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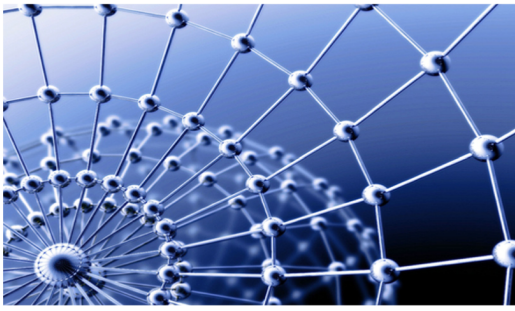
Trust-Related Network Collaboration - Difficulties, Potential and Paradoxes



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Trust-Related Network Collaboration – Difficulties, Potential and Paradoxes

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ABSTRACT

This report describes two explorative studies conducted on this research project: (1) Trust related network collaboration in purchase functions in a maritime industry network and (2) Maritime industry network collaboration. These surveys took place at the end of 2009 and at the beginning of 2010.

The object of this research was to explore the nature of Finnish maritime industry network collaboration and further to identify the other research topics in the maritime network. A sample of 392 organizations from the Finnish shipyard cluster database was surveyed. An Internet-based survey was administered by Tampere University of Technology and conducted by the company Yoso Oy. The effective response rate was approximately 12.0 percent. This report presents the results of the survey. At the end of the report some conclusions are drawn. Suggestions for further research will be published in the form of a research funding application to TEKES.

Based on this two-step survey research, several relevant research questions on the field of Finnish maritime industry network were formulated. The topics concern for example, the *competitiveness* of the network in a global context, how to create and nurture competitive innovations in the network, how to communicate value gaps and evaluate the degree of integration necessary in the network. Topics worth researching relate to the *efficiency and effectiveness* of network collaboration such as maturity of purchase functions, horizontal and vertical dynamics in supply chains and value formation in the network environment. Proactive topics related to *global network collaboration capability* and worth researching include trust formation in virtual relationships, maturity of network performance and capability to form value through networks.

Keywords: project procurement, procurement maturity, integration, collaboration, network, supply chain management

TIIVISTELMÄ

Tämä tutkimus on esiselvitys suomalaisen meriteollisuuden verkostotoiminnan tilasta. Tutkimuksen tavoitteena oli selvittää, mitä aihealueita meriklusterin verkoston toiminnassa kannattaisi jatkotutkia.

Tutkimuksen aikana suoritettiin kaksi kohdennettua kyselytutkimusta meriklusterin verkoston toimijoille. Kyselyt lähetettiin 392:en sähköpostiosoitteeseen vuoden 2009 lopulla ja kakkosvaiheessa vuoden 2010 alkupuolella. Vastausprosentti tutkimuskyselyyn oli 12 %. Tutkimuksen suunnitteli ja tutkimuskysymykset laati Tampereen teknillisen yliopiston tuotantotalouden sekä tiedonhallinnan ja logistiikan laitoksen yhteinen tutkimusryhmä. Yoso Oy avusti kyselyn laatimisessa ja kyselytutkimuksen tulosten analysoinnissa. Kysely toteutettiin Yoso Oy:n Internet-pohjaisella kyselytyökalulla.

Tutkimuksessa löytyi useita tutkimuksen kannalta mielenkiintoisia osa-alueita koskien verkoston toimintaa. Tässä raportissa julkaistaan tutkimuksen tulokset ja raportin lopussa pohditaan johtopäätöksiä tuloksista. Yleisesti voidaan todeta, että meriklusterin verkoston toiminta on suomalaisen meriteollisuuden kilpailukyvyn näkökulmasta avainasemassa. Verkoston *kilpailukykyyn* vaikuttavia havaittuja potentiaalisia tutkimusalueita ovat mm. miten verkostossa synnytetään ja vaalitaan kilpailukykyä edistäviä innovaatioita (liiketoiminta- sekä teknologiainnovaatiot), miten arvontuotossa ilmeneviä ongelmia verkostossa kommunikoidaan sekä esim. kilpailukykyisen toiminnan vaatiman integraation aste verkostossa. Verkoston *tehokkuuteen ja tuottavuuteen* vaikuttavia tutkimuksen arvoisia tekijöitä havaittiin olevan mm. toimintojen kypsyys, horisontaalinen ja vertikaalinen dynamiikka verkostossa sekä arvonmuodostuksen mekanismit. Tulevaisuuteen tähtäävän *globaalin verkottuneen toiminnan* näkökulmasta tutkimisen arvoista olisi mm. luottamuksen synnyttäminen virtuaalisessa verkostossa (toimijat ovat maantieteellisesti ja kulttuurisesti etäällä toisistaan), verkostotoiminnan kypsyys pk-sektorilla sekä arvontuottokyvykkyys verkoston välityksellä.

AKNOWLEDGEMENTS

This research was funded by Prizztech Oy, the University Consortium of Pori, and the administration of the town of Pori. The collection of empirical data was conducted with help from the Center of Expertise Maritime Cluster (OSKE), and the Machine Technology Center, Turku.

10.12.2010 Pori and Tampere

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LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS

1. INTRODUCTION

The Finnish marine industry consists of a diverse network of technology and equipment suppliers. In the maritime technology sector competitiveness will depend increasingly on how well innovativeness and profitable, continuously renewing business can be combined by the network's operators with the design and production of new technologies and products. Businesses in the maritime cluster can make a significant financial contribution to Finland's national economy thanks to their internationality and strong involvement in exports (source: the Center of Expertise Maritime Cluster, Maritime Cluster Programme). Maritime cluster network companies' requirements are characterized by customer orientation, high-technology products and services and innovativeness.

According to the Finnish Maritime Cluster Programme the operations of the maritime cluster (for network companies) focus primarily on (1) increasing companies' R&D investments and competencies, (2) activating, planning and implementing ventures (3) sharing and collating information (4) increasing companies' internationalization and cooperation.

Furthermore, the cluster pays attention to sustainable development and cost-effectiveness, business-driven development of products and network-generated services, competitiveness and productivity and development of new innovation environments, such as work or social organizations. The maritime cluster strategic focus is discussed as below:

"Networks are of major significance to the cluster's operations. A special characteristic of project activities within the industry is networked operations, through which the cluster is reinforcing networked companies' competence, research and product development."
(the Center of Expertise Maritime Cluster, Maritime Cluster Programme)

In this preliminary survey research the above-mentioned challenge from the maritime industry served as a guideline in order to formulate meaningful and

practically relevant research questions concerning solution oriented research in a technology cluster network environment (e.g. the maritime industry).

In this report the research project is first introduced and then the two surveys are discussed. Finally, some results are presented in the form of suggestions for further research.

2. RESEARCH PROJECT

The research was conducted at the end of 2009 and at the beginning of 2010. A sample of 392 organizations from the Finnish shipyard cluster database was surveyed. Two Internet-based survey rounds were administered.

The object of survey 1 was to examine processes supporting trust and commitment formation in supply chains and also to increase the understanding of the maturity level of network purchase functions. In the first survey 104 questions on project procurement maturity related subjects were asked.

The object of survey 2 was first to ascertain the essential elements necessary for successful supply chain integration (SCI) and second to explore supply chain collaboration as regards trust and commitment in a dynamic network environment. In the second survey, 68 questions were addressed to network companies.

The data was collected by the company Yoso Oy and analysed by researchers of Tampere University of Technology. During the process, four international research articles were published (Aramo-Immonen, 2010; Breite and Mäenpää 2009a and 2009b; Breite and Mäenpää, 2010). The two surveys are described below.

3. SURVEY 1: NETWORK PROCUREMENT MATURITY

The objective of this first study was to examine processes that support trust and commitment formation in supply chains and also to increase the understanding of network procurement function maturity. The following research question was formulated: *Can the level of trust be indicated by identifying the maturity of purchase performance?* The study focuses especially on the assessment of operative purchase function maturity among 'lower level network partners' (Figure 2) illustrates extended sources of added value. Therefore the conceptual part of the paper includes a discussion of the concepts of trust and commitment, relationship management and project network procurement, likewise of the maturity of purchase functions. The empirical part of the study was conducted in an industrial project network in the maritime cluster.

3.1 Sources of Dynamics in Supply Network

The company's position as an individual in the chain and/or in the sourcing network is determined by the following principles: i) the company's capability to add value to the chain or network, ii) the suitability of the company's core competence, iii) the position tier from the focal company's point of view. The company's capability to add value to the chain or network is understood to mean that it must add value either directly or indirectly to its end customers. This also means that a single company must know the demands of the supply chain and also how to satisfy these demands. The suitability of the company's core competence is a main prerequisite for the formation of the supply chain. Therefore each company has the necessary core competence i.e., the necessary organization, people, and particularly the technology for the supply chain. A single company also has to understand how the supplier's and the customer's core competences support the focal company's business concept. (Kidd, 1995; Cox, 1996; Hamel, 2000; Breite, 2003) The position tier from the focal company's point of view can be examined in different ways: i) The company's competitive position in networks – which is understood to mean the company's capability to utilise the resource potential of the network (Harland, 1996; Cunningham, 1990) ii) The definitions of the

components of networks – the company is the actor that performs activities and controls resources (Harland, 1996). iii) The company is part of the network structure – the position of the company is defined through placement in the tiers (Harland, 1996; Nishiguchi 1994).

These position definitions reveal two elements which affect the management of the relationship between companies. The first element emphasises the company's capability to create value for another company or customer by utilising its external environment and the efficiency and effectiveness of its internal processes. In this case the examination concentrates on the company's competences to utilise its surrounding network or the supply chain in its value adding processes. The second element emphasises the company's position in the network or the supply chain from another company's point of view. The position is ranked by considering the company's importance to its customer and its physical location in the network or in the supply chain. The first element has been entitled the area of horizontal dynamics and the second one has been entitled the area of vertical dynamics. Figure 1 is formed utilising these elements. In Figure 1 the area of horizontal dynamics indicates the variance of the expected value added. This indicates that the suppliers' capability to deliver products or services varies. Figure 1 illustrates the external cumulative value added which starts from 0% and ends at 100%. The value of 100% indicates that the members of the supply chain have a common perception of the delivered value added. The area of vertical dynamics affects the supplier relationships, which indicates that the circumstances of the relationship environment change. This area has been illustrated by distinguishing the relationships of five different categories between the supplier or subcontractor and the buyer company. These are adversarial leverage, preferred supplier, single sourcing, network sourcing partnership and strategic supplier alliance (cf. Cox 1996). This implies that the supplier's importance to the buyer company also changes and vice versa. Figure 1 also illustrates how the expected supplier's trustworthiness and commitment are assumed to depend upon the type of the relationship.

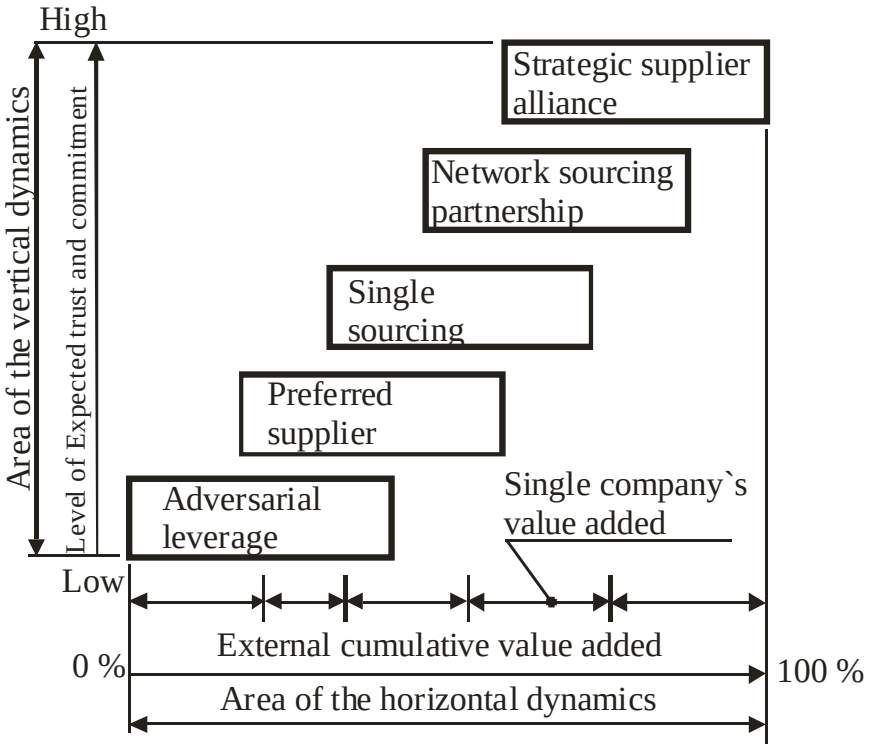

Figure 1. Vertical and Horizontal Dynamics (Breite and Torkkola, 2009; Aramo-Immonen & Breite, 2009)

The background of the area of horizontal dynamics consists of the company's value creation in a certain supply chain or a network. Thus, when the company adds value directly to the end customer, it is essential to know how to create this value for the customer and what kinds of elements affect and shape the customer's and supplier's value thinking (see e.g. Porter and Kramer, 1999; Kim and Mauborne, 1999). It can be argued that the value-adding processes should not contain value gaps or discontinuities and customers should perceive value superiority in which they take account of perceived costs and perceived value (Vandermerwe, 2000; Harland, 1996; Day, 1990). In these perspectives the goal of the company is to satisfy its customers' needs holistically, not by the partial optimization of its own position, which means an ideal value adding process. In these processes delivering and receiving value are on an optimal level in the supply chain or in the network. It can be assumed that in some cases ideal holistic value-adding processes are not realised in every case, and therefore the sources of the dynamics set the scene for lack of value, which has been presented in the area of horizontal dynamics. The authors' findings can be presented as the following factors, which set the scene for the horizontal dynamics:

1)Internal confusion of value formation. This factor implies that the different functions in the organisation understand value formation differently. 2)External confusion of value formation: This factor implies that in the supplier – customer relationships there may be differences in the understanding of value formation. 3)Unfavourable circumstances regarding the delivery of value: This factor highlights the circumstances which may change drastically during the process of delivery of value. 4)Unsuitable measurment system: The measuring system utilised emphasises the value added from the perspective of the wrong stakeholders (cf. Payne and Holt, 2001) 5)Value gaps on the chain level: Lack of demand management (e.g. the Forrester effect) on the chain or network level will affect the value delivering processes negatively in a single relationship. (Aramo-Immonen and Breite 2009)

The source of the vertical dynamics can be separated into two bases: the people basis and the firm basis. In this report we focus on the people basis. The people basis is related to commitment and trust. Level of trust is very difficult (or impossible) to measure directly (Gustaffson et al. 2009). However, conditions of trust are contextual (Smyth and Thompson, 2005). Creating supportive behavioural ground encourages trust formation. Trust is in people, thus organization structures, culture and behaviour are enablers of trust. In project procurement, which is always temporal, the identification of these enablers among supply partners is a relevant objective (Koskinen and Pihlanto, 2007). Trust is based on an attempt to understand partners' behaviour, state of mind and motives. Trust in relation to the organisational mind and collective action is an important issue, because it ties together a complex and attentive system, which forms the collective mindset required for reliable performance (Weick and Roberts 1993; Senge 1990; Cox 1996).

The notion of trust is complex. At one level, reasoned expectations will be fulfilled. Predictability is related to past experiences. On both personal and business levels trust is as much about something happening as not happening. (Walker and Hampson, 2003). Commitment is the practical manifestation of the concept of trust. In practice it can also be an act of

loyalty. This occurs when trust and commitment are tested. In purchase relationship loyalty is an element of sustainability.

Trust does not come as part of a particular procurement system, thus the system can enable the trust to flourish (Walker and Hampson, 2003; Koskinen and Pihlanto 2007). Luhmann (1979) differentiates between personal trust and system trust. Personal trust is an emotional bond between individuals. Personal trust can be intuitive, based on one´s impression. System trust is on a presentational basis (no emotions involved). It is essential for the effective functioning of money or power exchange (Wong et al., 2008). Rousseau et al. (1998) introduces three categories of trust: calculus-based trust, relational trust, and institution-based trust. Calculus-based trust relies on mediators such as references, certificates and diplomas. Relational trust evolves in interactions between individuals. Institution-based trust relies on systems, such as co-operation, professional practice and organizational rules.

Both personal trust and system-based institutional trust are needed in the supply network. Personal trust is a base for intentional commitment. However, it is vulnerable and dependent on individual actors in the chain. System-based trust is embedded in predictable performance processes, contracts and institutional organisational behaviour. System-based trust could be supported by manifestations of calculus-based trust (e.g. references, certificates, and audit reports). (Aramo-Immonen, 2010).

3.2 Project Procurement Maturity

In the project network structure (Figure 2) there is a variety of organisations of different sizes, scopes and shapes. Networked structure is fragmented and complex to manage. Supply chains cross each other and the purchase performance maturity in organisations varies. In the network there are single product or service micro-organisations, typically handled by the owner himself. In this same network are multi-product companies ranging in size from small to large, large multinational performers and local project-based

businesses. Therefore the maturity of purchase functions is also heterogeneous.

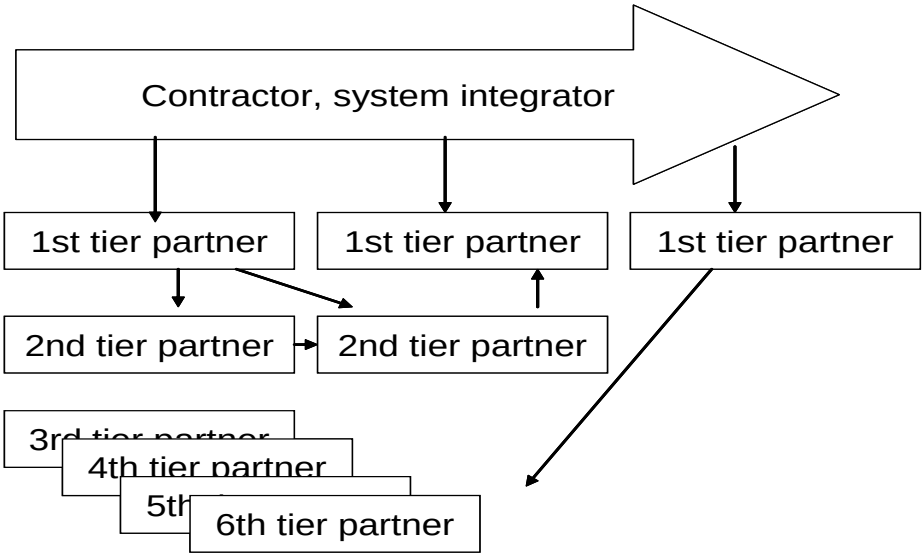

Figure 2. Project network structure. Lower level network partners are 2-6 tier partners in the network.

Customer supplier relations in micro-organizations are based on personal trust and individual interactions. Large organisations typically have resources to structure the purchase function as a part of institutional system. Procurement organisations, purchasing departments, supply chain and vendor management are strategic elements for these companies. For the project customer in case of a complex project network the competitive edge is the efficiency and effectiveness of supply chains in network (Gattorna and Walters, 1996; Walker and Hampson 2003).

Maturity of Procurement functions:

At the operative purchasing level, Reck and Long (1988) have introduced a four-stage purchasing development model. These stages are passive, independent, supportive, and integrative (Baily et al., 2008):

Passive purchasing function has no strategic direction and is reactive to other functions' requirements. Purchaser's time is spent on routine operations. Control of the purchasing function and performance is based on efficiency measures. Purchase has low visibility and interactions inside the company. Supplier selection is based on price and availability.

Independent purchasing function adopts new purchasing practices. However, purchasing is not integrated into company strategy. Performance is based on cost reduction and efficiency. Co-ordination between technology, R&D and purchasing may exist. Management recognizes the importance of professional purchasing.

Supportive purchasing function adopts techniques and practices strengthening the company's competitive strategy. Purchasers are typically involved with sales proposals. Vendor management disciplines do exist. Supplier markets and products are monitored and analysed.

Integrative purchase function is part of company strategic resource. It is fully integrated into strategy planning processes and implements a competitive strategy. Training and education are available for purchasers. Cross-functional interactive in-house communication is permanent (e.g. between technology, R&D and purchasing). Development focuses on strategic areas. The purchasing function is measured in terms of contribution to company success.

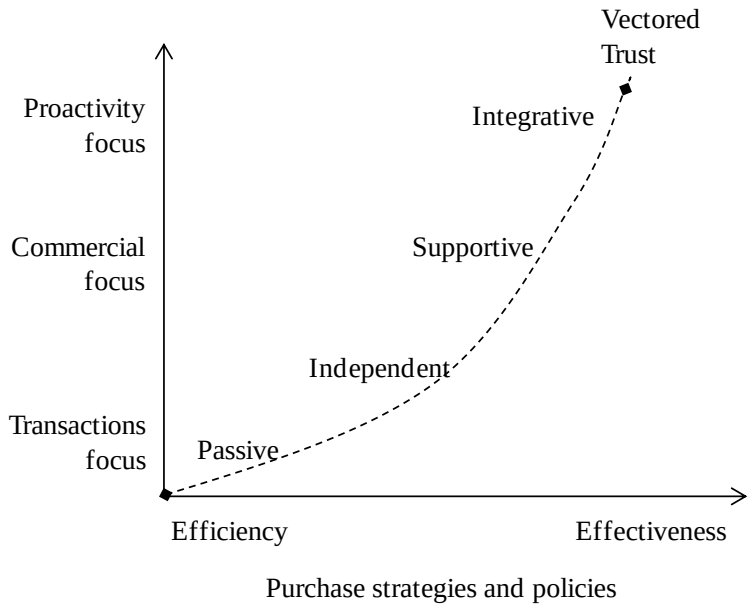

Figure 3. Purchasing development typology (adapted from Reck and Long, 1988; Syson 1989; Baily et al., 2008; Aramo-Immonen, 2010)

Syson (1989) has introduced three principal focus areas of purchasing. Namely, transactions focus, commercial focus, and proactivity focus. The more involved a purchasing function becomes in commercial and strategic planning, the greater is its effectiveness to the organisation. The proactivity focus is on the strategic level. Whereas the transaction focus has a reactive role in the organisation. The development stages of purchasing functions and strategic procurement focus areas of company are introduced in Figure 2. In this model the efficiency and effectiveness of purchasing strategies and chosen focus areas constitute the level of trust (Vectored trust in Figure 3).

3.3 Method of Survey 1

The research domain is a temporal project network environment, therefore the empirical study is contextual. The empirical study was carried out in the same industrial environment as the mega-project network in the previous study (Aramo-Immonen 2009; Aramo-Immonen & Porkka 2009). A survey questionnaire with 93 questions was sent to 392 recipients' e-mail addresses in the Finnish marine industry sector. The method utilised was survey with responses on a 5-point Likert-scale also including some open questions. The assessment of maturity (scale) was adapted from Jones (1997). He introduced five measurable stages of purchase function development. Namely: (1) Infant, (2) awakening, (3) developing, (4) mature and (5) advanced. The evaluative survey questions are shown in Appendix 1. Respondents reported their opinions of purchasing performance maturity (1) in their own organisation, (2) in their supplier organisation and (3) in their customer organisation.

At the time of writing this report the empirical research was still ongoing. The first survey round yielded replies from 23 respondents answers (n=23). The expectation is to have over 50 answers after a reminder e-mail to the sample of 392 respondents. However, some demographic data of the first result are introduced in Table 1.

After the second survey round, the total number of respondents to the survey was 40 (n=40), with some incomplete responses (n=11).

Table 1. Number of personnel in companies, turnover and work experience in years.

Personnel	Qty
1-10	8
11-50	13
51-250	8
251-	11
Turnover	Qty
< 2 MEUR	5
2-10 MEUR	12
11-50 MEUR	12
> 50 MEUR	11
Work experience	Qty
6-10	1
11-15	7
16-20	4
21-25	2
26-	26

It is noteworthy that 65% of respondents had more than 26 years' work experience in the field. The next section presents some of the results obtained.

3.4 Result of Survey 1

In order to explore the research question: Can the level of trust be indicated by identifying the maturity of purchasing performance? Questions on trust between supplier and customer were posed to respondents. When asked if the company had a purchasing department, 10 responded Yes and 11 No. The question whether there was a purchase manager in the company yielded 16 Yes and 4 No answers. Figure 4 illustrates the evaluation of trust level between supplier and customer.

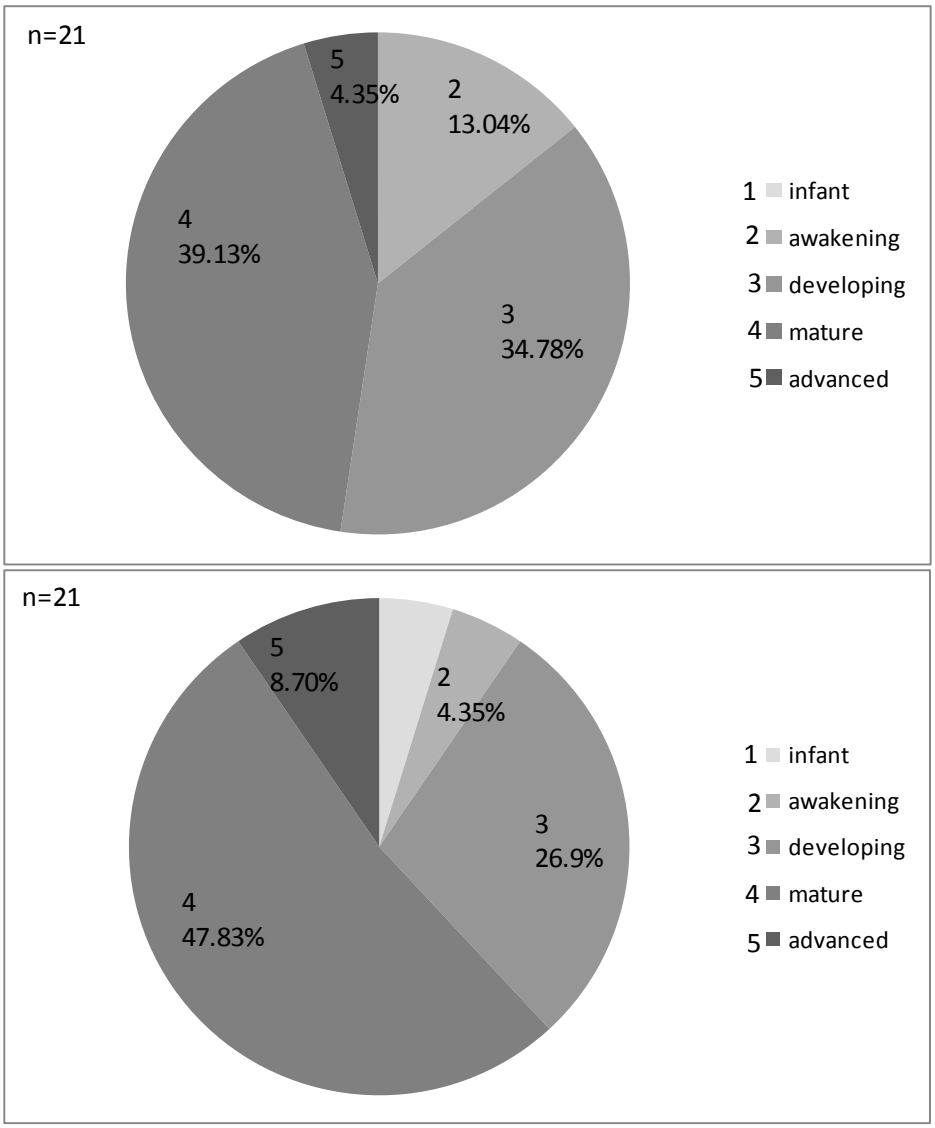

Figure 4. Your own organization's trust in the supplier. Question 31 above. Your own organization's trust in the customer. Question 30 below.

To evaluate own organization's purchasing functions and features affecting relationships and trust 31 questions were posed. Companies were divided into two groups (Table 2 and Figure 5). Group 1 companies had purchasing departments (n=10), Group 2 companies did not have purchasing departments (n=10). The mean of value of results on the maturity scale (1-5) was calculated (first and second columns in Table 2). The third column shows the difference calculated between the two groups. The table is presented in ascending order by difference calculated.

Table 2. Evaluating own organization's purchase functions and features affecting relationships and trust. Mean of value of results on maturity scale (1-5) in ascending order. Group 1 companies have a purchasing department and group 2 companies do not.

Group 1	Group 2	Difference	Purchase function/feature
3,78	2,09	1,69	Purchase department
3,67	2,55	1,12	Structure of purchase organization
3,22	2,27	0,95	Purchase order documentation
3,56	2,64	0,92	Project procurement resources
3,33	2,45	0,88	Purchase services
3,67	2,82	0,85	Material resource planning systems (MRP)
3,00	2,18	0,82	E-invoicing
3,56	2,91	0,65	Purchasers' competence level
2,89	2,27	0,62	Purchase training
3,89	3,36	0,53	Annual contracting
3,89	3,36	0,53	Trust in customer
2,56	2,18	0,38	Measurement of purchase function
3,00	2,64	0,36	Co-operation between purchase and R&D
2,78	2,45	0,33	Supplier training
3.78	3,45	0,33	Contracting culture
2,67	2,36	0,31	Supplier certification system
3,67	3.36	0,31	Logistics management
3,56	3,27	0,29	Co-operation between purchase and sales & marketing
3,56	3,27	0,29	Trust in supplier
3,33	3,09	0,24	Partnership contracting
3,22	3.00	0.22	Measurement of purchase lead times
3,56	3,36	0,20	Competitive bidding
3,00	2,82	0,18	E-purchasing
3,44	3,27	0.17	Co-operation between purchase and production
2,89	2,73	0,16	Measurement of delivery times
3,00	3,00	0,00	Warehouse management
3,44	3,64	-0,20	Measurement of delivery accuracy
2,67	2,91	-0,24	MRP compatibility with suppliers
3,11	3,55	-0,44	Measurement of delivery quality
2,67	3,18	-0,51	Supplier quality auditing
2,22	3,00	-0,78	Supplier process auditing

Figure 5 shows how paradoxically companies assess the measurement of delivery functions of suppliers. According to the results the companies not having purchasing functions organized do believe that their supplier measurement is in good order (better than those with purchasing departments). This may indicate severe myopia, in other words ignorance, about the real life situation.

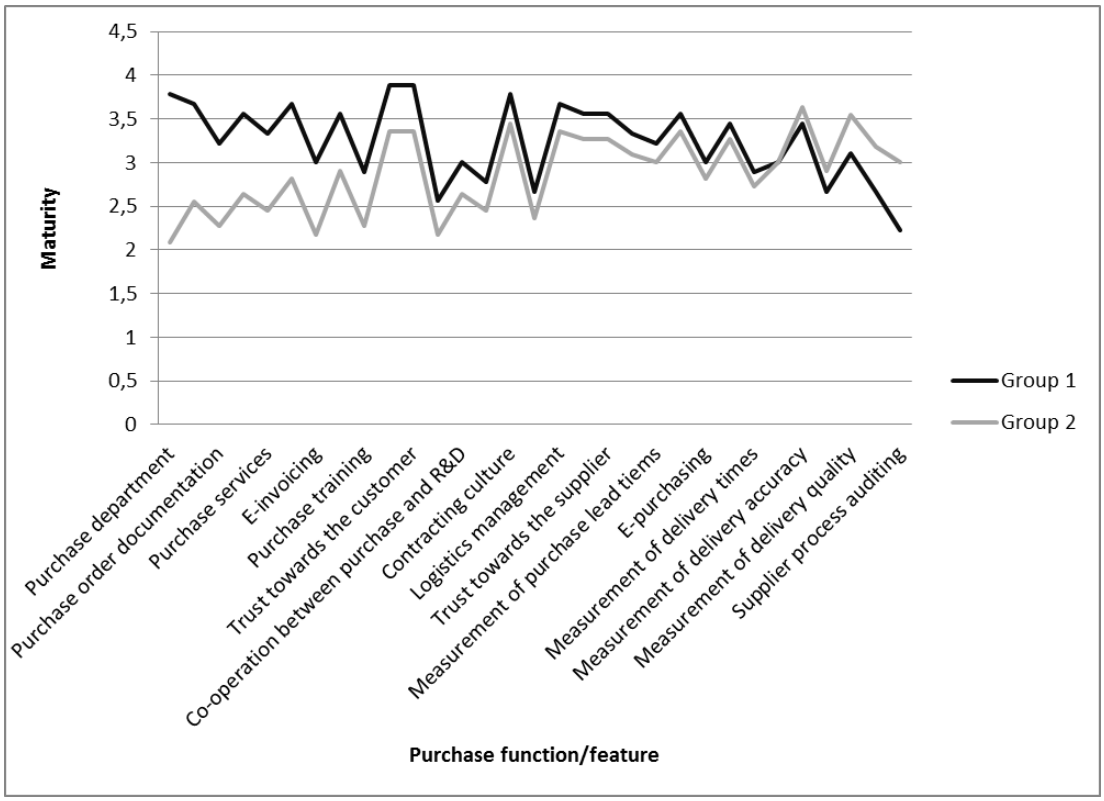

Figure 5. Evaluating own organizations' purchase functions and features affecting relationships and trust. The difference in mean value. Group 1 companies have a purchasing department and group 2 companies do not.

When assessing trust from three perspectives, organisations' assessment of their own performance, organisations' assessment of their customers' performance and organisations' assessment of their suppliers' performance (Figure 6), the bond between focal organisation and customer was seen to be tight measured by the level of trust assessed by the focal company. Trust between focal company and supplier was seen to be much lower. In other words, the trustworthiness of the customer was higher.

When assessing the purchase functions' characteristics from three perspectives, organisation's assessment of their own performance, organisation's assessment of their customers' performance and organisation's assessment of their supplier's performance (Figure 7), focal company's customers' performance was seen to be slightly superior to own performance and supplier's performance. The purchasing departments' service level, purchase personnel expertise and purchaser's training were evaluated.

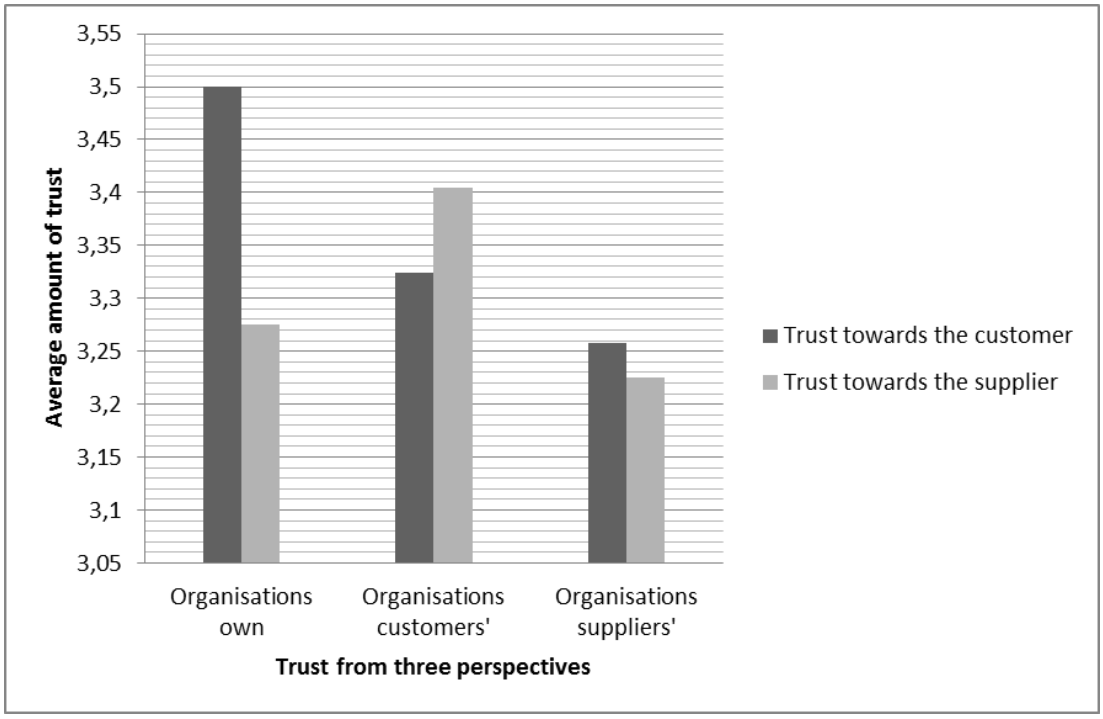

Figure 6. Trust from three perspectives, organisation's assessment of their own performance, organisation's assessment of their customers' performance and organisation's assessment of their supplier's performance. Trust in the customer (darker bar) Trust in the supplier (lighter bar). Average amount of trust is the mean value of respondents' answers.

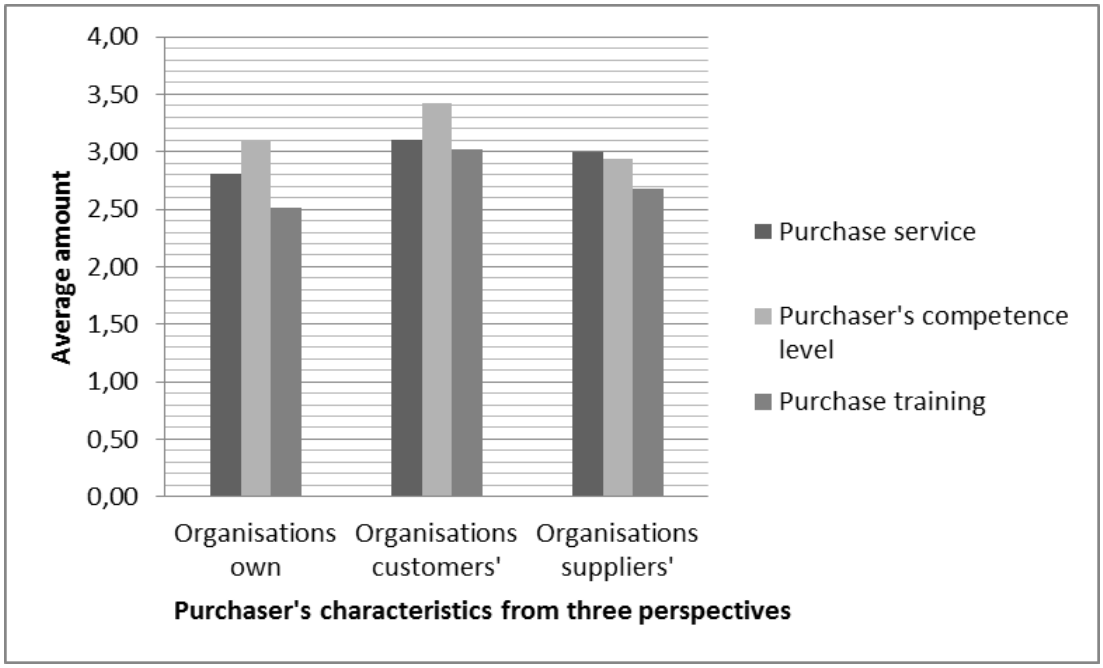

Figure 7. Purchase functions' characteristics from three perspectives, organizations' assessment of their own performance, Organizations' assessment of their customers' performance and organizations' assessment of their suppliers' performance. Average amount is the mean value of respondents' answers.

When assessing delivery measurement from three perspectives, organisation's assessment of their own performance, organization's assessment of their customer's performance and organisation's assessment of their supplier's performance (Figure 8), focal company's own result was found to be significantly lower than the other assessments. Surprisingly, the measurement of delivery quality was found to be high in own organization and lower in customer's organisation.

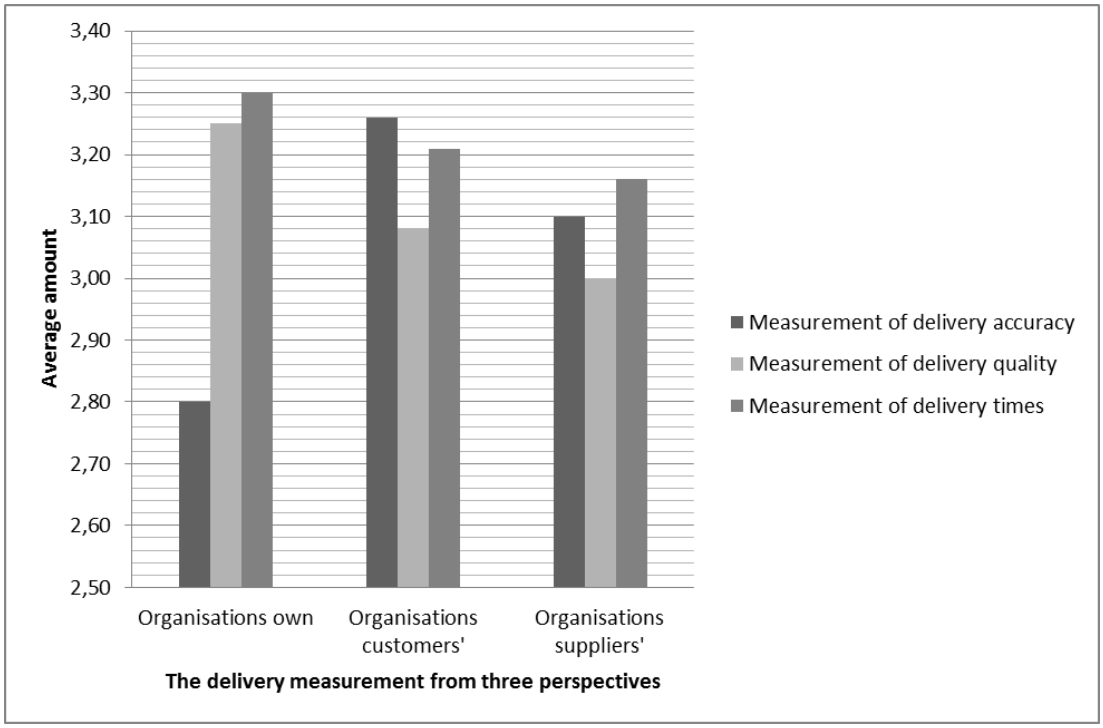

Figure 8. The Delivery measurement from perspectives, organizations' assessment of their own performance, Organizations' assessment of their customers' performance and organizations' assessment of their suppliers' performance. Average amount is the mean value of respondents' answers.

In summary, three perspectives of the evaluation were introduced here. From the collected data more information could be generated. However, from these results it is already apparent that the positioning of focal company's relation to value creation in the supply chain is demanding. The positioning of the focal company in the supplier network from the focal company's own perspective is relatively vague. Therefore the efficient and effective value adding performance is hard to measure in the supply network. Hidden value gaps may be bigger than assumed. Consequently the competitiveness of the

supply network may be lower than best estimates. There is therefore a need for further explorative research in this field.

4. SURVEY 2: NETWORK COLLABORATION

The aim of this survey was first to discuss the elements essential for successful supply chain integration (SCI) and second to explore supply chain collaboration as regards trust and commitment in a dynamic network environment. An empirical survey was concluded based on the focal integration elements. The results concerning trust and commitment were analysed in more detail.

4.1 Convolution of Integration

The evolution of supply chain management has led authors to define the concept of supply chain integration (SCI) and its advantages in varying ways. Integration offers benefits such as reduced cost, superior customer service levels and improved responsiveness (e.g. Jahre and Fabbe-Costes, 2005; Power, 2005; Pagell, 2004). Authors also agree that integrative practices and a high level of integration have positive impacts on both corporate and supply chain performance (Cousins and Menguc, 2006; Kim, 2006; Zailani and Rajagopal, 2005). Power (2005) concludes that the requirement for integration of supply chains is inherently strategic, and a potential source of competitive advantage. According to Kwon and Suh (2005) supply chain integration is a strategic tool, which attempts to minimize the operating costs and thereby enhancing values for customers and stakeholders by linking all participants throughout the system, i.e. from supplier´s suppliers to the customers. Researchers like Frohlich and Westbrook (2001); Vickery, Jayaram, Droge and Calantone, (2003); Zailani and Rajagopal, (2005) have also provided convincing empirical evidence for the relationship between integration and performance. Most managers strive to integrate the processes of sourcing, manufacturing and distribution in order to increase value by reducing waste, excessive work delays and redundancy.

The process of integration is not simple. It can be supposed that integration of supply chain activities requires dyadic involvement, i.e. consistent

involvement of both the buyer and the supplier, and investing in interaction and communication between various actors within and between the firms is critical in integration processes. (Cousins and Menguc, 2006) Supply chain integration is especially problematic in dynamic one-off project business environment, such as shipbuilding or construction industries. These supply chains are usually associated with large, complex projects varying in frequency, scope and scale. As Dainty, Briscoe and Millett (2001) state these sectors face wide fluctuating demand cycles, project-specific product demands, uncertain production conditions and have to combine a diverse range of specialist skills within geographically dispersed short-term project environments. For example, Gosling and Naim (2009) point out that the supply chains in construction and shipbuilding have emerged as a major supply chain structure and are assumed to become increasingly important as more customized products are demanded across a range of industries.

4.2 Essential Elements of Integration

The utilization of technology, especially information and communication technology (ICT), has played a significant role both in the management of the complexities of the supply chain and when the members of the supply chain have been integrated into the chain. However, the management of an efficient and effective supply chain with the help of ICT is not unambiguous, because the incorrect form of information may increase the expenses and lead-time of the supply chain. (cf. Sievänen, 2003) This, in turn, also implies that a more profound integration at the level of supply chain cannot be achieved by ICT alone; elements like common goals at the level of supply chain and reciprocal knowledge sharing between supply chain members are also needed.

Closer coordination is stated to help eliminate many non-value adding activities from internal and external production processes including overproduction, waiting, transportation, unnecessary processing steps, stockpiling and defects. In other words, better coordination translates directly into reduced variability, which leads to greater efficiency along with faster delivery of finished goods (Frohlich and Westbrook, 2001). Coordination

among functions is a critical precondition for effective supply chain integration and, together with shared information, improves the ability of supply chains to react to sudden changes in volatile demand environments (cf. Fawcett and Magnan, 2002; Lee, So and Tang, 2000). Thus, coordination or collaboration, regarded as a critical element of integration, contributes to these performance improvements. Benefits are expected to emerge when partners are willing to work together, understand other viewpoints, share information and resources and achieve collective goals.

Kwon and Suh (2005) state that successful supply chain performance is based on a high level of trust and a strong commitment among supply chain partners. Effective supply chain planning based on shared information and trust among partners is an essential requirement for successful SCM. Also Morgan and Hunt (1994) point out that “when both commitment and trust are present, they produce outcomes that promote efficiency, productivity and effectiveness.”

Relying on the theoretical review we summarize that the central elements in integration are interaction, collaboration, information sharing, trust, partnerships, shared technology, managing integrated chains of processes and cooperation to achieve the common objectives. Cooperation, for its part, is built by the interaction of buyer´s and supplier´s beliefs and actions leading to the commitment of resources. Thus, in the SCI typology six types of integration activities can be identified: a) setting common goals, b) ensuring the relevance of common objectives, c) sharing information and knowledge, d) identifying value formation, e) strengthening commitment and trust, and f) sharing the outcomes and risks (see Figure 9).

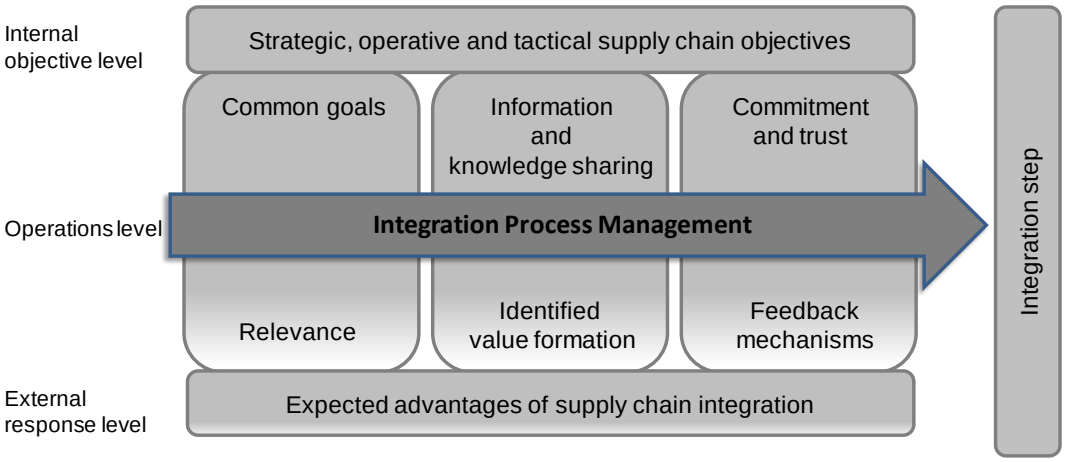

Figure 9. Typology for integration elements

In this research, the scale of *common goals* consists of sixteen items measuring the awareness of goals inside the company as well as upwards and downwards in the supply chain. The level of managing the supply chain as well as influencing on decision-making are also measured. A five-item scale of *relevance* asks respondents to indicate the extent to which they benefit from supply chain objectives and the extent to which they expect supply chain objectives to benefit supply chain participants further upstream or downstream.

Flexibility and output performance of supply chains can be improved by emphasizing integration and information sharing (Sezen, 2008). There are also many other studies showing that cooperative information sharing among supply chain members improves the effectiveness of supply chains and influences supply chain performance in terms of total cost and service level (cf. Li, Lin, Wang and Yan, 2006; Sahin and Robinson, 2004; Zhao, Xie and Zhang, 2002). Coordination becomes possible when information is transparently shared among supply chain partners (Bagchi and Skjoett-Larsen, 2002 and Bagchi, Chun, Skjoett-Larsen and Soerensen, 2005). Power (2005) emphasizes that organizations aiming to become part of an extended, integrated supply network can also expect that this will require an infrastructure enabling effective information flows and streamlined logistics. The scale of *common information and knowledge sharing* consists of fourteen items measuring the extent of utilizing information technology, the

level of sharing knowledge both internally and externally as well as exploiting interaction in relationships through the supply chain.

Supply chain integration has been found to offer benefits such as reduced cost, superior customer service levels and improved responsiveness to changes in the marketplace (Simchi-Levi, Kaminsky and Simchi-Levi, 2008; Power, 2005). As van der Vaart and van Donk (2008) state, many authors do indeed agree that integrative practices and a high level of integration have positive impacts on corporate and supply chain performance (Cousins and Menguc, 2006; Kim, 2006; Zailani and Rajagopal, 2005). Power (2005) among others concludes that the requirement for integration of supply chains is inherently strategic, and a potential source of competitive advantage. Previous research (Frohlich and Westbrook, 2001; Vickery et al., 2003; Zailani and Rajagopal, 2005) has also provided convincing empirical evidence for the relationship between integration and performance. Most managers strive to integrate the processes of sourcing, manufacturing and distribution in order to increase value by reducing waste, excessive work delays and redundancy. A seven-item scale of *identified value formation* asks respondents to indicate the extent to which they assess the development of profitability factors on different levels, and how relations and co-operation are identified to affect value formation.

Bagchi et al. (2005) state that it should become easier to generate trust among partners in an integrated supply chain. Trust can be defined in the activities that are inherent in high-trust relationships such as communication, informal agreement, absence of surveillance, and task-coordination (Curall and Judge, 1995). Trust should promote collaboration and decision realignment, reduce irrational behaviour and “second guessing” among supply chain members thereby reducing the need for safety stocks. According to Weick and Roberts (1993), co-operation is imperative for the development of the mind, and trust is imperative for co-operation. According to Nonaka and Takeuchi (1995), building trust requires the use of face-to-face dialogue that provides reassurance about points of doubt and leads to willingness to respect the others’ sincerity. Thus, we conclude that trust has

an indirect effect on the options in the process of supply chain integration. The scale of *commitment and trust* includes seven items measuring the reliability of customer and supplier, the extent of customer and supplier commitment to common goals as well as the effect of commitment and trust on supply chain.

Johnston, McCutcheon and Stuart (2004) state that success for individual firms depends on how well the supply chain functions as a whole. Furthermore, the success depends largely on the openness and extent of sharing of the outcomes of the new relationship. A five-item scale of *feedback* asks respondents to indicate the extent to which they get feedback from goal achievement and how feedback directs the development of supply chain activities.

To observe SCI in practice an empirical study is needed. The research variables based on the SCI typology introduced above form a survey questionnaire (see Appendix 2).

4.3 Method of Survey 2

A sample of 392 organizations from Finnish shipyard cluster database was surveyed. An Internet-based survey was administered. A total of 48 complete responses were received of which 1 was deemed unusable due to the nature of organization (not a company). The effective response rate was thus 12.0 percent (47/392). Of the responding firms, 49 percent were in the maritime industry, 15 percent were engineering workshops, 2 percent information technology companies, 6 percent port service, shipping and construction industry both 2 percent and 24 percent were in industries classified “other”. The response by position held within the supply chain was subcontractor (43 percent), turnkey supplier (43 percent), material supplier (8 percent) and component supplier (6 percent). The response by position held within the firm was owner/entrepreneur/senior management (48 percent), middle management (22 percent), specialist (20 percent) and clerical staff (6 percent). 4 percent were in position classified “other”. 72 percent of respondents had more than 26 years of experience in the industry. All the

respondents had more than 11 years of experience in the industry (Figure 10).

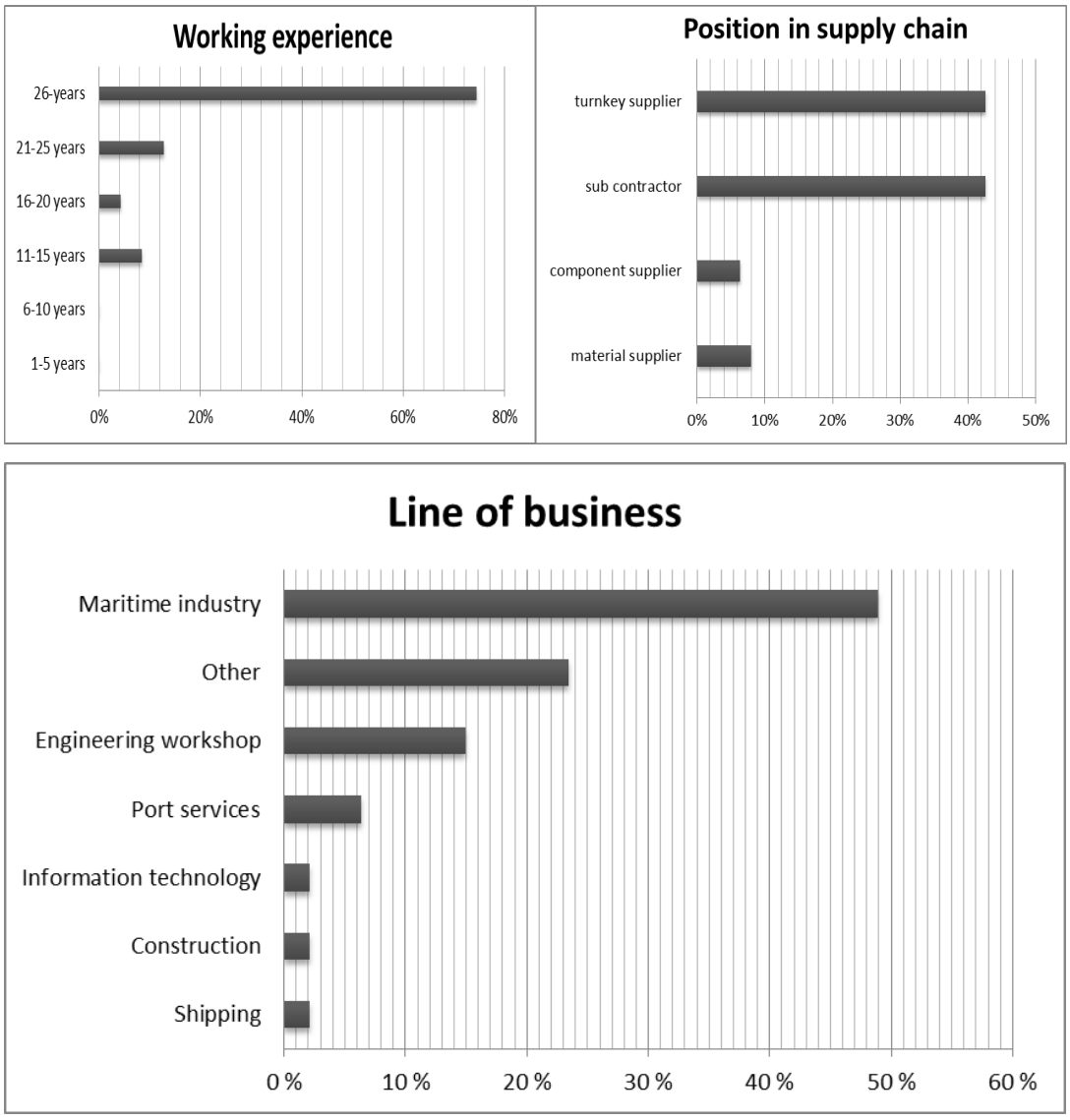

Figure 10. Respondents' line of business, working experience and position in supply chain

The survey included demographic questions about age, gender, education, working experience and job status. The items (see Appendix 2) were measured on sliding scale ranging from strongly disagree to strongly agree. There was also a possibility to choose "neither agree nor disagree" for an answer in every statement. On scale S3 one statement ("Information is transferred electronically") differed from other statements by having eight alternatives to choose from.

Tests for non-response bias were conducted by comparing early respondents (responses received within the first 2 weeks) and later respondents (responses received within the third week). An independent-samples t-test of difference was conducted on firm size (number of employees and revenue). No statistically significant differences were identified at $p<0.05$. This indicates that the study does not suffer from a serious non-response bias.

4.4 Results of Survey 2

In the previous section the essential elements necessary for successful supply chain integration were discussed. Next, supply chain collaboration is discussed with reference to trust and commitment.

First, the respondents´ views on their companies´ level of integration were elicited. The replies were divided into groups of turnkey suppliers and subcontractors (Table 3).

Table 3. Level of integration

The company is integrated towards its suppliers		
	Yes	No
Turnkey supplier	80 %	20 %
Subcontractor	61 %	39 %
The company is integrated towards its customers		
	Yes	No
Turnkey supplier	70 %	30 %
Subcontractor	78 %	22 %
The company is integrated both upwards and downwards		
	Yes	No
Turnkey supplier	70 %	30 %
Subcontractor	57 %	43 %

In these groups the level of integration is strong either upwards or downwards in supply chain, not both and (see Figure 11).

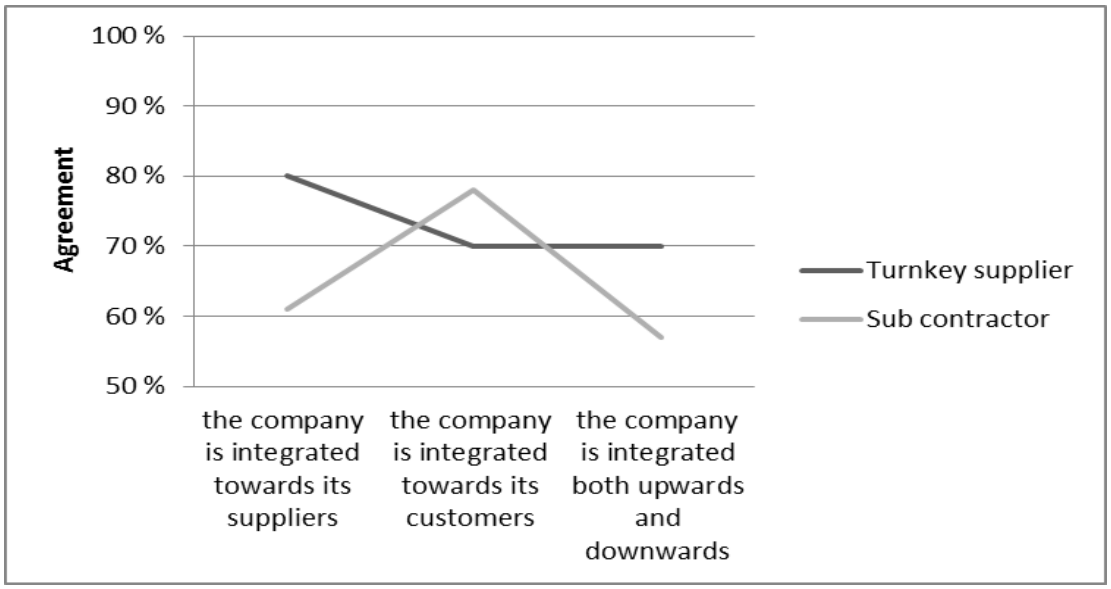

Figure 11. Level of integration

This also confirms the view of e.g. Fawcett and Magnan (2002) that integration is more difficult in practice than in theory and that integration is more rhetoric than reality.

Next, the questionnaire statements concerning trust and commitment are discussed (Table 4). All the respondents found the customer to be slightly more reliable (mean 74.53) than the supplier (65.00). The commitment of both customers and suppliers was found to be almost equal (66.09 and 65.00). There was no major difference between customers and suppliers in commitment to goals set in collaboration (61.17 and 63.75). Mutual trust appearing in SC activities was also identified fairly well (73.36).

Table 4. Statements on trust and commitment

Statement	**All (n=47) Mean**	**Turnkey supplier (n=20) Mean**	**Subcontractor (n=20) Mean**
Customers are strongly committed to common goals	61.17	**51.85**	**66.95**
Suppliers are strongly committed to common goals	63.75	61.16	66.53
Customer commitment appears in sc activities	66.09	**54.60**	**74.28**

Supplier commitment appears in sc activities	65.00	**60.45**	**68.39**
Customer is reliable	74.53	72.11	75.00
Supplier is reliable	65.00	67.42	63.17
Mutual trust appears in sc activities	73.36	71.05	72.16

Based on these narrow samples of empirical results presented, the heterogeneity in different cooperation forms seems obvious. This, in turn, supports our assumption that several value gap areas can be identified on the network level and in dyadic relationships. These findings highlight the need for a systematic and long-term research project based on theoretical and practical research problems.

5. DISCUSSION AND CONCLUSIONS

In this last chapter of the report, the contribution of the explorative studies is discussed and the validity, reliability, and generalizability of the results evaluated.

The objective of this research was to explore the nature of Finnish maritime industry network collaboration. Two explorative studies were conducted: (1) Trust related network collaboration in purchase functions on maritime industry network and (2) Maritime industry network collaboration. The research questions were found to be relevant for the area of interest. The topics were also introduced in academia for open discussion (Aramo-Immonen, 2010; Breite and Mäenpää, 2010).

The research was conducted at the end of 2009 and at the beginning of 2010. A sample of 392 organisations from the Finnish shipyard cluster database was surveyed. Two Internet-based survey rounds were administered. The generalizability of the research is good in the context of the Finnish maritime sector.

The object of survey 1 was to examine processes that support trust and commitment formation in supply chains and also to increase the understanding of the maturity level of network purchase functions. In the first survey 104 questions on project procurement maturity related subjects were posed. The results of survey 1 were found to be valid and reliable.

The object of survey 2 was first to discuss the elements essential for successful supply chain integration and second to explore supply chain collaboration as regards trust and commitment in dynamic network environment. In the second survey network companies were presented with 68 statements for evaluation. The results of survey 2 were found to be valid and reliable.

The results of the surveys explored the need for future research. The data gathered would enable further information to be extracted. However, these results already show that positioning the focal company's relation to value creation in the supply chain is demanding. Positioning of the focal company in the supplier network from the focal company's own perspective is relatively vague.

In light of our literature review we can argue that the level of trust between parties significantly affects performance measures. On the other hand, distrust causes lack of commitment. However, the mechanisms of trust-building processes in the supply network are unknown. Furthermore, trust-building in global contexts, where companies are networked geographically, socially and culturally, is an even more unknown area (e.g. cultural and social differences affecting trust formation).

Therefore, an efficient and effective value adding performance is hard to measure in supply network. Hidden value gaps may be more serious than previously assumed. Consequently, the competitiveness of the supply network may be lower than the best estimates. There is therefore a need for further explorative research in this field.

Moreover, the heterogeneity in different forms of cooperation emerges clearly. This in turn supports our assumption that several value gap areas can be identified in the network level and in dyadic relationships as well. These findings highlight the need for a systematic and long-term research project based on theoretical and practical research problems. Finally, this research has also achieved international publicity in the academic domain via conference presentations (Aramo-Immonen, 2010; Breite and Mäenpää, 2010).

As Gosling and Naim (2010) state, more testing and research are required in a one-off project environment, which also supports our findings. The network examined contains both practical and theoretical calls for future research on trust, commitment and related factors affecting dynamics in value adding processes and in the management of important relationships and indeed the supply chain as a whole.

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Appendix 1 Survey questions of survey 1

Maturity of Own organizations' purchase functions/features. Questions 1-31
Maturity of Supplier organizations' purchase functions/features. Questions 32-63
Maturity of Customer organizations' purchase functions/features. Questions 64-95

		Infant	awakening	developing	mature	advanced
	Maturity of Purchase Performance	1	2	3	4	5
1	Structure of purchase organization					
2	Purchase department					
3	Purchase service					
4	Purchasers' competence level					
5	Purchase training					
6	Measurement of purchase function					
7	Measurement of delivery times					
8	Measurement of purchase lead times					
9	Measurement of delivery quality					
10	Measurement of delivery accuracy					
11	Supplier training					
12	Supplier process auditing					
13	Supplier quality auditing					
14	Project procurement resources					
15	Contracting culture					
16	Partnership contracting					
17	Annual contracting					
18	Purchase order documentation					
19	Supplier certification system					
20	Logistics management					
21	Warehouse management					
22	E-purchasing					
23	Competitive bidding					
24	E-invoicing					
25	Material resource planning systems (MRP)					
26	MRP combatibility with suppliers					
27	Co-operation between purchase and R&D					
28	Co-operation between purchase and production					
29	Co-operation between purchase and sales & marketing					
30	Trust towards the customer					
31	Trust towards the supplier					

Appendix 2 Research statements of survey 2

Common goals

I know the goals of maritime cluster
I know the goals related to my company´s operation modes
I know the goals related to my company´s supply chain relations
I know the goals related to my company´s profits
I know our customer´s goals
I know our customer´s customer´s goals
I know our supplier´s goals
I know our supplier´s supplier´s goals
I am familiar with my company´s partners in co-operation
My company has got a supply chain strategy
I know my company´s supply chain strategy
My company manages the project/supply chain
I know the interfaces between project/supply chain actors
My company can contribute to choosing the suppliers
Our customers select the suppliers for the project/supply chain
All the members of the project/supply chain are heard in decision-making

Relevance of the goals

The project/supply chain goals benefit my company
The project/supply chain goals benefit our customer
The project/supply chain goals benefit our customer´s customer
The project/supply chain goals benefit our supplier
The project/supply chain goals benefit our supplier´s supplier

Common information and knowledge sharing

We manage well information technology
We exploit information technology inside our company
We exploit information technology on supply chain level
I know our co-partners´ information systems
All the members in project/supply chain have access to electronic databank/information needed
Information technology supports my company´s goal achievement
Information is transferred electronically
Flow of information inside our company works well
Flow of information towards customers works well
Flow of information towards suppliers works well
I exploit the interaction in company´s internal relations regularly
We exploit regularly the interaction in customer relationships
We exploit regularly the interaction in supplier relationships
We exploit regularly the interaction in achieving the supply chain goals

Value formation

We observe the development of our company´s profitability factors
We observe the development of our company´s profitability factors on customer level
We observe the development of our company´s profitability factors on supplier level
We observe the development of our company´s profitability factors on supply chain level
The negotiating power of our company on supply chain level is strong
Organizational relationships contribute to value formation
Interaction/co-operation contributes to value formation

Commitment and trust

Our customers are very committed to goals set in collaboration
Our suppliers are very committed to goals set in collaboration
The commitment of our customer appears in supply chain activities
The commitment of our supplier appears in supply chain activities
Our customer is reliable
Our supplier is reliable
Mutual trust appears in supply chain activities

Feedback mechanism

I am regularly informed of our customer´s goal achievement
I am regularly informed of our supplier´s goal achievement
I am regularly informed of supply chain´s goal achievement
Customer feedback directs the development of supply chain activities
Supplier feedback directs the development of supply chain activities

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