a high willingness for mutual development with other actors if suitable areas for improvement are found. Both the main contractor and the sub-contractors reported several ongoing improvement initiatives.	High (6.5)	Low to moderate (0.6)
Dependence	The main contractor was more dependent on the subcontractors than they were on the main contractor. The yard and the main contractor were highly dependent on each other.	Moderate to high (5.4)	Moderate (0.9)
Monitoring need	The need for the main contractor to monitor the subcontractors was lower than the need of the subcontractors to monitor the main contractor. The main contractor and the yard shared an average-level of need to monitor each other's compliance.	Moderate to high (4.6)	Moderate (1.1)
Transfer of fine-grained information	The main contractor was somewhat less willing to share fine-grained information with other project network actors than those actors were willing to share with the main contractor	Moderate to high (4.8)	Moderate to high (1.4)
Strength of inter-personal relationships	Some personnel changes in the organization of one project network actor were reported. On average, inter-personal relationships in the project network were strong.	High (6.4)	Low to moderate (0.8)
Expectation of continuity (shadow of the future)	All project network actors indicated that they were very likely to work together after the current project was completed.	High (6.9)	Low (0.3)

***Critical incidents that occurred during project implementation***

During the two rounds of interviews (consisting of 12 interviews altogether), 36 critical incidents were identified and documented. These incidents were categorized as unfavorable a total of 49 times, and as favorable a total of 15 times. Based on obtained results, *failure to keep schedule* (10 categorizations), *lack of management capability* (10 categorizations), and *mistake or quality problem* (9 categorizations) were frequent. The following brief quote from the first round of interviews illustrates critical incident # 133, involving a *failure to keep schedule*, typical to the project network:

*Well the boundaries of the ship blocks are still waiting to be put to their places... (# 133)*

In the following brief quote, an informant discusses critical incident # 142, categorized as *mistake or quality problem*:

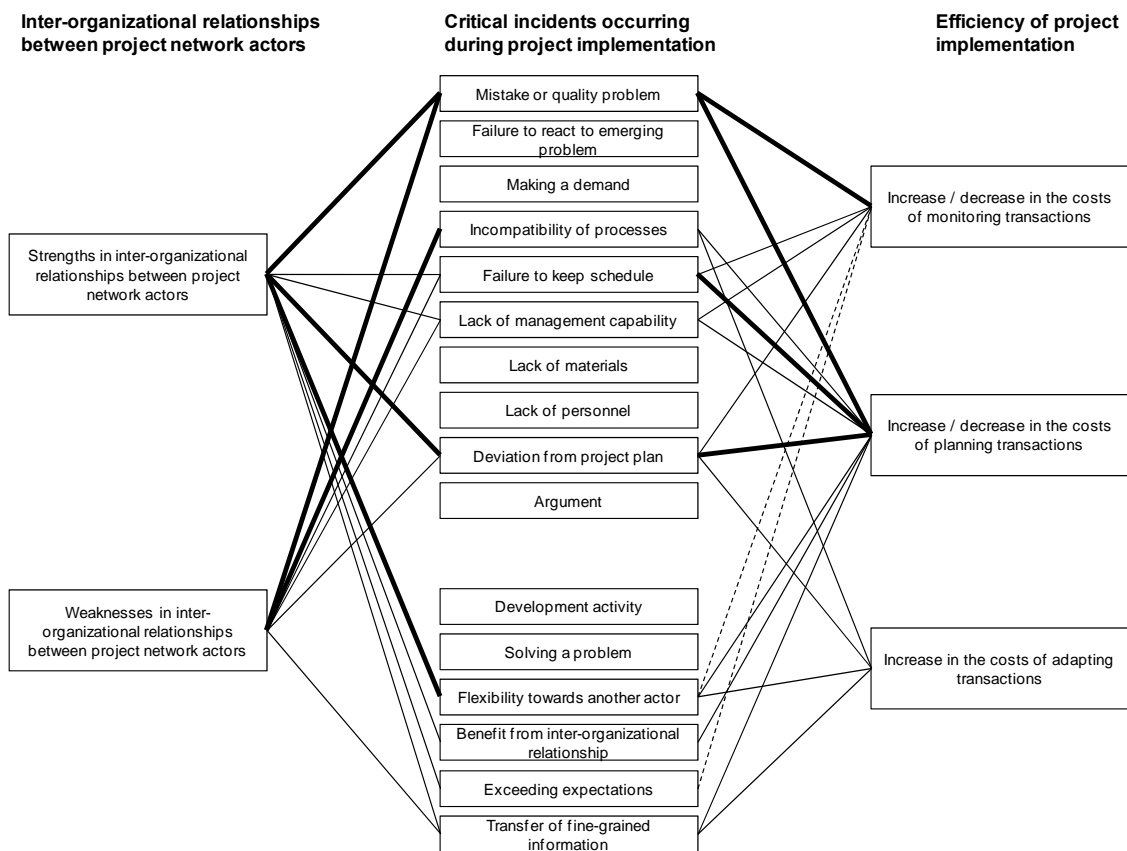
*This is entirely new for them, they really do have highly skilled employees and this quality problem is something entirely new. (# 142)*

Frequencies of critical incidents occurred in project network beta are attached as APPENDIX G.

***Critical incidents as a mechanism linking inter-organizational relationships between project network actors and the efficiency of project implementation in project network beta***

Eleven critical incidents out of a total of 36 identified and documented in project network alpha were related both to inter-organizational relationships between project network actors and to the efficiency of project implementation. Furthermore, strengths in IORs between project network actors were related to 11 categorized incidents, and weaknesses were related to 8 categorized incidents. Figure 32 illustrates how inter-organizational relationships influenced the efficiency of project implementation in project network beta. A single identified relation is marked with a continuous line, and multiple relations are marked with a thickened continuous line. Finally, the two relations identified in this case, in which a critical incident contributed favorably to the efficiency of project implementation by leading to a decrease in ex post transaction costs are represented by dotted lines. From the figure it can be observed that strengths and weaknesses in relationships between project network actors were rather evenly related to critical incidents in project network beta. Weaknesses in IORs between project network actors were frequently related to *mistakes or quality problems*, negatively contributing to the efficiency of project implementation. On the other hand, strengths in IORs between project network actors were frequently related to *mistakes or quality problems*, *deviations from project plan*, and *flexibility towards another project network actor*, re-

ducing their negative contribution on the efficiency of project implementation. Finally two critical incidents related to strengths in inter-organizational relationships between project network actors that led to decreases in ex post transaction costs were identified in the project network. To summarize, the highly established inter-organizational relationships between project network actors, generally characterized by an exceptionally high degree of dependence, functioned both as an asset and as a liability in the project network by creating both strengths that reduced transaction costs and weaknesses that increased transaction costs.



**Figure 32 – Link between inter-organizational relationships between project network actors and the efficiency of project implementation in project network beta**

### ***Summary***

Based on the two rounds of interviews conducted for this study, the implementation phase of the turnkey ship area subproject delivered by project network beta may be characterized as relatively successful and the inter-organizational relationships between project network actors can be characterized as strong with respect to most of the observed dimensions. In particular, project network actors were, on average, highly dependent on each other and reported that they were committed to continuing collaboration with the other actors after the completion of the current project. The interviews revealed a number of mistakes and problems related to the quality of work. In addition, difficulties with maintaining agreed schedules were reported. Despite these problems, none of the interviewed persons characterized the project as anything else other than highly or moderately successful. Finally, in project network beta, strengths in inter-organizational relationships between project network actors were somewhat more frequently related to the identified critical incidents than weaknesses were.

#### **4.2.3 Project network gamma: challenges in execution**

##### ***Introduction***

Project network *gamma* was responsible for delivering a turnkey ship area subproject for a vessel under construction at the yard's shipbuilding site, Red. Similar to project network beta, the ship area to be delivered was a technical area, in which passengers do not spend an extended period of time under normal circumstances. The project was in its late implementation phase when the first round of interviews was carried out and the second round of interviews was conducted shortly after the ship area had been delivered to the yard. Finally, similar to the area delivered by project network alpha, the vessel to which the ship area was delivered was transported from site Red to site Green in the midst of the implementation phase.

##### ***Inter-organizational relationships between actors of project network gamma at the time of the first interview round***

Based on the first round of interviews, inter-organizational relationships between the main contractor and the yard were long-term in nature, developed over several years and several consequent project deliveries. Similarly, relationships between the main contrac-



tor and the two subcontractors were of the established kind. The level of *trust* in the inter-organizational relationships in the project network varied considerably. In two out of three IORs, the main contractor's trust towards other project network actors was considerably higher than the trust of those actors towards the main contractor. The readiness for *opportunistic* behavior in the project network can be characterized as moderate to high and self-interests were clearly prioritized over the interests of other project network actors. However, no informant indicated a readiness to seriously hurt other project network actors as illustrated in the following quote:

*Well the contracts we write with other firms and, in general, what we do is based on a certain trust. I want to operate in a manner that shows that I have a spine.*

The level of *commitment* between project network actors was, on average, moderate to high: three out of four actors reported a high readiness for development activities with other project network actors; only one actor reported a low readiness in this regard. The *dependence* between project network actors was quite unbalanced as both the yard and the main contractor were highly dependent on each other, while the main contractor was much more dependent on the two subcontractors than they were dependent on it. In a similar manner, both the yard and the two subcontractors reported a rather high *need to monitor* the main contractor; the main contractor's need to monitor the subcontractors was clearly lower. Most project network actors reported a moderate willingness for *sharing fine-grained information* with other project network actors as illustrated in the following quote:

*Yes, for example a person representing another project network actor called once, a week or two back, asking how much a certain product would cost in order to calculate the price for their client. I was not sure if our firm would be involved in this project or not, but this person needed to calculate the price and I provided him this information. This is just an example of sharing fine-grained information.*

According to the interviews, the strength of inter-personal relationships between project network actors was generally moderate or high. Finally, according to the informants, all project network actors considered that it to be likely that they would continue collaboration after the current project had been delivered to the yard. Table 22 below summarizes the inter-organizational relationships between actors in project network gamma after the first round of interviews. In addition to their qualitative description, eight out of nine dimensions of inter-organizational relationships were quantitatively measured with a 7-point Likert-type scale ranging from (1) “not existing” to (7) “very high” as discussed in APPENDIX A<sup>85</sup>. All three inter-organizational relationships in the project network were described by both involved actors (N=6). Based on both the qualitative descriptions of IORs provided by informants and the rather high standard deviations in several of the dimensions describing IORs between actors of project network gamma, it can be concluded that IORs in the project network were rather heterogeneous regarding their descriptive characteristics.

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<sup>85</sup> The dimension of *age* (duration) makes an exception as it was not measured quantitatively. Further, in *mean*, 1-2.5 is considered low, 2.6-3.5 as low to moderate, 3.6-4.5 as moderate, 4.6-5.4 as moderate to high, and 5.5-7.0 as high. In *standard deviation*, 0-0.5 is considered low, 0.6-0.8 as low to moderate, 0.9-1.3 as moderate, 1.4-1.6 moderate to high, and over 1.6 as high.

**Table 22 – Summary of inter-organizational relationships between actors of project network gamma after the first round of interviews**

<b>Dimension</b>	<b>Description (1<sup>st</sup> interview round)</b>	<b>Mean (1<sup>st</sup> interview round) (N=6)</b>	<b>Standard deviation (1<sup>st</sup> interview round) (N=6)</b>
Age (duration)	There were well established inter-organizational relationship between the yard and the main contractor and well established IORs between the main contractor and the subcontractors.	NA	NA
Trust	On average the main contractor trusted other project network actors significantly more than the other actors trusted it.	Moderate (4.3)	Moderate to high (1.5)
Opportunism	All project network actors were willing to prioritize their interests over the interests of other actors. The main contractor was somewhat more ready to engage in opportunistic behavior than the subcontractors were.	Low to moderate (3.0)	Moderate (1.1)
Commitment	Project network actors reported a high willingness for development activities with other project network actors, especially if they were connected by a long-term relationship. However, no current development activities were reported.	Moderate to high (5.3)	Moderate (1.3)
Dependence	The main contractor and the yard were highly dependent on each other. The main contractor was more dependent on the subcontractors than the subcontractors were on the main contractor.	Moderate (4.0)	High (1.7)
Monitoring need	The need for the main contractor to monitor the subcontractors was rather low but the need to monitor the yard was higher. Both subcontractors and the yard reported either a moderate or a high need to monitor the main contractor.	Moderate to high (5.0)	High (2.0)

Transfer of fine-grained information	All project network actors were moderately open to sharing fine-grained information.	Moderate to high (4.6)	Moderate to high (1.6)
Strength of inter-personal relationships	Strength of inter-personal relationships between project network actors was typically described as moderate.	Moderate to high (4.8)	Moderate (1.2)
Expectation of continuity (shadow of the future)	All project network actors indicated that they are highly likely to work together after the completion of the current project.	High (6.5)	Low to moderate (0.7)

### ***Critical incidents that occurred during project implementation***

A total of 60 critical incidents were identified and documented during the eight interviews conducted with informants representing project network gamma. The incidents were categorized as unfavorable 79 times and as favorable 18 times. Based on the interviews, *failure to keep schedule* (15 categorizations) and *lack of management capability* (15 categorizations) were by far the most frequent categories. In addition, *demands* (10 categorizations) were frequent. The following quote discussing critical incident # 9, categorized as both *failure to keep schedule* and *lack of management capability* illustrates difficulties that were frequently encountered in project network gamma:

*All boundaries between the ship blocks were all unpainted so that nothing could really be done there. But it took, actually, to the end of that month before things started to happen with the painting. In my opinion we lost four months here. (# 9)*

An additional quote discussing critical incident # 172, categorized as *making a demand* illustrates difficulties with the progress of the project during late implementation:

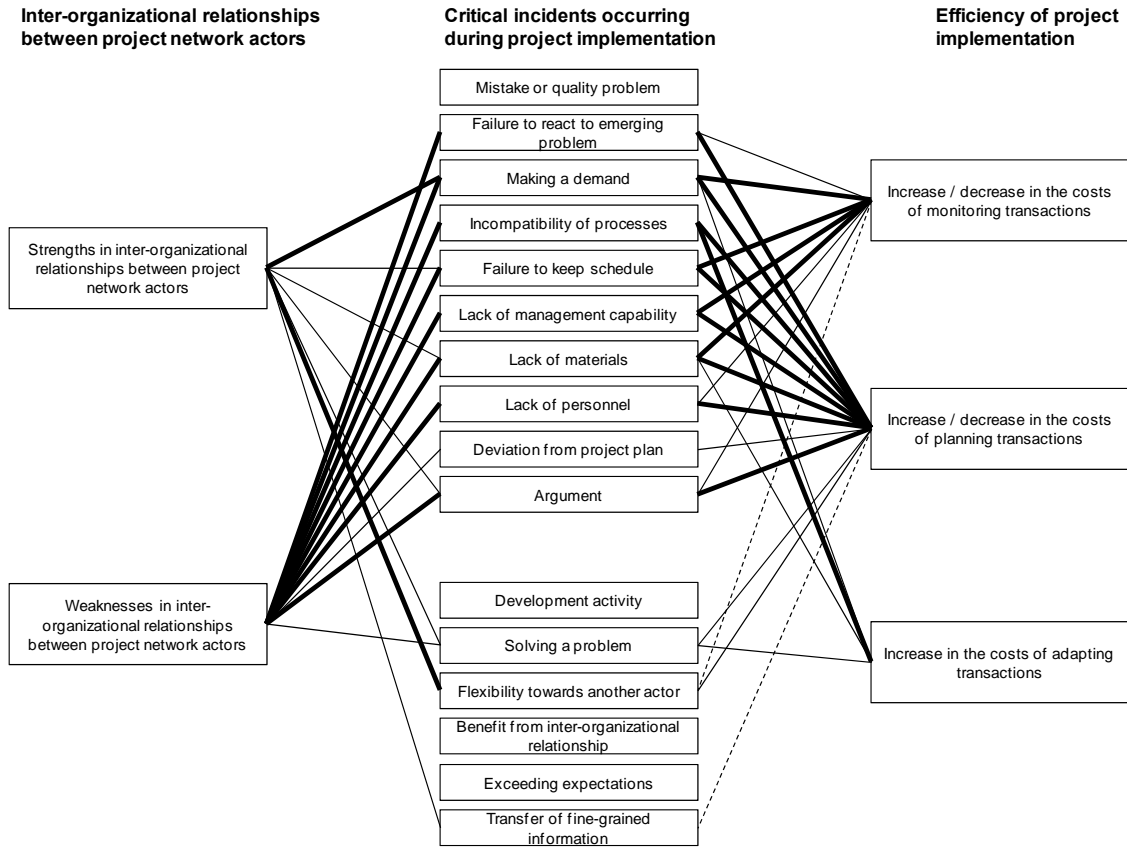
*... these weak signals coming from the network started to alarm us. There were different firms that were contacting us about this issue. We started hearing that they were forced to assign workers to other projects in order to receive money from elsewhere. (# 172)*

The difficulties related to a *lack of management capability* and *failures with keeping schedule* became frequent in the late implementation phase of the project. As a result, one project network actor was replaced with another actor in the midst of project implementation. Frequencies of critical incidents that occurred in project network gamma can be found in APPENDIX G.

***Critical incidents as a mechanism linking inter-organizational relationships between project network actors and the efficiency of project implementation in project network gamma***

Twenty-one critical incidents out of a total of 60 identified and documented in project network gamma were related both to inter-organizational relationships between project network actors and the efficiency of project implementation. Furthermore, strengths in IORs between project network actors were related to 8 categorized incidents, and weaknesses were related to 35 categorized incidents. Figure 33 illustrates how inter-organizational relationships influenced the efficiency of project implementation in project network gamma. A single identified relation is marked with a continuous line, and multiple relations are marked with a thickened, continuous line. Finally, the two relations identified in this case, in which a critical incident contributed favorably the efficiency of project implementation by leading to a decrease in ex post transaction costs, are represented by dotted lines. From the figure it can be observed that in project network gamma, weaknesses in inter-organizational relationships between project network actors were more frequently related to critical incidents than were the strengths in IORs between project network actors. Weaknesses in IORs were frequently related to most categories of critical incidents unfavorable for the project, negatively contributing to the efficiency of project implementation. There were also some critical incidents in which strengths of IORs between project network actors limited the negative contribution of unfavorable critical incidents. For example, in an incident involving difficulties with meeting payments, another actor granted some extra time for arranging the required funding. To summarize the role of IORs for efficiency of project implementation in project network gamma, IORs between actors of project network actors were generally characterized by a somewhat low level of trust, and in many cases a rather high need to monitor other actors, which played a central role in the constitution of weaknesses

that increased the transaction costs, which had to be carried by the project network actors.



**Figure 33 – Link between inter-organizational relationships between project network actors and the efficiency of project implementation in project network gamma**

**Summary**

The delivery of the turnkey ship area subproject by project network gamma cannot be characterized as successful. The need to monitor the progress of other actors characterized inter-organizational relationships in the project network and the level of trust varied considerably between individual IORs. The project was eventually delivered to the yard, but only after severe difficulties related to the progress of work and the replacement of a project network actor. In addition, as a result of the subproject, a number of project network actors reported that they had suffered severe financial losses. Critical incidents identified in the project network were more frequently related to weaknesses

rather than strengths in inter-organizational relationships between project network actors, and thus frequently led to an unfavorable contribution in the efficiency of project implementation.

#### **4.2.4 Project network delta: open towards improvement**

##### ***Introduction***

Project network *delta* was responsible for the delivery of a turnkey ship area subproject for a vessel under construction at the yard's shipbuilding site, Red. As was the case for project network beta and gamma, the ship area to be delivered was a technical area not intended to be visited by passengers for extended periods of time under normal circumstances. As a result, demands set for the finish of this section were somewhat lower than what they typically are in visual ship areas. On the other hand, the technical complexity in terms of systems and equipment included in the scope of the delivery could be characterized as moderate to high. The subproject was in an early implementation phase during the first round of interviews and was delivered to the customer shortly after the completion of the second round of interviews.

##### ***Inter-organizational relationships between actors of project network delta at the time of the first interview round***

The inter-organizational relationship between the main contractor and the yard was well established as the two firms shared a long history of working together. Inter-organizational relationships between the main contractor, and the two subcontractors, however, were somewhat less established. A feature characterizing project network delta was a high degree of *trust* in all inter-organizational relationships, as illustrated by the following quote:

*In this sense it is enjoyable to work with them, as you know people, and then you know that you can trust them. If you ask the other party you can count on it that they keep their promise. In this line of business there are many of those individuals that when they promise you something – well, that is an empty promise. Then you may need to negotiate after six months that what was it that we agreed on earlier.*

The readiness for *opportunistic* behavior in the project network could be characterized as moderate to high: self-interests were prioritized over the interest of others, but guileful behavior was not considered to be an option. Furthermore, all actors displayed a high level of *commitment* as they demonstrated a willingness to collaborate and develop better working practices together with the other project network actors. In addition, several ongoing development activities were reported by the informants. The degree of *dependence* in the project network may be characterized as moderate. The yard and the main contractor were slightly more dependent on each other than the main contractor and the subcontractors were on each other. The *need to monitor* other project network actors was rather low between the main contractor and the subcontractors, but somewhat higher in the yard – main contractor relationship. All project network actors were moderately willing to *share fine-grained information* with other actors. Also, this willingness was slightly lower between the main contractor and the yard than it was between the main contractor and the subcontractors. The strength of *inter-personal relationships* between project network actors could be characterized as moderate. Several informants reported rather strong inter-personal relationships to individuals representing other project network actors. In addition, one informant noted that recent personnel changes had unfavorably affected inter-personal relationships between two of the project network actors. This personnel change had not weakened the inter-personal relationship per se, but it had weakened the strength of inter-personal relationships between the organizational actor that the informant represented and another actor in the project network. Finally, most project network actors indicated that they would be moderately inclined to collaborate with other project network actors after the current project had been delivered to the yard. Table 23 below summarizes inter-organizational relationships between project network actors in project network delta after the first round of interviews. In addition to their qualitative description, eight out of nine dimensions of inter-organizational relationships were quantitatively measured with a 7-point Likert-type scale ranging from (1) “not existing” to (7) “very high” as discussed in APPENDIX A<sup>86</sup>. All three inter-organizational relationships in the project network were described by

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<sup>86</sup> The dimension of *age* (duration) makes an exception as it was not measured quantitatively. Further, in *mean*, 1-2.5 is considered low, 2.6-3.5 as low to moderate, 3.6-4.5 as moderate, 4.6-5.4 as moderate to



both involved actors (N=6). Based on both the qualitative descriptions of IORs provided by informants and the rather high standard deviations in several dimensions describing IORs between actors of project network delta, it can be concluded that IORs in the project network with the exception of the following dimensions: *dependence*, *monitoring need*, and *strength of inter-personal relationships*, were similar with respect to many of their descriptive characteristics.

**Table 23 – Summary of inter-organizational relationships between actors of project network delta after the first round of interviews**

Dimension	Description (1 <sup>st</sup> interview round)	Mean (1 <sup>st</sup> interview round) (N=6)	Standard deviation (1 <sup>st</sup> interview round) (N=6)
Age (duration)	Established inter-organizational relationship between the yard and the main contractor and between the main contractor and one subcontractor. Emerging IOR between the main contractor and one subcontractor.	NA	NA
Trust	A high degree of trust between the main contractor and the subcontractors. Moderate to high degree of trust between the main contractor and the yard.	High (5.8)	Low to moderate (0.6)
Opportunism	All project network actors were ready to prioritize their interests over the interests of other actors. However, “self-interest seeking with guile” was not considered as an option. Opportunism was slightly higher between the yard and the main contractor than between the main contractor and the subcontractors.	Moderate to high (4.9)	Low to moderate (0.8)

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high, and 5.5-7.0 as high. In *standard deviation*, 0-0.5 is considered low, 0.6-0.8 as low to moderate, 0.9-1.3 as moderate, 1.4-1.6 moderate to high, and over 1.6 as high.

Commitment	All project network actors reported a high willingness for development activities with other actors. On-going development activities were also reported between the yard and the main contractor and between the main contractor and the subcontractors.	High (6.3)	Low (0.5)
Dependence	The main contractor and the yard were slightly more dependent on each other than the main contractor and the two subcontractors were.	Moderate (4.1)	Moderate to high (1.4)
Monitoring need	The need for the main contractor to monitor the subcontractors and vice versa was low. However, the main contractor reported a moderate to high need to monitor the yard while the yard reported a moderate need to monitor the main contractor.	Low to moderate (3.5)	Moderate to high (1.6)
Transfer of fine-grained information	The main contractor and the two subcontractors were moderately ready to share fine-grained information. However, the willingness to share fine-grained information was slightly lower between the yard and the main contractor.	Moderate (3.9)	Low to moderate (0.8)
Strength of inter-personal relationships	Two informants reported that the actors they represented had strong inter-personal relationships to other project network actors. One informant reported weak inter-personal relationships to other project network actor due to recent personnel changes in the project network.	Moderate (4.4)	Moderate to high (1.4)
Expectation of continuity (shadow of the future)	All project network actors indicated that they were either likely or highly likely to work together once the current project was completed.	Moderate (4.5)	Moderate (1.3)

***Critical incidents that occurred during project implementation***

A total of 61 critical incidents were identified and documented during the 12 interviews. These incidents were categorized as unfavorable 69 times and as favorable 18 times. Based on the interviews, critical incidents were most frequently categorized as *lack of personnel* (13 categorizations), *failure to keep schedule* (11 categorizations), and *making a demand* (9 categorizations). The following quote addressing critical incident #

12 illustrates an *argument* (7 categorizations) that was related to a quality problem in project network delta:

*... it needs to be done again, but it has not been done yet, because they say that they are incurring extra costs. We have paid them for the work, but we have also bought decent work... (# 12)*

The following quote addresses critical incident, # 42 categorized as *failure to keep schedule*, typical to the project network:

*We are behind schedule, that is clear, but it is not because of [firm A] but apparently because of [firm B]. The ship blocks are, to my knowledge, somewhat late. I think that [person representing firm A] said that we would be able to start [working on] the first boundaries on week [number], and now it is week [number]. (# 42)*

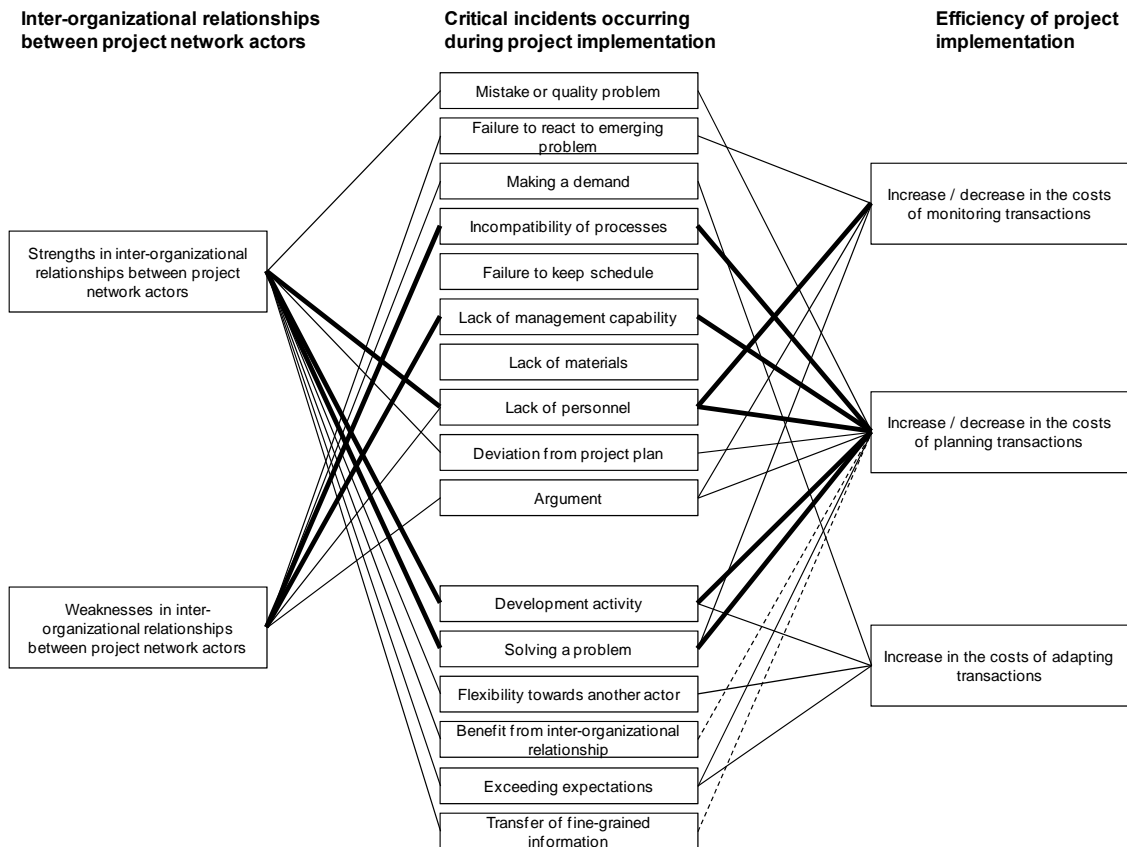
Finally, critical incident # 140 related to the frequent difficulties with *lack of personnel* in the project network is discussed in the following:

*Especially related to this firm we have seen that when we have visited the vessel after the holidays and done our tours there, even though they have said that there are [more than five] men working at the area, and when we go there and look we find less men actually working there. So where are these men really? Of course, there are many places onboard the ship where they could be, but as we start counting, one individual is sick, the second one has gone there, and the third here...*

Frequencies of critical incidents occurred in project network gamma can be found in APPENDIX G.

***Critical incidents as a mechanism linking inter-organizational relationships between project network actors and the efficiency of project implementation in project network delta***

Twelve critical incidents out of a total of 61 identified and documented in project network delta were related to both inter-organizational relationships between project network actors and the efficiency of project implementation. Furthermore, strengths in IORs between project network actors were related to 12 categorized incidents, and weaknesses were related to 8 categorized incidents. Figure 34 illustrates how inter-organizational relationships influenced the efficiency of project implementation in project network delta. A single identified relation is marked with a continuous line, and multiple relations are marked with a thick, continuous line. Finally, the two relations identified in this case, in which a critical incident contributed favorably the efficiency of project implementation by leading to a decrease in ex post transaction costs, are represented by dotted lines. From the figure it can be observed that similarly to project network beta, strengths and weaknesses in relationships between project network actors were rather evenly related to critical incidents. Weaknesses in IORs between project network actors were frequently related to *incompatibility of processes* and *lack of management capability*, negatively contributing to the efficiency of project implementation. On the other hand, strengths in IORs between project network actors were frequently related to a *lack of personnel*, reducing their negative contribution to the efficiency of project implementation. One further feature characterizing project network delta is that strengths in IORs between project network actors were frequently related to *development activities* and *solving a problem*. These incidents, while favorable for the project, also led to increases in the costs of planning transactions, which decreased the efficiency of project implementation. Due to the limitations of the study discussed earlier, the potential long term benefits resulting from these kinds of incidents were not explored. Finally two critical incidents related to the strengths in inter-organizational relationships between project network actors that led to decreases in ex post transaction costs were identified in the project network. In summary, the role of IORs for the efficiency of project implementation was balanced: this emphasizes the fact that different dimensions of the IORs in different critical incidents contributed both to increases and decreases in transaction costs for the involved actors.



**Figure 34 – Link between inter-organizational relationships between project network actors and the efficiency of project implementation in project network delta**

**Summary**

Project network delta was characterized by a particularly high degree of trust and commitment between actors. The implementation phase of the turnkey ship area subproject delivered by project network delta can be considered as moderately successful. Even though not profitable for all project network actors, the area, meeting the predetermined requirements, was delivered to the yard after the second round of interviews. Most critical incidents identified and documented in this study were related to maintaining schedules and the availability of personnel. In addition, the implementation phase was characterized by a relatively high number of arguments and demands. Despite these difficulties, strengths and weaknesses in IORs between project network actors were rather evenly related to critical incidents that occurred during project implementation.

#### 4.2.5 The temporal dimension: differences in results of the two interview rounds

Two rounds of interviews separated by a period of roughly six months were carried out for this study. This resulted in longitudinal data from which changes in both inter-organizational relationships and the occurrence of critical incidents can be observed.

##### *Development of in inter-organizational relationships in studied project networks*

A comparison of results from the two rounds of interviews demonstrates development in inter-organizational relationships between actors of the four project networks, alpha, beta, gamma, and delta. During the interviews carried out in the second interview round, the same informants that had described the IORs during the first interview round described these IORs for a second time. In addition to providing both qualitative and quantitative descriptions of IORs, informants often provided explicit explanations for why development had taken place in the IORs during the approximately six months separating the interview rounds. In the following, an informant explains why *trust* had slightly decreased and the *need for monitoring* increased in inter-organizational *relationship D*<sup>87</sup>:

*...because of financial matters and a little bit with the progress of work, I would say, our relationship has slightly weakened, but we are really not yet in any real difficulties, and I would say that the change has been neutral or slightly negative.*<sup>88</sup>

This quote illustrates how critical incidents that had occurred during the implementation of the project in question had influenced the development of inter-organizational *relationship D*. In the following quote, an informant explains a decrease in *trust* in inter-organizational *relationship E*:

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<sup>87</sup> See APPENDIX C for a quantitative description of the inter-organizational relationship in question.

<sup>88</sup> To ensure anonymity, the identity of the respondent cannot be revealed in any of the quotes in this section.

*... just for this reason, trust in them has been reduced, as there have been these delays. Shipbuilding resembles a certain kind of puzzle, in which all of us should proceed at the same pace, or at least close to the same pace. Yes, it will result in some atonement if one of us is late.*

Here again, according to the informant, the development of *relationship E* had been influenced by difficulties experienced during project implementation. In the following, an informant discussed a slight increase in the *strength of inter-personal relationships* in inter-organizational *relationship J*:

*With them we have strong inter-personal relationships. They have there a lot of positive individuals working for them. I say that the relationship between us is stronger now than it was six months ago.*

The informant had experienced the behavior of individuals representing the other project network actor during the project as positive and considered that this had influenced the development of the IOR in question.

In addition, to the cases discussed above, several inter-organizational relationships had developed much more noticeably, i.e. with respect to four or more dimensions characterizing the IOR in question. In the following, an informant discusses the development of inter-organizational *relationship L*:

*Well, this situation happened to escalate too much. Yes, trust towards them has severely weakened. But, they still have good individuals working for them, real professionals. I would not say that I would not be ready to develop some project with them in the future. But they are in serious difficulties now, for what I have heard. I really hope that they will survive over this as they are, in principle, a good firm. They have normally done good work, but now in this project, I think that they took a bit too big a slice of the cake to deal with. But getting back to the development of the relationship between us, I would say that it has clearly weakened.*

This quote lucidly explains how difficulties experienced during project implementation had strongly influenced the development of *relationship L* with respect to several of its descriptive dimensions including: *trust*, *opportunism*, *transfer of fine-grained information*, and *expectation of continuity*. In the following quote concerning another IOR that was strongly influenced by project implementation, an informant explains why several dimensions of inter-organizational *relationship G* had been influenced:

*Well now if we talk about our relationship [with the other project network actor] it has clearly not improved. These difficulties mentioned earlier in the interview started to have an effect on the relationship in a rather early in project implementation. You do not believe how many times I have had to negotiate with them concerning the payments. They have not, even once, arrived as promised, if I remember correctly.*

The development of several dimensions describing *relationship G*, including *trust*, *opportunism*, *commitment* and *monitoring need* had been affected by critical incidents that occurred during project implementation.

Based on both the analysis of qualitative and the quantitative descriptions of the twelve inter-organizational relationships A-L (for a detailed description of how each IOR developed between the two interview rounds, see APPENDIX C) provided by the informants, four inter-organizational relationships (A, G, K, and L) had clearly *deteriorated* as the development regarding *two or more dimensions* describing these relationship was both *substantial* and *negative* in nature, while positive development in the remaining dimensions was either minor or nonexistent. The development regarding a dimension was considered as *substantial* when the change between the two interview rounds exceeded one interval (for example, changed from “moderate” to “high”) and as *minor* when the change was equal to or less than one interval (for example, changed from “low to moderate” to “moderate”) in the scale defined in APPENDIX C.



In the inter-organizational relationships (B, C, D, E, F, H, and J), the development between the two interview rounds can be described as *modest* as fewer substantial changes regarding the dimensions characterizing the relationships were observed. Further, in these IORs, the development was not strongly dominated by either positive or negative changes in the observed dimensions.

With regard to the project four networks alpha, beta, gamma, and delta featured in this study, the development of inter-organizational relationships can be summarized as follows:

- In project network alpha, one IOR had deteriorated while the development of two IORs had been modest
- In project network beta, the development of all three IORs had been modest
- In project network gamma, all three IORs had deteriorated
- In project network delta, the development of all three IORs had been modest

When considering the development of inter-organizational relationships across all project networks examined in this study, no strong patterns of development, in terms of any specific dimension used to describe IORs in this study could be observed in project networks alpha, beta, and delta. However, in project network gamma, noticeable changes in *trust*, *opportunism*, *commitment*, *dependence*, *transfer of fine-grained information*, and *expectation of continuity* in all three inter-organizational relationships between project network actors could be observed. In the following, an informant, after describing the development of an individual IOR, continued to discuss the development of IORs at the level of the entire project network gamma:

*Well, I would say that achieving a sufficient level of motivation in these projects is always a challenge as collaboration between firms does not come naturally. And well ... then came this situation in which it was agreed that this other firm will replace them [in the project network] and take care of the work. I can say that firm action was really taken. But, I would say that we also paid a quite heavy financial price for this decision. In this sense, okay it would be easy to*

*call them [the actor removed from the project network] the villain in this play, but I would, in a way, also throw the arrow at this new firm as they also, in a way, were guilty of this certain game-like behavior.*

This quote, describing how the development of IORs was influenced by project implementation, highlights the interdependencies between individual inter-organizational relationships in a specific project network. As such, it illustrates how the development of IORs, in addition to being dependent on how the two actors involved interact during the project, can also be further influenced by the behavior of other actors in the project network.

#### ***Changes in the occurrence of critical incidents in studied project networks***

The results obtained in this study demonstrate some changes in the occurrence of critical incidents between the two rounds of interviews. More specifically, as the four projects progressed to later stages in implementation, the occurrence of some categories of incidents became more frequent while the occurrence of other categories became less frequent. Based on this observation, in the case of the project networks under examination, the entire implementation phase cannot be characterized as a homogeneous: within the implementation phase, different incidents occur and may be resolved and replaced by the occurrence of others. Table 24 below illustrates how the most frequent categories of critical incidents changed between the two interview rounds in the four studied project networks. Detailed case-specific tables including all categories of critical incidents are presented in APPENDIX G.

**Table 24 – Frequent categories of critical incidents in the studied project networks<sup>89</sup>**

<b>Project network</b>	<b>Alpha</b>	<b>Beta</b>	<b>Gamma</b>	<b>Delta</b>
<b>Most frequent categories of critical incidents identified during first interview round</b>	-Failure to keep schedule (29 per cent)  -Lack of management capability (26 per cent)	-Failure to keep schedule (16 per cent)	-Failure to keep schedule (15 per cent)  -Lack of management capability (15 per cent)	-Failure to keep schedule (16 per cent)  -Mistake or quality problem (13 per cent)
<b>Most frequent categories of critical incidents identified during second interview round</b>	-Lack of management capability (28 per cent)	-Mistake or quality problem (22 per cent)  -Lack of management capability (22 per cent)	-Diverse	-Lack of personnel (18 per cent) -Making a demand (11 per cent)  -Failure to keep schedule (11 per cent)

#### **4.2.6 Similarities and differences between studied project networks**

The empirical similarities and differences between project networks examined in this study relate to inter-organizational relationships between project network actors, critical incidents that occurred during project implementation, and the relation between inter-organizational relationships between project network actors and efficiency of project implementation.

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<sup>89</sup> Percentages in table refer all critical incidents, both unfavorable and favorable, identified during a specific interview round, in a specific project network.

### *Similarities and differences in inter-organizational relationships found in the four project networks*

A comparison of inter-organizational relationships in the four project networks revealed a considerable degree of uniformity among the studied cases. First, based on the interviews carried out during the initial interview round, each of the four project networks was characterized by either a *highly or a moderately established IOR between the yard and the main contractor*. These relationships had been built during several project deliveries spanning multiple years, and as such, are distinct from what one would call a “one-time” relationship. Second, each project network, on average, was characterized by a *rather high degree of trust*, i.e. most project network actors placed a considerable amount of trust on other network actors. Third, the readiness to resort to *opportunistic behavior was generally moderate* in the studied networks. In each network studied, actors prioritized their own interests over the interests of other actors. However, no actor indicated a very high willingness to engage in actions that would seriously damage other actors. One factor, often mentioned by the informants that reduced the attractiveness of resorting to opportunistic behavior was the fact that, in the Finnish shipbuilding industry, key executives tend to know most of the other executives on a personal basis, and, as a result, knowledge of opportunistic behavior of an individual actor would spread rapidly throughout the entire industry. Fourth, on average, each of the studied project networks was characterized by *a moderate or high degree of commitment*: actors were generally highly willing to develop practices and processes with other actors. Fifth, all actors representing the project networks examined in this study were quite ready and *willing to share fine-grained information* with other project network actors. Sixth, actors representing the project networks indicated, in general, that they had considerably *strong interpersonal relationships* to other project network actors. This observation is partially explained by the small number of main contractor firms operating the Finnish shipbuilding industry, and the fact that many informants had worked for several firms during their careers. Finally, actors from the four project networks, in general, *expected to continue working* with other project network actors after the currently ongoing project had been delivered to the yard. This indicated a considerable expectation of continuity in the relationships between the main contractors and the yard and the relationships between the main contractors and the eight subcontractors.

There were also dissimilarities regarding several of the dimensions characterizing inter-organizational relationships in project networks alpha, beta, gamma, and delta. First, there were *both established and emerging inter-organizational relationships between the main contractors and the subcontractors*. For example, while the main contractor in project network alpha relied on subcontractors with whom it had virtually no experience of, relationships between the main contractor and its subcontractors in project network gamma were much more established. Second, the average level of *dependence between actors varied substantially between studied project networks*. For example, all IORs in project network alpha were characterized by either a low or moderate degree of dependence, while mutual dependence between actors participating in project network beta was much higher. Third, the average *need to monitor other actors varied considerably* between the project networks. Furthermore, at the *level of individual inter-organizational relationships* within a project network, this variation was even higher. In most of the studied project networks, there were one or two actors that were monitored more actively than other network actors. This feature was most evident in project network gamma in which all other project network actors reported a considerably high need to monitor the main contractor.

Based on the observations discussed in the preceding paragraphs it can be concluded that the studied project networks delivering turnkey ship area subprojects in the Finnish shipbuilding were characterized by inter-organizational relationships based on trust, commitment, considerably open sharing of fine-grained information, and rather high expectations of continuity. This observation is important because these kinds of relationships enable long-term development activities between project network actors which would not be viable in the context of one-time relationships. However, in addition to the considerable degree of similarity with other project networks, each network studied had its own distinguishing features. For example, project network alpha was characterized by low dependence, beta by high dependence, gamma by a somewhat low level of trust, and delta by a high level of trust. Substantial differences in inter-organizational relationships were found within each individual project network as illustrated by the standard deviations calculated for the eight dimensions (excluding duration) describing the inter-organizational relationships. More specifically, while the three IORs between the actors

of project network beta were rather similar across most dimensions used to describe them, IORs between actors of project networks alpha and gamma were quite dissimilar and IORs between actors of project network delta could be placed somewhere in the middle of this continuum.

### ***Similarities and differences in critical incidents that occurred in the four project networks***

The results discussed earlier in this chapter indicate a degree of consistency in the occurrence of critical incidents across the four project networks in this study. In particular, incidents identified in all four project networks were frequently categorized as *failure to keep schedule*, and incidents identified in three project networks were frequently categorized as *lack of management capability* and *lack of personnel*. Based on these observations, it could be expected that turnkey ship area subprojects in the Finnish shipbuilding industry suffer from a set of generic problems that contribute unfavorably to the implementation phase of their life cycles. Furthermore, based on the informants, it is likely, although not explored in the present study, that several of these generic problems may be interrelated as, for example, an incident categorized as *lack of materials* may be an antecedent or an outcome of an incident categorized as *failure to keep schedule*. In this sense, an interrelated chain of critical incidents can manifest for different project network actors in the form of different (in terms of categorization) incidents. Despite categories of incidents frequent in all studied project networks, all four were still characterized by an individual profile of critical incidents. More specifically, project network *alpha* experienced a relatively high amount of incidents related to a lack of materials, project network *beta* experienced several difficulties with mistakes or quality problems, project network *gamma* faced difficulties with demands and did not perform particularly well in reacting to emerging problems, while actors in project network *delta* experienced frequent demands.

***Critical incidents as a mechanism relating inter-organizational relationships between project network actors and the efficiency of project implementation in the studied four project networks***

Finally, in each of the project networks under examination, both weaknesses and strengths in inter-organizational relationships between project network actors were related to critical incidents that occurred during project implementation. Strengths in inter-organizational relationships between project actors of project network beta and delta limited the unfavorable contribution of critical incidents on the efficiency of project implementation, as opposed to project networks alpha and gamma, in which weaknesses in inter-organizational relationships were notably more frequently related to critical incidents. A summary of similar features of the four studied project networks is presented in Table 25 and a summary of distinguishing features of the four studied project networks is presented in Table 26.

**Table 25 – Features similar to the four studied project networks**

<b>Feature</b>	<b>Description</b>
Inter-organizational relationships between project network actors after the first round of interviews	<ul style="list-style-type: none"> <li>• Established inter-organizational relationship between client and main contractor</li> <li>• Moderate to high degree of trust</li> <li>• Moderate readiness to resort to opportunistic behavior</li> <li>• Moderate to high degree of commitment</li> <li>• Moderate to high degree of sharing of fine-grained information</li> <li>• Moderate to strong inter-personal relationships</li> <li>• Moderate to high expectation of continuity</li> </ul>
Frequent critical incidents during project implementation	<ul style="list-style-type: none"> <li>• Failure to keep schedule (unfavorable)</li> <li>• Lack of management capability (unfavorable)</li> <li>• Lack of personnel (unfavorable)</li> </ul>
Relatedness of inter-organizational relationships between project network actors and the efficiency of project implementation	<ul style="list-style-type: none"> <li>• Weaknesses in inter-organizational relationships between project network actors frequently related to unfavorable critical incidents, leading to a reduction in the efficiency of project implementation</li> </ul>

**Table 26 – Distinguishing features of the four studied project networks**

<b>Feature</b>	<b>Project network alpha</b>	<b>Project network beta</b>	<b>Project network gamma</b>	<b>Project network delta</b>
Established or emerging inter-organizational relationships between project network actors	Both	Established	Established	Both
Dimensions of inter-organizational relationships emphasized during first interview round	Low degree of dependence	High degree of commitment, high degree of dependence, strong inter-personal relationships, high expectation of continuity	Low to moderate degree of trust, low degree of opportunism	High degree of trust, high degree of commitment
Similarity of three inter-organizational relationships within project network actors	Low	High	Low	Moderate
Development of inter-organizational relationships between project network actors during project implementation	The development of two IORs was modest, while one had deteriorated	Modest	All three IORs had deteriorated	Modest
Typical unfavorable critical incident	Failure to keep schedule, lack of management capability	Failure to keep schedule, lack of management capability	Failure to keep schedule, lack of management capability	Lack of personnel, failure to keep schedule
Typical favorable critical incident	Diverse	Exceeding expectations	Solving a problem	Diverse



Nature of relation between inter-organizational relationships between project network actors and the efficiency of project implementation	Dominated by weaknesses in inter-organizational relationships	Balanced combination of strengths and weaknesses in inter-organizational relationships	Dominated by weaknesses in inter-organizational relationships	Balanced combination of strengths and weaknesses in inter-organizational relationships
Outcome of implementation phase	Relatively successful	Relatively successful	Relatively unsuccessful	Relatively successful

## 5 DISCUSSION AND CONCLUSIONS

The objective of this study was to explore how inter-organizational relationships and project implementation are related in project network contexts. In particular, the study examined the role of critical incidents in such a relation by seeking for answers to the following two research questions:

*How do inter-organizational relationships between firms participating in a project network influence the efficiency of project implementation?*

And,

*How is the development of inter-organizational relationships between firms participating in a project network influenced by project implementation?*

To be able to the objective of the study, literature on project business, inter-organizational relationships, transaction cost economics, and critical incidents were reviewed. Based on the literature review, a conceptual framework was developed to guide the empirical part of this study. Empirical data was collected from four project networks representing the Finnish shipbuilding industry by means of a mainly qualitative case study. This final chapter first discusses the obtained results in light of existing knowledge and then highlights some of their implications for both theory and practice. After this discussion, the reliability and validity of the study are discussed. Finally, some promising avenues for further research are presented.

### **5.1 *The relation between inter-organizational relationships and the efficiency of project implementation***

How are inter-organizational relationships between project network actors and the efficiency of project implementation related? Several studies have provided evidence of a relation between inter-organizational relationships and efficiency of economic transactions (see e.g. Parkhe, 1993; Dyer, 1997; Zaheer et al. 1998; Gulati et al., 2000). Furthermore, it has been demonstrated, that the implementation phase of the project life

cycle is often characterized by the occurrence of unexpected incidents (see e.g. Thmhain and Wilemon 1975; Slevin and Pinto, 1987; Morris and Hough, 1987; Morris, 1994). Finally, such incidents have been shown to contribute significantly both to the outcomes and success of projects (Morris and Hough, 1987; Orr, 2005; Orr and Scott, 2008).

The results of the present study show how the implementation phase of each of the four project networks, i.e. alpha, beta, gamma, and delta, was characterized by critical incidents that occurred frequently and were unforeseen by the thirteen project network actors included in this study. Both project network alpha and project network beta were characterized by frequent difficulties with maintaining project schedule and a lack of management capability, while project network gamma suffered from a diverse range of critical incidents unfavorably contributing to its progress. Project network delta, on the other hand, frequently suffered from difficulties related to the availability of personnel. Furthermore, a total of 57 critical incidents out of 197 critical incident identified in this study were found to be related both to inter-organizational relationships between project network actors and to the efficiency of project implementation. In addition, it was found that these critical incidents frequently led to an unfavorable, rather than a favorable, contribution to the efficiency of project implementation in the studied project networks, as they incurred additional costs of monitoring, planning, and adapting transactions that project network actors had to carry. Increases in transaction costs were particularly frequent in project network gamma, in which project network actors had to frequently commit additional resources to planning to overcome difficulties related to critical incidents.

The empirical study demonstrated that inter-organizational relationships between project network actors frequently constituted both strengths and weaknesses, which either favorably (in case of a strength) or unfavorably (in case of a weakness) contributed to the outcomes of critical incidents that occurred during project implementation. In project network alpha, in which IORs between project network actors were characterized by a relatively low degree of dependence, and project network gamma, in which IORs between project network actors were characterized by a relatively low degree of

trust, these dimensions of IORs frequently played a role in the constitution of weaknesses in IORs that were associated with unfavorable critical incidents. Some relevant examples include: incompatibility of processes and difficulties in ensuring the availability of material. On the other hand, in the context of project network beta, in which IORs between project network actors were characterized by a high degree of dependence, and project network gamma, in which IORs between project network actors were characterized by a high degree of trust, IORs between project network actors frequently played a role in the constitution of both strengths and weaknesses related to critical incidents that occurred during project implementation. Combined, the findings of this study discussed above provide a description of critical incidents that occur during project implementation as a mechanism that links inter-organizational relationships between project network actors with the efficiency of project implementation. The functioning of this mechanism is summarized in the form of the following three propositions.

*Proposition 1a: Critical incidents occurring during project implementation make a predominantly negative contribution to the efficiency of project implementation in project network contexts.*

*Proposition 1b: Critical incidents occurring during project implementation are frequently related to inter-organizational relationships between project network actors.*

*Proposition 1c: Inter-organizational relationships between project network actors constitute strengths by reducing the negative contribution of critical incidents to the efficiency of project implementation and weaknesses by increasing the negative contribution of critical incidents to the efficiency of project implementation.*

The findings discussed above complement those of earlier studies that have demonstrated a relation between inter-organizational relationships and project execution (Hobbs and Andersen, 2001; Skaates et al., 2002; Ahola et al., 2006; Larson and Wikström, 2007; Eloranta, 2007; Ruuska et al. 2009) and studies that have emphasized the role of

critical incidents in projects (Thamhain and Wilemon, 1975; Alsakini et al, 2004; Dvir and Lechler, 2004; Hällgren and Maaninen-Olsson, 2005; Ahola et al., 2006; Hällgren 2007). In earlier literature, it has also been discussed whether established, as opposed to emerging inter-organizational relationships facilitate project implementation (Hobbs and Andersen, 2001; Skaates et al. 2002). Based on the results of this study, it does not appear that established inter-organizational relationships are a prerequisite for well functioning project implementation as two out of the four project networks studied exhibited both established and emerging relationships and the inter-organizational relationships in project network gamma, characterized as unsuccessful, were exclusively of the former kind.

## **5.2 *The effects of project implementation on the development of inter-organizational relationships between project network actors***

What is the role of project implementation for the development of inter-organizational relationships between firms that participate in project networks? In the literature, inter-organizational relationships are generally regarded as a byproduct of collaboration, and their development has been described with several models (see e.g. Dwyer et al., 1987; Larson 1992; Ring and Van de Ven 1994; Tähtinen, 2001). In a project context, there are both studies that have argued that inter-organizational relationship develop over an extended period of time involving several recurrent projects between the involved actors (Grabher 2002b; Sydow and Staber, 2002), and studies that have argued for the view that inter-organizational relationships may develop significantly during the life cycle of a single project (Bengtson et al. 2001; Tähtinen, 2001; Kadefors, 2004).

Two rounds of interviews were carried out during this study, which resulted in an opportunity to observe how the twelve inter-organizational relationships (A-L) in project networks, alpha, beta, gamma, and delta, had developed during project implementation. Indeed, as discussed in section 4.2.5, informants provided several illustrative examples of how the implementation phase had affected the development of inter-organizational relationships. Based on the interviews, the development of most inter-organizational relationships (B, C, D, E, F, H, and J) had been modest, as informants routinely characterized the influence of project implementation on these inter-organizational relation-

ships as “neutral” or “incremental”. However, based on the interviews it is clear that the development of four inter-organizational relationships (A, G, K, and L) had been unfavorably affected by critical incidents that had occurred during project implementation. In particular, the responses of project network actors to those critical incidents had played a central role for the development of IORs, as several illustrative examples were provided, describing how the behavior or progress of another project network had disappointed the informant during project implementation. Finally, the case of project network gamma, in which all three inter-organizational relationships between project network actors had notably deteriorated, provides evidence that the development of the inter-organizational relationship between any two project network actors is, to an extent, dependent on the development of other inter-organizational relationships in the project network. Specifically, in project network gamma, the serious difficulties experienced during project implementation induced opportunistic behavior that further deteriorated IORs between project network actors. Based on these findings, this study displays evidence of a relation between critical incidents occurring during project implementation and the development of inter-organizational relationships between project network actors. Thus, the following propositions are offered:

*Proposition 2a: When project network actors assess each other’s responses to critical incidents that occur during project implementation as acceptable, the development of inter-organizational relationships between these actors is gradual in nature.*

*Proposition 2b: When project network actors assess each other’s responses to critical incidents that occur during project implementation as unacceptable, inter-organizational relationships between these actors deteriorate rapidly.*

*Proposition 2c: The development of the inter-organizational relationship between any two project network actors is interdependent on the development of inter-organizational relationships of these two actors to other project network actors.*

These findings offer support to earlier research that has argued that the development of inter-organizational relationships may be significantly influenced by the relatively short time frame of project implementation (Bengtson et al., 2001; Tähtinen, 2001; Kadefors, 2004). Furthermore, the development of inter-organizational relationships between project networks actors in the project networks alpha, beta, gamma, and delta featured in this study appeared to accurately follow the processual model for IOR development presented by Ring and Van de Ven (1994). More specifically, project network actors continuously assessed the behavior of other project network actors during project implementation, characterized by the occurrence of critical incidents, and the results of these assessments then influenced the development of different dimensions characterizing the inter-organizational relationships.

### **5.3 Characterization of project networks in the Finnish shipbuilding industry**

Four project networks from the Finnish shipbuilding industry were empirically examined for this study. Each of these project networks had been set up for the purpose of delivering a turnkey ship area subproject to the yard and was disbanded after delivery of the finished area. Even though the studied project networks were explicitly limited in the temporal domain, several participating actors expected to continue working with other project network actors in forthcoming projects. This finding is congruent with Hellgren and Stjernberg (1995) and Bengtson et al. (2001) who have argued that project networks are partially reconstructed from one project to the next. Furthermore, in accordance with Eccles (1981), history shared by actors participating in project networks appears to play an important role during the selection of actors to join the network, as experiences from prior projects had, in many cases, affected the composition of the studied network.

The tasks executed during the implementation phase of the life cycle were found to be often highly non-routine in nature, and as a result, often required immediate managerial response. This observation may be partially explained by the nature and characteristics of the shipbuilding industry discussed earlier in section 3.2 and partially by the involvement of multiple organizational actors, linked by complex interdependencies (Pin-

to and Prescott, 1988; Packendorff, 1995). Furthermore, in accordance to Davies (2004) and Brady et al. (2005) the main contractor in each network functioned as a systems integrator, responsible for ensuring that the project was finished on time and according to requirements of the yard. However, an important additional feature that characterized the networks was that yard also played a highly significant role in the supervision and coordination of work by actively taking measures to direct the actions of the main contractor when it considered necessary. On the other hand, the role of the subcontractors in the organization of tasks was found to be quite limited; they occasionally made suggestions to the main contractor regarding the organization of work, which the main contractor then either accepted or rejected. When including all separate deliveries of materials and minor subassemblies, each of the project networks studied encompassed tens if not hundreds of organizations, and in accordance to prior research (Hellgren and Stjernberg, 1995; Jones, 1996) both the main contractors and the subcontractors in the project networks were free to subcontract work further to other organizations as they saw fit, and in this sense, no single actor could alone define the boundaries of the project network or act as a legitimate authority for the network as a whole. Furthermore, the composition of all studied project networks did not remain constant during the implementation phase of the project life cycle even though this study was limited to four core actor. For instance, in project network gamma an actor was removed from the project network by another actor due to difficulties in the completion of work. Finally, in accordance with prior literature (Hellgren and Stjernberg, 1995; Olander and Landin, 2005), power was found to be unevenly distributed in the project networks: while the yard and the main contractor possessed considerable power to influence other network actors, power possessed by the subcontractors was found to be rather limited.

The results of this study showed that two project networks may differ considerably regarding inter-organizational relationships between project network actors. While *on average*, inter-organizational relationships in project networks examined here were characterized by trust, commitment, openness in the sharing of fine-grained information, and high expectations of continuity, each studied network possessed its own distinguishing features in terms of inter-organizational relationships. Prior literature (e.g. Eccles, 1981; Hellgren and Stjernberg, 1995; Hadjikhani, 1996; Bengtson et al., 2001) has



acknowledged the importance of inter-organizational relationships characterized by trust and inter-organizational relationships developed over an extended period of time in project networks, but this study presents novel evidence demonstrating that, in addition to the dimensions of age and trust, several additional dimensions, such as commitment, dependence, and the need to monitor compliance of another actor may differ considerably both *between two project networks* and also *between two inter-organizational relationships* within a single project network. Another observation made during this study was that two of the studied project networks alpha and delta included both established and emerging inter-organizational relationships while in two project networks beta and gamma, inter-organizational relationships were exclusively of the established type.

The results of this study also showed that all four project networks alpha, beta, gamma, and delta were characterized by a distinct profile of both favorable and unfavorable critical incidents that occurred during project implementation. In addition, inter-organizational relationships in the project networks were shown to constitute both weaknesses and strengths in relation to these critical incidents. As such, it was demonstrated that in two project networks alpha and gamma, inter-organizational relationships between project network actors constituted mostly weaknesses that increased the negative contribution of the critical incidents to the efficiency of project implementation, while in the remaining two project networks beta and delta the extent of weaknesses and strengths were close to being even. Based on these observations, inter-organizational relationships were found to both increase, *and* decrease efficiency of project implementation in project networks. However, the ratio of increases to decreases was also found to vary across project networks, indicating that some project networks receive a benefit, in terms of efficiency of project implementation, from their inter-organizational relationships *vis-à-vis* other project networks.

Finally, project networks have been described in earlier literature as dynamic in the sense that the actors participating in one phase of the project life cycle may be different from those participating in another phase of the project life cycle (Hellgren and Stjernberg, 1995). The results of this study demonstrate that project network actors who are not meeting the expectations of other, more powerful, project network actor may sud-

denly find themselves removed from the project network ahead of their scheduled time. Based on this finding, project networks appear somewhat more dynamic in terms of actor composition than discussed in previous literature.

#### **5.4 Theoretical contributions**

##### ***Contribution to literature on the management of a project network***

Answering the calls for more interdisciplinary research on projects (Shenhar and Dvir, 2004; Artto and Wikström, 2005) and for additional research on the management of project networks (Söderlund 2004; Artto and Wikström, 2005) this study offers a number of contributions to existing knowledge. Specifically, this study has added to the body of literature addressing the nature and functioning of project networks. Also, by means of an empirical multiple case study, the present study has described how critical incidents occurring during project implementation constitute a mechanism that links inter-organizational relationships between project network actors with the efficiency of project implementation, and identified several salient characteristics that describe the nature of project networks.

The two constructs *inter-organizational relationships between project network actors*, and *efficiency of project implementation* developed for the present study may be considered as another central contribution of this study. These constructs may aid to direct the attention of academics and practitioners to phenomena and variables found to be central for understanding the functioning of project networks. The construct *inter-organizational relationships between project network actors* provides multidimensional descriptions of inter-organizational relationships between project network actors, while the construct *efficiency of project implementation* (building on transaction cost economics literature), is essentially a tool for measuring ex post transaction costs incurring in project networks. The latter construct complements traditionally adopted measures for efficiency in a project context (cf. Pinto and Mantel, 1990; Shenhar et al., 2001; Dvir and Lecher, 2004) as it directs attention towards ex post transaction costs as important sources of inefficiency in projects. As such, the construct provides an alternative, and in transaction cost terms, a more informative (albeit more laborious) measure for efficiency of project implementation. For example, a mistake committed by a project network

actor in executing a certain task, may, *in addition* to the costs of rework that decrease efficiency, also lead to an increase in the costs of monitoring and/or planning, further reducing the efficiency of project implementation.

A categorization consisting of ten categories unfavorable for the project as a whole and six categories favorable for the project as a whole was developed to elaborate the nature and frequency of different types of critical incidents. The categorization of the critical incidents presented earlier in Table 17 also complements earlier categorizations presented in literature (e.g. Pinto, 2002; Alsakini et al., 2004; Hällgren and Maaninen-Olsson, 2005; Söderholm, 2008), and may prove as a valuable tool for academics and practitioners aiming to understand and overcome frequent challenges related to the implementation phase in project network contexts. In addition, while most existing categorizations do not distinguish between favorable and unfavorable critical incidents, the categorization presented in this study does.

#### ***Contribution to the literature on inter-organizational relationships***

This study offers a few modest contributions to literature addressing the nature and development of inter-organizational relationships. First, consistent with several other studies (e.g. Jarillo, 1988; Parkhe, 1993; Dyer, 1997; Zaheer et al., 1998; Zaghoul and Hartman, 2003; Kadefors, 2004) this study has demonstrated evidence of a link between inter-organizational relationships and the efficiency of economic transactions. Prior to the present study, *reduced need of supervision, learning to work together* (Eccles, 1981), *restricted access, macroculture, social sanctions, and reputation* (Jones et al., 1997) have been presented as mechanisms that, when coupled with long-term IORs, may increase the efficiency of economic transactions in networked contexts. This study highlights the importance of one additional mechanism found to be tightly coupled with IORs in a project network context: *critical incidents that occur during project implementation*. More specifically, critical incidents were found to be related to the efficiency of project implementation, and inter-organizational relationships between project network actors were found to influence the effects that resulted from critical incidents. Another result of this study that may prove to have some value for the study of inter-organizational relationships was the observation that, depending on the characteristics

of inter-organizational relationships between project network actors *and* the content of a specific critical incident that occurred during project implementation, inter-organizational relationships in a project network could constitute either a *strength* or a *weakness*. Thus, for example, an inter-organizational relationship characterized by a high degree of both trust and commitment is neither inherently positive nor negative from a transaction costs point of view, but its influence on efficiency of project implementation is dependent on the content of each specific critical incident it is related to.

As discussed earlier in section 5.2, the development of inter-organizational relationships was found to follow the processual framework presented by Ring and Van de Ven (1994). By following the development of IORs and considering how they were influenced by the critical incidents that occurred during the implementation phase of the project in the four project networks, this study has highlighted how project network actors repeatedly negotiate with other project network actors, make commitments, and execute these commitments. Thus, the findings of this study support the view of Ring and Van de Ven (1994) that the development of IORs is cyclical in nature. In addition, consistent with Bengtson et al. (2001) and Sydow and Staber (2002) long-term inter-organizational relationships that had outlived the duration of several projects were found as frequent in project networks examined in this study.

### ***Other contributions***

Several scholars have criticized the transaction cost economics framework for an exclusive focus on single-party cost minimization. Further, it has been argued that the application of the framework may limit opportunities for joint value maximization by transacting parties (Johanson and Mattsson, 1987; Zajac and Olsen, 1993; Dyer, 1997). The present study has applied TCE logic in a multi-firm context that can be conceptualized as a nexus of *interdependent transactions* between legally separate firms. In this sense, the present study has provided evidence that, consistent with Winch (1989), demonstrates how the domain of application of TCE is not limited to the analysis of individual and independent, dyadic transactions. Several scholars have further criticized the TCE framework for failing to consider how inter-organizational relationships may affect economic transactions (Doz and Prahalad, 1991, Rindfleisch and Heide, 1997; Gulati,

1998). This study has proffered evidence for a relationship between inter-organizational relationships and transaction costs.

One of the main focuses of this study has been on critical incidents occurring during project implementation. Consequently, this study has been able to provide a novel operationalization, adapted to a project network context, of ex post transaction costs. This operationalization, while neglecting transaction costs occurring during routine operations, may help to shed light on the costs of “the unexpected” that occurs in projects. In empirical studies, transaction costs have typically been measured by multiple questionnaire items (see e.g. Leffler and Rucker, 1991; Walker and Poppo, 1991; Sriram et al., 1992; Pilling et al., 1994). The present study has provided an operationalization that may be more applicable in some qualitative studies.

Based on the results of this study, in the Finnish shipbuilding industry, the yard and its first-tier subcontractors can be perceived to constitute a somewhat stable organizational unit, a *quasifirm*, similarly to the conceptualization of the Massachusetts construction industry by Eccles in 1981. In the Finnish shipbuilding industry, many of the relationships between the main contractors and subcontractors were found to be relatively established. However, not all relationships in the studied project networks were long-term in nature. As was the case for Manning and Sydow (2008), who found project networks in the German television industry to include both established and emerging relationships, the studied project networks in the Finnish shipbuilding industry also involved a combination of established and emerging inter-organizational relationships. More specifically, while relationships between the yard and the main contractors were established in all studied project networks, there was a substantial variation in the age of IORs between the main contractors and the subcontractors.

Finally, in this study a variation of the critical incident technique (CIT) was applied to study project networks. Critical incidents that had occurred in the past were identified and documented during interviews with informants representing actors of the studied project networks. Based on the richness of data obtained, CIT (which has already been

proven as versatile technique; see Butterfield et al., 2005) appears to be well suited for studying projects networks involving multiple actors as well.

### **5.5 Managerial implications**

The findings of this study may have value for practitioners employed by project-based firms. First, by demonstrating that inter-organizational relationships have considerable implications for efficiency of project implementation in a project network context, the study emphasizes the importance of developing and maintaining inter-organizational relationships in many of today's project-based industries. Following this reasoning, managers who focus exclusively on meeting the predetermined short-term objectives regarding scope, cost and time, may actually forfeit opportunities for developing inter-organizational relationships with other project network actors – relationships that may actually facilitate the achievement of the former objectives.

Practitioners may also benefit from the characterization of project networks presented in this study. A manager who is aware of how, for example, the goals of two actors participating to a project network are in conflict, or that the inter-organizational relationship between these two actors has just recently been established and is not characterized by a high degree of trust, is in an advantageous position to act in a project network as opposed to another manager who does not have this information. Similarly, a manager who is aware of the both the salient characteristics and functioning of project networks may be able to identify opportunities to exploit this knowledge by, for example, increasing the power of the firm she is employed by via the development of an inter-organizational relationship characterized by sharing of fine-grained information and trust to an actor that has a central in the project network.

Furthermore, this study has provided a categorization (see section 4.1.1) of critical incidents that occur frequently and reduce the efficiency of implementation of turnkey ship area subprojects delivered in the Finnish shipbuilding industry. This categorization should function as a valuable tool for managers employed by the Finnish shipbuilding industry, as it can be used to facilitate both the identification and mitigation of frequently occurring unfavorable critical incidents. The assumption here is that an individual

who is aware of the nature of problems threatening the efficiency of the project she is managing, is in a stronger position to respond to these challenges in a proactive rather than reactive manner. It should be duly noted that the empirical evidence for this study was collected exclusively from the Finnish shipbuilding industry. Therefore, it is unclear to what extent the categorization of critical incidents might be applicable in contexts of other project-based industries such as construction, television production, and fashion. As a result, managers should use caution when applying the categorization outside the context in which the present study was conducted.

Finally, the results of this study stress the risks related to short-term optimization and resorting to opportunistic behavior in an environment where actors are interconnected with strong inter-organizational relationships. As demonstrated in one of the four project networks examined in this study, when project network actors deem the behavior of another project networks to be unacceptable, inter-organizational relationships, which might have taken years or even decades, and a considerable amount of resources to build, can deteriorate rapidly. Following this reasoning, the project manager, ultimately responsible for interacting with other project network actors may be held accountable for both the favorable and the unfavorable developments in inter-organizational relationships. Or, to paraphrase: in addition to managing the project, the project manager may be able to either strengthen or weaken the relational position of the firm he is employed by. This highlights the strategic importance of the management of project networks in project-based industries. The construct *inter-organizational relationships between project network actors* developed for this study may help managers in the challenging task of assessing the current state of inter-organizational relationships to other project network actors, and consequently planning actions necessary for further development of these IORs.

## **5.6 Evaluation of the present study**

As previously noted (see section 3.1) this study can be characterized as a mainly qualitative multiple case study that seeks to answer two research questions both descriptive and explanatory in their nature. As such, the quality of the present study can be evaluated with criteria presented by Yin (1994). More specifically, the quality of research

design may be evaluated by focusing on whether different tactics might have been used to increase the reliability and validity of the study. These tactics are categorized into four general areas: construct validity, internal validity, external validity, and reliability.

### ***Construct validity***

Evaluating construct validity involves assessing whether correct operational measures have been established for the concepts being studied (Yin, 1994). Measures used in case studies have often been criticized for a lack of objectivity (ibid.). While the author does not argue that the two constructs used in this study are free of subjective judgment, multiple tactics were used to increase the validity of the constructs. First, both constructs are based on a rather extensive review of existing literature, including an evaluation of existing related constructs (see Chapter 2). Thus, the literature review can be considered to lay the theoretical foundation for the development of the constructs. Second, multiple sources of evidence were used in the data collection phase of the research process. More specifically, empirical evidence was obtained from 22 informants, and, in addition, various types of documentation were used to complement interview data (see section 3.6). Third, a chain of evidence was established to increase the transparency of data collection and subsequent analysis (see section 3.7 and Appendixes A and B). Fourth, informants were provided several opportunities to review and comment on the research results that relied on the two constructs, ensuring both their clarity and practical validity (see section 3.6). As this study was mainly a qualitative one, it was not practical to use any quantitative technique such as factor analysis to collapse multiple variables into a single construct measure (Eisenhardt, 1989). Instead, tables were used to summarize and tabulate evidence underlying each construct (Miles and Huberman, 1994). Finally, it needs to be noted here, that the two constructs should not be employed in quantitative studies without the appropriate additional analysis<sup>90</sup> concerning their validity and operationalization (see e.g. Venkatraman and Grant, 1986). In particular, prior to utilizing the construct *inter-organizational relationships between project network actors* in any qualitative study, the questions posed earlier in section 2.3.2 concerning both the explicit

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<sup>90</sup> Typical considerations include (but are not limited to) Cronbach's alpha, correlation analysis & exploratory factor analysis



definitions and potential interrelatedness of the nine dimensions included in the construct should be addressed.

### ***Internal validity***

Assessing the internal validity of a qualitative study concerns how inferences concerning causal relationships between variables or constructs of interest have been established. As this study attempts to provide answers to research questions that are explanatory and descriptive in nature, the importance of ensuring acceptable internal validity is considerable. The logic of drawing causal inferences that connect the two constructs was discussed earlier (see section 3.7). To summarize, inferences made concerning relations between the two constructs were based *primarily* on interviews in which the 22 informants described 197 critical incidents, the *reasons* that, according to their understanding, led to these incidents, and the *outcomes*, again according to their understanding, resulted from these critical incidents. However, it is important to note that when the interview transcripts were analyzed, the author had to rely on a degree of judgment when coding the critical incidents. More specifically, phenomena described by the informants were always considered in the context of what other informants had described; additionally, it was illustrated by the various kinds of documentation obtained for this study. As a result, it was unavoidable that drawing causal inferences, despite considerable effort to describe the process as transparently as possible (see section 3.7), was to a considerable degree a subjective process. In Yin's (1994) terms the tactics of *pattern matching* and *time-series-analysis* were used to further increase internal validity of the present study. The former refers to comparing the pattern of empirical results with a predicted one; the latter refers to considering the sequence of empirical observations. As the empirical evidence for this study was collected with two rounds of interviews, typically six months apart, a consideration of how results obtained from the second round of interviews could be partially explained with results obtained from the first round, was included in data analysis.

### ***External validity***

External validity concerns the degree to which the results of a study can be generalized outside of the observed context. The empirical evidence for this study was collected from four project networks in the Finnish shipbuilding industry. As discussed earlier (see section 3.3), theoretical sampling logic was followed in the selection of cases (Yin, 1994). As a consequence, statistical generalizability outside the observed context cannot be claimed. However, the results of the present study discussed earlier were rather consistent across the observed cases, implying that they may have some potential for generalization outside the observed context. Based on the results of this study, the author expects that inter-organizational relationships between project networks will influence the efficiency of project implementation in any project-based industry in which project networks represent the predominant form for organizing production. Furthermore, the author predicts that critical incidents occurring during project implementation will affect the development of inter-organizational relationships between project network actors in any project-based industry in which project networks represent the predominant form for organizing production. Additional research is required to determine whether this generalization to theory will hold or not.

### ***Reliability***

Assessing the reliability of a study concerns evaluating whether the study could be repeated by other investigators, and whether they would come to the same conclusions (Yin, 1994). To increase the transparency, and as a result, reliability of this study, the logic for selecting the cases, organizations, and informants was discussed earlier (see sections 3.3, 3.4, and 0). As the four project networks featured in the present study were obtained on voluntary basis, it is likely that the sample of organizations and informants suffers from a degree of respondent bias (Kumar et al., 1993). This is a common problem affecting most organizational research. As no informant representing any of the four project networks declined to participate in this study, the effect of non-response bias may be considered to be tolerable. Further, all informants were also open to discussing the phenomena of interest, which indicates that the empirical evidence obtained was both rich in detail and accurately reflected the views held by the informants. Multiple informants were interviewed to study each project network, which increased relia-

bility, in contrast to an approach that relies on data obtained from a single informant (Golden, 1992; Kumar et al., 1993). The research interviews were conducted by two researchers and, as no salient differences in their structure could be observed, data are arguably reliable to an acceptable degree. The use of multiple investigators and standardized interview guides (see Appendixes A and B) can be expected to have further increased the reliability of the findings of this study (Eisenhardt, 1989).

The variation of the critical incident technique employed in this study (see section 3.6.3) has some implications for the reliability of the results of the present study. When carrying out the interviews, it became evident that it was not equally easy for all informants to recall past critical incidents. More specifically, some informants could identify and describe up to ten different critical incidents during an interview, while some informants could only identify and describe two at most. This limitation of the method discussed earlier (see section 3.6.3, in particular, Figure 13) may have unfavorably contributed the reliability of results. Furthermore, the categorization of critical incidents discussed in sections 3.7.2 and 4.1.1 was a partially subjective process. It is possible that a categorization structure developed by another researcher based on the content of the critical incidents identified would not have been identical to the structure developed during this study. In addition, despite every attempt to explicitly describe the logic followed when categorizing each of the 197 critical incidents into one or several of the sixteen categories included in the categorization structure, the categorization process was partially subjective.

Another identified limitation affecting the reliability of findings of this study is related to the selection of organizations that represent a project network. As discussed earlier (see section 3.4) a project network responsible for delivering a turnkey ship area subproject can include more than a hundred organizational actors when actors with a minor role are included. For obvious practical reasons, several hundreds of personal interviews could not be carried out for this study. Based on the high consistency of obtained results within each of the studied case project networks, it appears that limiting to the four core organizational actors per project network was sufficient to achieve results of acceptable reliability.

### ***Limitations and other considerations***

This study is limited in several respects, many of which have already been discussed (see section 1.2). The present study focuses exclusively on inter-firm projects and the implementation phase of the project life cycle. Furthermore, all empirical evidence was collected from one specific industry, namely the Finnish shipbuilding industry. Finally, the literature review was nearly exclusively limited to literature on project business, inter-organizational relationships, transaction cost economics, and critical incidents. These limitations, while necessary to keep this study manageable, severely narrow the domain over which the results of this study can be applied.

As discussed earlier (see Chapter 4) one of the four project networks studied turned out to be relatively unsuccessful, while the remaining three were categorized as relatively successful. The fact that one of the cases turned out as a *polar case* highlights the partially unforeseeable, even exciting nature of empirical case studies (Eisenhardt, 1989). Retrospectively thinking, without this one clearly distinguishable case, the conclusions regarding how inter-organizational relationships may deteriorate as a result of critical incidents occurring during the implementation phase of a project could not have been drawn.

### **5.7 Directions for future research**

While this study has extended our knowledge of the relation between inter-organizational relationships between project network actors and the efficiency of project implementation, several questions still remain unanswered. First, this study did not clarify why in two of the studied project networks inter-organizational relationships between project network actors constituted *both* weaknesses, which contributed negatively to efficiency, and strengths, that contributed favorably to efficiency, while IORs in the remaining two project networks constituted almost exclusively weaknesses. A further study would be required to clarify whether this difference could be explained by contextual factors, interdependence between two or more dimensions of IORs, or by something else. Second, future studies could direct attention towards identifying and describing additional mechanisms that may link together inter-organizational relationships between project network actors and the functioning and efficiency of project networks.

Eloranta (2007) and Artto et al. (2008) have discussed how IORs between project network actors may function as sources of risk. An additional study focusing on how IORs between project network actors may affect transaction costs incurred during routine activities (as opposed to critical incidents) could also lead to important insights. Third, the results of this study highlighted the dynamic nature of project networks. For example, in project network gamma, one of the participating actors was replaced with another actor in the midst of the implementation phase of the project life cycle. A further empirical study could examine how and why organizational actors are removed and joined to project networks during different stages of the project life cycle, and determine to what extent these changes can be explained by inter-organizational relationships between involved actors. For example, one might expect that if a project network actor needs to be replaced with another actor, inter-organizational relationships may play a significant role in the selection of the substitutive actor. Fourth, as the project networks observed in this study were limited to four actors per studied project network, a future study could examine a single project network, but empirically observe as many participating actors as possible – also including more peripheral actors with minor (expected) contributions for the project as a whole. The results of such a study would provide information that could be used as a basis for assessing how accurately information collected from a limited number of core actors may be generalized to represent a wider (in terms of actors) project network. Further, in a study involving tens or hundreds of project network actors, network level variables which were not used in this study such as density, cohesion, and centrality could possess considerable explanatory power<sup>91</sup>. Finally, additional work directed towards describing the different roles that may be adopted by project network actors is still required. In addition to the central role of a systems integrator discussed in earlier research (Davies, 2004; Brady, Davies, and Gann, 2005; Hobday, Davies, and Prencipe, 2005), the present study highlighted the importance of the owner in coordinating the work of the main contractors which functioned as systems integrators in the studied project networks. Future research could aim to identify and describe additional roles that individual project network actors may contribute with.

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<sup>91</sup> For additional information concerning the use of these variables, see for example, Reagans & McEvily (2003) and Jones et al. (1997)

While this study has highlighted the importance of critical incidents in a project network context, several issues related to critical incidents remain unexplored. First, as discussed earlier, critical incidents may be causally related to other critical incidents and as a result, form patterns of consequent incidents. Focusing empirical research on identifying and describing such patterns could yield substantial findings. Second, while the results of this study portray critical incidents in a rather negative light, it is likely that critical incidents may also lead to favorable long-term outcomes which were not explored in this study. For example, while the immediate effects of critical incidents identified in the present study leading to a reduction in ex post transaction costs were few in number (see section 4.1.3), it is possible that some of these incidents may have resulted in favorable long-term effects relating to, for example, innovation and organizational learning. Third, it is possible that the outcome of a critical incident may be dependent on how one or several project network actors respond to it. In this sense, a critical incident leading to an increase in ex post transaction costs might simultaneously provide an opportunity for a project network actor to increase its credibility by demonstrating to other actors that it can overcome challenging situations that arise during the project. Thus, an empirical study could focus on describing the tactics used by project network actors to respond to various kinds of critical incidents. Fourth, as earlier discussed, the relative importance of critical incidents is often difficult to evaluate (Stauss and Weinlich, 1997). While this study has provided some additional knowledge concerning the effects of critical incidents on the efficiency of project implementation, it did not consider how evenly, or unevenly the burden of these transaction costs is carried by different project network actors.

This study demonstrated that project networks differ considerably in terms of inter-organizational relationships between participating actors. For example, project network beta was characterized by established relationships and a high degree of dependence, while relationships in project network delta, in general, were less established. As three project networks characterized by different kinds of IORs were relatively successful in project implementation, one could ask what the importance of IORs for predicting project success? Based on the findings of the present study, IORs do have some relation to project success, as they were shown to affect transaction costs incurred during project

implementation. In addition, large projects often include actors based in more than one country. Several studies have discussed the challenges related to large international projects (Orr 2005; Orr and Scott, 2008; Ruuska et al. 2009), but additional research is still required to understand the efficiency-implications of operating in a project network that is composed of an international ‘team’ of actors. Further research would also be required to clarify the role of different dimensions were used to describe IORs in this study (such as trust and commitment) in different circumstances. A separate study could attempt to provide clear definitions for the nine dimensions used in this study, either by means of a literature review or by interviewing practitioners who are actively engaged in the development of IORs. In any case, providing more explicit definitions for the dimensions and is a necessity prior to the application of the construct developed here in any quantitative study.

While this study has placed considerable emphasis on transaction costs in project networks, it has completely excluded the *costs of production*. According to the transaction cost economics framework, firms economize on the sum of transaction costs and production costs (Williamson, 1979). The present study has not examined how inter-organizational relationships might affect production costs, and if these two concepts are related, whether critical incidents play any role in this relation.

The author considers that in addition to the research approach adopted in this study, additional research strategies would have potential to bring novel and complementary insights into our knowledge of efficiency in project network contexts. For example, a combination of soft systems thinking and action research (see e.g. Sankaran, Tay, and Orr, 2008) could lead to the identification and description of many additional mechanisms that are of importance to organizations participating in project networks.

By concentrating on the literature on projects and their management, inter-organizational relationships, transaction cost economics, and critical incidents, this study has excluded many fine bodies of literature that are likely to have considerable potential for providing additional insight to our knowledge of project networks. Several

of these were mentioned earlier (see Chapter 2). Finally, the generalizability of findings obtained in this study outside the research context remains to be explored.



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## APPENDIX A      INTERVIEW GUIDE FOR PHASE ONE – INTER- ORGANIZATIONAL RELATIONSHIPS BETWEEN PROJECT NETWORK ACTORS

In the first phase of each interview, inter-organizational relationships between the organization represented by the informant and other organizations in the studied project network were discussed. The phase was further separated into two parts, a qualitative, and a quantitative one. The content of the interview guide is based on the construct *inter-organizational relationships between project network actors* developed in section 2.3.2.

### *Qualitative part: semi-structured discussion of IORs in project network*

In this part, the following factors related to the IORs were discussed in order to obtain a rich and holistic description of the history, current state and future plans related to the IORs:

- ❖ Duration of collaboration, previous projects with other actors in the project network (**is the relationship established or emerging, measures dimension: length (duration)<sup>92</sup>**)
- ❖ Resources and capabilities of other actors in the project network
- ❖ Plans or strategies regarding the other actors in the project network
- ❖ Why the other actors in the project network were selected for the current project (when applicable)?
- ❖ How inter-organizational relationships have evolved during the course of last year?
- ❖ Have there been any mutual development activities with other actors in the project network during last 6 months?

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<sup>92</sup> 'Length (duration)' was the only dimension of the construct *inter-organizational relationships in project network* measured in the qualitative phase of the interview. All 8 remaining dimensions were measured in the following quantitative phase (see following page).

- ❖ Are responsibilities clearly divided between the actors in the project network?

The following quote (translated from Finnish by the author) presents a typical example in which the informant discusses the length and history of collaboration with another project network actor:

*“Our collaboration with (...) goes ages back to the 90’s and, actually even beyond that. In turnkey ship area deliveries our first project together was in 1995 and we have collaborated in practically all projects delivered after that. Overall, I would estimate that we have worked on about 20 projects together ... These projects include also projects delivered to other customers than the yard.”*

***Quantitative part: structured description of IORs in project network***

In addition to the qualitative description of the IORs, informants were asked to describe the IORs with respect to the following eight dimensions included in the construct *inter-organizational relationships between project network actors* developed in section 2.3.2. A 7-point Likert-type scale ranging from (1) “nonexistent” to (7) “very high” was used.

**Measurement of inter-organizational relationships between project network actors**

Dimension	Non-	mod-		very			
	existent	erate	erate	high	high	high	
	1	2	3	4	5	6	7
<b>1 Trust</b>							
“Degree of trust towards project network actor X”							
<b>2 Commitment</b>							
“Willingness for mutual development activities with project network actor X”							
<b>3 Opportunism</b>							
“Readiness to pursue own interests at the expense of interests of project network actor X”							
<b>4 Dependence</b>							
“Degree of dependence on project network actor X”							
<b>5 Monitoring need</b>							
“Degree of monitoring the progress of project network actor X’s work”							
<b>6 Transfer of fine-grained information</b>							
“Degree of sharing business critical and confidential information with project network actor X”							



**7 Strength of inter-personal relationships**

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“Strength of inter-personal relationships between individuals representing your organization and individuals representing project network actor X”							
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**8 Expectation of continuity**

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“The likelihood of collaboration with project network actor X after the completion of the current project”							
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During the quantitative description of the IORs, the informants had also the opportunity to provide reasoning for the values chosen. Often, after selecting a very low or a very high value for a specific dimension, the informant chose to provide additional details that were recorded and used in consequent analysis. The following example highlights a typical example of how additional information was provided by an informant:

(informant, after rating the need to monitor work of another project network actor as 4 on the scale ranging from 1 to 7): *“We have to be involved with their work at some degree. In my opinion, it was a surprise that they had some quality issues that needed to be dealt with. Especially, the difficulties with welding... But, I want to emphasize here that their workers are really skilled individuals and these problems have been related to lack of communication, not to lack of knowledge.”*

**APPENDIX B      INTERVIEW GUIDE FOR PHASE TWO – CRITICAL INCIDENTS OCCURRING DURING PROJECT IMPLEMENTATION**

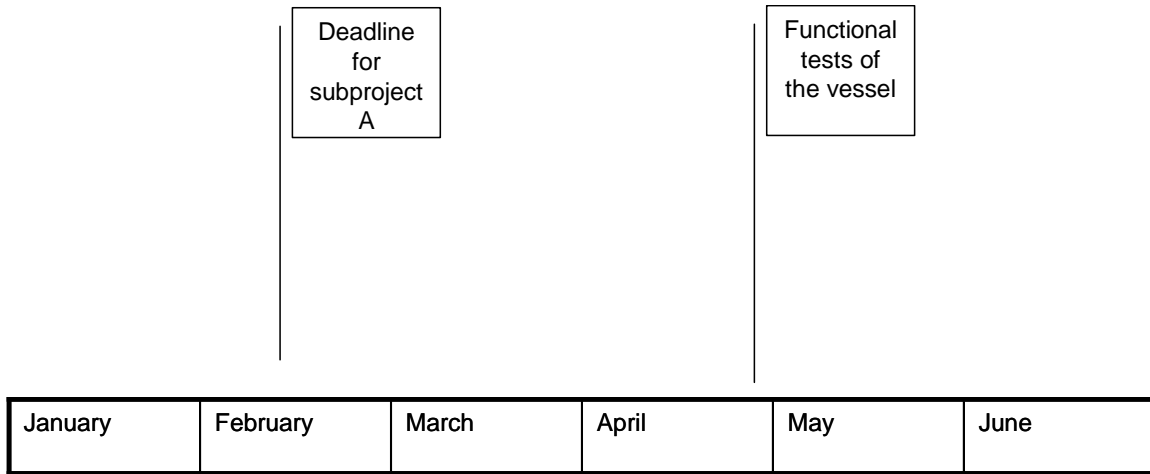
In the beginning of phase two of the interview, the informant was first introduced to the concept of a *critical incident*. A critical incident was defined as “*any highly significant event (from the viewpoint of the informant) that occurred during the implementation phase of the project and was either favorable or unfavorable for the project as a whole.*” After this definition a few examples of incidents which *might occur* in a project context were discussed and if the concept of a critical incident still remained unclear, the informant was provided the possibility to ask further questions. It was emphasized that the *informant* decides which event is critical and which is not.

The following structure (see Table below) for discussing and documenting **each** critical incident was then presented and a printed copy of it was handed out to the informant so that it would be easily available for the entire duration of the second interview phase:

**Table – The documentation of critical incidents (handed out to the interviewee)**

<b>Time of critical incident</b>	<b>Description of critical incident</b>	<b>Reason for critical incident</b>	<b>Result of the critical incident</b>
(when did the critical incident happen, what was the duration of critical incident)	(what happened)	(the reason or reasons leading to the critical incident)	(what did the critical incident result in, if known)

In addition, to further facilitate recalling past critical incidents, a printed copy of a timeline illustrating the last six months was also handed out to the informant. A few sample events (*not considered as critical incidents*) were marked from project documentation obtained by prior to the interview date. Figure below illustrates a typical timeline handed out to the informant.



**Figure - Example of timeline handed out to the interviewee to facilitate the process of identifying and describing critical incident**

**APPENDIX C      QUANTITATIVE DESCRIPTION OF TWELVE INTER-  
ORGANIZATIONAL RELATIONSHIPS (A-L) IN FOUR PROJECT NET-  
WORKS (ALPHA, BETA, GAMMA, DELTA)**

As discussed in section 4.1.2, due to the highly sensitive nature of information, the identities of the twelve relationships, in terms of which of the four studied project networks (alpha, beta, gamma, and delta) they belonged to, cannot be disclosed.

Legend:

L= Low (1-2.5), LM= Low to moderate (2.6-3.5), M= Moderate (3.6-4.5), MH= Moderate to high (4.6-5.4), H= High (5.5-7.0), NA= Not available. In age: ES= established relationship, EM= emerging relationship.

Relation-ship	A		B		C		D		E		F		G		H		I		J		K		L	
Interview round	1	2	1	2	1	2	1	1	1	2	2	1	1	2	1	2	1	2	1	2	1	2	1	2
Age (duration)	EM	EM	ES	ES	ES	ES	EM	EM	ES	ES	EM	EM	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
Trust	MH	L	M	H	MH	MH	H	MH	H	M	M	M	L	H	MH	NA	NA	H	H	LM	L	MH	LM	
Opportunism	M	MH	H	H	MH	LM	M	M	M	MH	MH	H	LM	H	H	MH	NA	NA	M	M	M	H	L	H
Commitment	H	M	H	H	H	M	H	H	H	H	MH	M	M	L	H	H	NA	NA	H	MH	MH	M	H	M
Dependence	L	L	M	H	MH	H	LM	LM	H	MH	L	L	LM	L	MH	M	NA	NA	LM	LM	H	L	LM	L
Monitoring need	M	H	H	H	H	MH	LM	H	MH	MH	M	MH	M	H	MH	M	NA	NA	LM	M	H	H	MH	H
Transfer of fine-grained information	MH	M	H	M	MH	H	MH	MH	MH	MH	L	LM	MH	M	LM	M	NA	NA	M	M	LM	L	H	M
Strength of inter-personal relationships	H	M	H	MH	H	H	LM	MH	MH	H	LM	LM	H	NA	MH	MH	NA	NA	M	MH	MH	M	MH	MH
Expectation of continuity	MH	L	H	H	H	H	M	MH	H	H	MH	H	H	L	MH	H	NA	NA	LM	H	NA	L	H	LM

Grayed rectangle denotes *substantial negative* development in dimension between two interview rounds. Rectangle with white inner area (no line between interview rounds 1 & 2) denotes *substantial positive* development in dimension between two interview rounds.

A change in excess of one scale, e.g. from “Low” to “Moderate” or from “Low to moderate” to “Moderate to High” is considered *as substantial* and a change equal to or less than one scale as *minor*. Further, *increases* in the following dimensions: trust, commitment, dependence, transfer of fine-grained information, strength of inter-personal relationships, and expectation of continuity, and *decreases* in the following dimensions: opportunism, and monitoring need, are considered as *positive*, and changes in the opposite direction as *negative*. Finally, *deterioration* of a relationship is defined as substantial negative development in two or more dimensions and no substantial positive development in the remaining dimensions describing a specific relationship.

Note that inter-organizational relationship “I” was not quantitatively described by the informants. The decision not to do so was based on the shared ownership of the involved actors.

**APPENDIX D      RELATEDNESS OF INTER-ORGANIZATIONAL RELATIONSHIPS BETWEEN PROJECT NETWORK ACTORS AND CRITICAL INCIDENTS OCCURRING DURING PROJECT IMPLEMENTATION**

Category	Categorized incidents related to a strength in IORs between project network actors		Categorized incidents related to a weakness in IORs between project network actors	
	N	%	N	%
Mistake or quality problem	3	16	3	16
Failure to react to emerging problem	1	6	8	50
Making a demand	3	13	9	39
Incompatibility of processes	0	0	13	81
Failure to keep schedule	2	4	5	10
Lack of management capability	3	6	18	38
Lack of materials	3	16	11	58
Lack of personnel	2	8	5	19
Deviation from project plan	3	18	3	18
Argument	2	11	13	72
<b>Total</b>	<b>22</b>		<b>88</b>	
Development activity	4	33	0	0
Solving a problem	5	42	1	8
Flexibility towards another actor	7	88	0	0
Benefit from inter-organizational relationship	6	86	0	0
Exceeding expectations	11	61	0	0
Transfer of fine-grained information	5	36	4	29
<b>Total</b>	<b>38</b>		<b>5</b>	
<b>Total categorized critical incidents related to inter-organizational relationships between project network actors</b>	<b>60</b>		<b>93</b>	

**APPENDIX E      RELATEDNESS OF CRITICAL INCIDENTS OCCURRING  
DURING PROJECT IMPLEMENTATION AND EFFICIENCY OF PROJECT  
IMPLEMENTATION**

	Increase in the costs of monitor- ing transac- tions	Decrease the costs of moni- toring transac- tions	Increase in the costs of planning transac- tions	Decrease in the costs of planning transac- tions	Increase in the costs of adapting transac- tions
<b>Category</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>
Mistake or quality problem	6	0	12	0	1
Failure to react to emerging problem	9	0	7	0	0
Making a demand	7	0	9	0	3
Incompatibility of processes	3	0	10	0	6
Failure to keep schedule	21	0	39	0	3
Lack of management capability	18	0	32	0	2
Lack of materials	8	0	15	0	3
Lack of personnel	8	0	14	0	1
Deviation from project plan	3	0	11	0	1
Argument	3	0	5	0	0
Development activity	2	1	5	1	1
Solving a problem	2	2	7	0	2
Flexibility towards another actor	0	2	3	0	2
Benefit from inter-organizational relation- ship	0	1	2	1	0
Exceeding expectations	1	3	2	1	2
Transfer of fine-grained information	2	0	2	2	1
<b>SUM</b>	<b>93</b>	<b>9</b>	<b>175</b>	<b>5</b>	<b>28</b>



	Increase (or decrease) in the costs of monitoring transactions	Increase (or decrease) in the costs of planning transactions	Increase in the costs of adapting transactions
<b>Category</b>	<b>%</b>	<b>%</b>	<b>%</b>
Mistake or quality problem	32	63	5
Failure to react to emerging problem	56	44	0
Making a demand	30	39	13
Incompatibility of processes	19	63	38
Failure to keep schedule	44	81	6
Lack of management capability	38	68	4
Lack of materials	42	79	16
Lack of personnel	31	54	4
Deviation from project plan	18	65	6
Argument	17	28	0
Development activity	8	33	8
Solving a problem	0	58	17
Flexibility towards another actor	(25)	38	25
Benefit from inter-organizational relationship	(14)	14	0
Exceeding expectations	(11)	6	11
Transfer of fine-grained information	14	0	7

	Percentage of critical incidents related to inter-organizational relationships between project network actors	Percentage of all identified effects on transaction costs resulting from critical incidents related to inter-organizational relationships between project network actors
<b>Category</b>	<b>%</b>	<b>%</b>
Mistake or quality problem	32	37
Failure to react to emerging problem	56	56
Making a demand	52	47
Incompatibility of processes	81	74
Failure to keep schedule	15	17
Lack of management capability	45	37
Lack of materials	74	77
Lack of personnel	27	35
Deviation from project plan	35	47
Argument	83	75
Development activity	33	40
Solving a problem	50	38
Flexibility towards another actor	88	100
Benefit from inter-organizational relationship	86	50
Exceeding expectations	61	33
Transfer of fine-grained information	64	86

**APPENDIX F      CRITICAL INCIDENTS RELATED BOTH TO INTER-  
ORGANIZATIONAL RELATIONSHIPS BETWEEN PROJECT NETWORK  
ACTORS AND EFFICIENCY OF PROJECT IMPLEMENTATION**

	Amount of critical incidents related to strengths in inter-organizational relationships between project network actors	Amount of critical incidents related to weaknesses in inter-organizational relationships between project network actors
<b>Category</b>	<b>N</b>	<b>N</b>
Mistake or quality problem	3	2
Failure to react to emerging problem	1	6
Making a demand	2	6
Incompatibility of processes	0	10
Failure to keep schedule	2	5
Lack of management capability	2	13
Lack of materials	2	11
Lack of personnel	2	4
Deviation from project plan	3	2
Argument	1	4
<b>SUM</b>	<b>18</b>	<b>63</b>
Development activity	3	0
Solving a problem	3	1
Flexibility towards another actor	6	0
Benefit from inter-organizational relationship	2	0
Exceeding expectations	2	0
Transfer of fine-grained information	3	2
<b>SUM</b>	<b>19</b>	<b>3</b>
<b>TOTAL</b>	<b>37</b>	<b>66</b>

	<b>Increase in the costs of moni- toring transac- tions</b>	<b>De- crease the costs of moni- toring transac- tions</b>	<b>Increase in the costs of plan- ning transac- tions</b>	<b>De- crease in the costs of plan- ning transac- tions</b>	<b>Increase in the costs of adapt- ing transac- tions</b>
<b>Category</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>	<b>N</b>
Mistake or quality problem	3	0	4	0	0
Failure to react to emerging problem	4	0	5	0	0
Making a demand	3	0	4	0	2
Incompatibility of processes	3	0	7	0	4
Failure to keep schedule	4	0	7	0	0
Lack of management capability	7	0	12	0	0
Lack of materials	7	0	11	0	2
Lack of personnel	3	0	5	0	0
Deviation from project plan	1	0	5	0	1
Argument	3	0	3	0	0
Development activity	0	1	2	0	1
Solving a problem	1	0	3	0	1
Flexibility towards another actor	0	2	3	0	2
Benefit from inter-organizational relation- ship	0	0	1	1	0
Exceeding expectations	0	1	1	0	1
Transfer of fine-grained information	1	0	2	2	1
<b>SUM</b>	<b>40</b>	<b>4</b>	<b>75</b>	<b>3</b>	<b>15</b>

## APPENDIX G      CRITICAL INCIDENTS IDENTIFIED AND DOCUMENTED IN STUDIED FOUR PROJECT NETWORKS

### Project network alpha

#### Number of critical incidents identified and documented during the interviews

	N
1 <sup>st</sup> interview round	23
2 <sup>nd</sup> interview round	17
<b>Total</b>	<b>40</b>

#### Categorization of critical incidents

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
<b>Unfavorable</b>				
Mistake or quality problem	1	3	0	0
Failure to react to emerging problem	0	0	3	10
Making a demand	1	3	1	3
Incompatibility of processes	1	3	2	7
Failure to keep schedule	10	29	2	7
Lack of management capability	9	26	8	28
Lack of materials	4	12	2	7
Lack of personnel	0	0	1	3
Deviation from project plan	2	6	0	0
Argument	1	3	4	14
<b>Total</b>	<b>29</b>	<b>85</b>	<b>23</b>	<b>79</b>
<b>Favorable</b>				
	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Development activity	0	0	1	3
Solving a problem	1	3	0	0
Flexibility towards another actor	0	0	1	3
Benefit from inter-organizational relationship	0	0	0	0
Exceeding expectations	4	12	2	7
Transfer of fine-grained information	0	0	2	7
<b>Total</b>	<b>5</b>	<b>15</b>	<b>6</b>	<b>21</b>

## Project network beta

### Number of critical incidents identified and documented during the interviews

	N
1 <sup>st</sup> interview round	17
2 <sup>nd</sup> interview round	19
<b>Total</b>	<b>36</b>

### Categorization of critical incidents

#### Unfavorable

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Mistake or quality problem	2	6	7	22
Failure to react to emerging problem	0	0	0	0
Making a demand	2	6	0	0
Incompatibility of processes	1	3	4	13
Failure to keep schedule	5	16	5	16
Lack of management capability	3	9	7	22
Lack of materials	0	0	2	6
Lack of personnel	3	9	2	6
Deviation from project plan	3	9	2	6
Argument	1	3	0	0
<b>Total</b>	<b>20</b>	<b>63</b>	<b>29</b>	<b>91</b>

#### Favorable

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Development activity	1	3	1	3
Solving a problem	0	0	0	0
Flexibility towards another actor	2	6	0	0
Benefit from inter-organizational relationship	3	9	0	0
Exceeding expectations	3	9	1	3
Transfer of fine-grained information	3	9	1	3
<b>Total</b>	<b>12</b>	<b>38</b>	<b>3</b>	<b>9</b>

## Project network gamma

### Number of critical incidents identified and documented during the interviews

	N
1 <sup>st</sup> interview round	42
2 <sup>nd</sup> interview round	18
<b>Total</b>	<b>60</b>

### Categorization of critical incidents

#### Unfavorable

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Mistake or quality problem	4	6	0	0
Failure to react to emerging problem	3	5	5	13
Making a demand	5	8	5	13
Incompatibility of processes	4	6	0	0
Failure to keep schedule	10	15	5	13
Lack of management capability	10	15	5	13
Lack of materials	3	5	5	13
Lack of personnel	4	6	3	8
Deviation from project plan	2	3	1	3
Argument	3	5	2	5
<b>Total</b>	<b>48</b>	<b>73</b>	<b>31</b>	<b>78</b>

#### Favorable

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Development activity	2	3	3	8
Solving a problem	4	6	3	8
Flexibility towards another actor	3	5	0	0
Benefit from inter-organizational relationship	3	5	0	0
Exceeding expectations	3	5	1	3
Transfer of fine-grained information	3	5	2	5
<b>Total</b>	<b>18</b>	<b>27</b>	<b>9</b>	<b>23</b>

## Project network delta

### Number of critical incidents identified and documented during the interviews

	N
1 <sup>st</sup> interview round	24
2 <sup>nd</sup> interview round	37
<b>Total</b>	<b>61</b>

### Categorization of critical incidents

#### Unfavorable

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Mistake or quality problem	4	13	1	2
Failure to react to emerging problem	1	3	4	7
Making a demand	3	9	6	11
Incompatibility of processes	1	3	3	5
Failure to keep schedule	5	16	6	11
Lack of management capability	1	3	4	7
Lack of materials	0	0	3	5
Lack of personnel	3	9	10	18
Deviation from project plan	4	13	3	5
Argument	5	16	2	4
<b>Total</b>	<b>27</b>	<b>84</b>	<b>42</b>	<b>76</b>

#### Favorable

	1 <sup>st</sup> interview round		2 <sup>nd</sup> interview round	
	N	%	N	%
Development activity	1	3	3	5
Solving a problem	1	3	3	5
Flexibility towards another actor	1	3	1	2
Benefit from inter-organizational relationship	0	0	1	2
Exceeding expectations	1	3	3	5
Transfer of fine-grained information	1	3	2	4
<b>Total</b>	<b>5</b>	<b>16</b>	<b>13</b>	<b>24</b>