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Katrina Lintukangas, Jukka Hallikas, Anni-Kaisa Kähkönen, Ida Bolander, Sirpa Multaharju

Supply network risks and costs in Finnish project business

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ABSTRACT

Katrina Lintukangas, Jukka Hallikas, Anni-Kaisa Kähkönen, Ida Bolander and Sirpa Multaharju

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47 Pages, 32 Figures, 9 Tables

This report summarizes the results of the survey *HAVERI – Supply network risks in business*. The survey was conducted in Finland during the spring and summer of year 2013. The survey is part of a large two-year research project started in June 2012 in Finland (on-going 06/2012–07/2014). The project is launched and financed by TEKES, the Finnish Funding Agency for Technology and Innovation, and executed together with the researchers from Lappeenranta University of Technology and Tampere University of Technology. The overall goal of this on-going research project is to find out the decision-making practices in the project-oriented companies in their purchasing decisions especially in the mechanical engineering and construction industries in Finland.

The objective of the survey was to gain cross-sectional data concerning the challenges, risks and cost factors in Finnish project business companies. The results show that Finnish companies rely on their experience and supplier references in their risk management. In general, the understanding of the total cost structure varies among the industries and companies. The main cost factor in risk management was costs before the actual purchase decision. Overall, it seems that the monetary value of the whole project and capability of purchasing personnel are the main influencing factors on risk management activity in project purchasing.

Key words: supply management, supply chain management, competitiveness, risk management, cost management

TIIVISTELMÄ

Katrina Lintukangas, Jukka Hallikas, Anni-Kaisa Kähkönen, Ida Bolander ja Sirpa Multaharju

Hankintatoimen osaaminen kilpailukyvyn lähteenä globaaleissa arvoverkostoissa Research

Reports 20

Lappeenranta 2014

47 Sivua, 32 Kuvaa, 9 Taulukkoa

Tämä raportti on yhteenveto HAVERI – Hankintaverkotoriskit liiketoiminnassa - tutkimusprojektissa toteutetun kyselyn tuloksista. Kyselytutkimus on osa laajaa tutkimuskokonaisuutta. TEKESin rahoittama HAVERI-projekti on Tampereen teknillisen yliopiston ja Lappeenrannan teknillisen yliopiston tutkimus, jossa pyritään selvittämään rakennusala ja koneenrakennuksessa hankintojen johtamiseen liittyviä keskeisiä riskien hallintaan käytettyjä tapoja, itse riskejä ja sekä riskien että talouden hallinnan tapoja. Tarkastelun kohteena ovat erityisesti projektiliiketoiminnan haasteet hankinnoissa.

Kyselytutkimuksen tärkeimpänä tavoitteena oli saada läpileikkaus hankintatoimen haasteista, riskeistä ja kustannustekijöistä suomalaisissa projektiliiketoimintaa harjoittavissa yrityksissä. Tutkimuksesta kävi ilmi, että suomalaiset yritykset luottavat eniten kokemukseensa ja toimittajien referensseihin hankintariskien hallinnassa. Yleisesti ottaen kokonaiskustannuksen käsite vaihteli toimialojen ja yritysten välillä. Suurimpana kustannustekijänä arvioitiin olevan hankintaa edeltävät kustannukset. Yleisesti ottaen, tämän tutkimuksen valossa näyttäisi siltä että projektien rahallinen arvo ja hankinnan osaaminen olisivat projektihankintojen riskien hallinnan aktiivisuuteen kaikkein vaikuttavimpia tekijöitä.

Avainsanat: hankintatoimi, toimitusketjun hallinta, kilpailukyky, riskienhallinta, kustannusten hallinta

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1. INTRODUCTION

1.1 Background and objectives

In tight global competition, companies aim at integrated supply chains to ensure the availability of materials and flexibility of services. Moreover, to keep the costs on a bearable level outsourcing and acquisition from cost-competitive countries have become commonplace in many companies. However, long and complex supply chains may create huge challenges to company executives in terms of risk and cost management with their supply networks. Especially, if companies are involved in project type business, supply management can be a critical point of the project's success and, therefore, understanding the total costs for project purchases (processes, materials and services) is essential. It is important to realize that the costs are not only those found inside the company, because competition takes place among supply chains and networks. Consequently, costs occurring in the entire supply chain reflect the price of the finished product or project. Moreover, projects carry inherent risk and uncertainty because of their temporary nature and, therefore, investment in strategic cost management and risk assessment of purchasing decision situations in projects can result in better financial performance in terms of cost reductions, improved working capital and risk mitigation.

Complex supply chains and the network environment can lead a company to a situation where it is not able to control its independent suppliers. Hence, the question is how far upstream in the supply chain it is possible to extend the control of suppliers to reduce supply risks. Furthermore, the risks in supply chains are often interrelated. Consequently, risk mitigation strategies should aim at the root causes of the risks and cost factors. Because the root causes of supply risks are derived mostly from upstream suppliers, it is important to assess supply network risks and costs by mapping the entire supply network and following with risk identification and finding the locations of the possible risks and cost factors.

This report summarizes the survey results where the risks and costs in purchasing decision situations in project business were under scrutiny. The survey is part of a large two-year research project started in June 2012 in Finland (on-going 06/2012–07/2014). The project is launched and financed by TEKES, the Finnish Funding Agency for Technology and Innovation, and executed together with the researchers from Lappeenranta University of

Technology and Tampere University of Technology. The overall goal of this on-going research project is to find out the decision-making practices in the project-oriented companies in their purchasing decisions especially in the mechanical engineering, construction and ship-building industries in Finland. Firstly, the aim is to understand purchasing decision-making and the organizing of purchasing processes in project business. Secondly, the objective is to examine the ways of utilizing profitability management and risk management in the decision-making. Furthermore, the aim of this research project is to create knowledge of the special features of project procurement, promote understanding of the total cost of ownership in project planning and increase awareness of the critical supply network risks. The research project takes a multidisciplinary approach by combining the disciplines of accounting, supply management and risk management. From the managerial point of view the objective is to develop the project managers' ability to evaluate proactively the economic and financial effects of supply network risks in the purchasing decision situations in project business. The aim of this specific survey was to identify the substantial risks occurring in supply management and supply chains, the cost effects of those risks to business and figure out how these risks can be managed in supply decisions in the Finnish companies.

1.2 Conducting the survey

The survey questionnaire was designed to cover strategic supply management, risk management, cost management, supplier relationship management, sustainability and capability. The risk and cost factors included in the questionnaire were partly collected from the previous studies and incorporated in the results of a workshop organized with three company representatives to ensure the relevance of the factors. In addition, the questionnaire was sent to five academics and three purchasing professionals working in project business for comments. After this the questionnaire was revised accordingly and modified for Webropol online survey software.

The sample was limited to companies situated in Finland with more than 50 employees and a turnover of at least €1 million. The emphasis was on the fields that were engaged in project business. The included fields were the manufacture of machinery and equipment, boat and shipbuilding, repair and installation of machinery and equipment, building construction and civil engineering (NACE codes 28, 301, 33, 41 and 42). A total of 347 companies were

identified in the selected industries drawn from the commercial Amadeus database. All 347 companies were contacted by phone in the first phase. The purpose of the phone call was to identify a suitable key informant, to give potential respondents some advance information about the survey and to increase the response rate. Of the 347 companies, 101 declined to participate in the survey (29%). A total of 260 agreed to answer, and some companies offered multiple respondents. Of those, 97 responses were received and the response rate was 37% (28% of the entire sample).

Several descriptive and background factors were included in the questionnaire to be able to categorize the responses. The financial figures were generated from the Amadeus database showing financial data based on the last available financial statement of the respondent companies and two preceding years. Table 1 summarizes the descriptive statistics of the respondents.

Table 1. Summary of the descriptive statistics of the respondents

| Descriptive Statistics* | N | Min | Max | Mean | Std. Dev. |
|--------------------------------|----------|------------|------------|-------------|------------------|
| Turnover (t€) | 97 | 4 602 | 2 586 814 | 204 301 | 482 914 |
| Employees | 97 | 40 | 8 180 | 544 | 1 099 |
| Net income (t€) | 97 | -39 013 | 691 369 | 9 282 | 70 505 |
| Profit margin % | 96 | -16 | 51 | 4 | 9 |
| ROCE | 81 | -170 | 312 | 21 | 58 |

*last available year from Amadeus database, April 12, 2013

1.3 Main results

The survey was divided to six main sections. The first two sections covered background information. The following sections were strategicness of supply management, risk management, cost management, supplier management and sustainability in supply management. The strategicness of supply management included following constructs: performance, capability, strategy and policy. A correlation analysis was run to examine correlations between the main constructs. It was found that the constructs correlated significantly with each other, except supply management performance, which did not correlate with the risk management. This is logical because the performance of supply management was measured with statements reflecting on how well purchasing fulfils the

internal customer needs whereas risk management is typically externally focused activity aiming at mitigation of losses and protection of company business.

Furthermore, supply management's capability, strategy, policy and cost management are clearly intertwined with company risk management. This is important because it has been found previously that risks are more likely to occur when purchasing is not included in the strategic planning process (Smeltzer and Siferd, 1998). In case supply management has only limited or low role in company's strategy and it is seen only a function of operational buying and purchasing, the firm is more likely to be unable to recognize the risks related to purchasing decisions. Table 2 shows the correlations between the constructs.

Table 2. The correlations of the main concepts in the survey

| Variables | N | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------|----|------|------|--------|--------|--------|--------|--------|---|
| RISKMGM | 93 | 4.07 | 1.13 | 1 | | | | | |
| COSTMGM | 96 | 5.05 | 0.52 | 0.316* | 1 | | | | |
| POLICY | 96 | 4.98 | 1.26 | 0.364* | 0.441* | 1 | | | |
| STRATEGY | 96 | 5.33 | 1.10 | 0.407* | 0.417* | 0.705* | 1 | | |
| CAPABILITY | 96 | 4.52 | 1.16 | 0.473* | 0.452* | 0.783* | 0.806* | 1 | |
| PERFORMANCE | 95 | 5.26 | 0.74 | 0.060 | 0.399* | 0.631* | 0.543* | 0.570* | 1 |

* Correlation is significant at the 0.01 level (2-tailed).

It seems that Finnish companies rely on their experience and supplier references in their risk management. There is a lack of skills using special risk management methods and tools, and the main risk management element in the respondent companies was subjective judgment and the decision-maker's experience of the supply market. The impact of the risk was assessed mainly based on cost effects and the monetary value of the project. However, the respondents used enforcing elements in their purchasing contracts, collaboration with suppliers and multiple sourcing. When examining the impact of the duration of the project, the value of the project, the company's purchasing policy, strategy and capability; it was found that the capability of supply management is of main importance in risk management. Moreover, the monetary value of the project was an influencing factor.

Interestingly, strategic role of supply management and purchasing policy did not have direct effect on risk management activity in the respondent companies even though significant correlation was found. Hence, further examination is needed. Table 3 shows the results of the regression analysis.

Table 3. Influencing factors on risk management activity

| Factors | Coefficient β | St. Error | St. Coefficient β | t-value | Sig. |
|-------------------------------|---------------------------------------|------------------|---|----------------|-------------|
| Duration of the project | -0.032 | 0.12 | -0.027 | -0.267 | 0.791 |
| Monetary value of the project | 0.073 | 0.038 | 0.185 | 1.893 | 0.062* |
| POLICY | -0.035 | 0.146 | -0.04 | -0.244 | 0.808 |
| STRATEGY | 0.074 | 0.172 | 0.072 | 0.431 | 0.667 |
| CAPABILITY | 0.447 | 0.187 | 0.459 | 2.383 | 0.020** |
| Adjusted R square | 0.213 | | | | |
| F-value | 5.492*** | | | | |

*p<0.1;**p<0.05;***p<0.01

In general, the understanding of the total cost structure varies among the industries and companies. Often it is referred to be life-cycle costs covering the costs over an expected life span of an investment or is associated with the costs of the inbound supply chain. In this study, based on the Total Cost of Ownership or TCO model (Ellram, 1995), the total costs of purchasing were divided in the survey into pre-transaction costs, actual transaction costs and post-transaction costs. The main cost factor in risk management was costs before the actual purchase decision. The costs before purchasing are comprised of planning, specification and negotiation of purchases and investments. In addition, costs after the buying decision, such as waste disposal, maintenance and costs of environment protection had a significant impact on risk management. Table 4 presents the result of the regression analysis.

Table 4. The importance of total cost factors

| Cost factors | Coefficient β | SE | St. Coefficient β | t | Sig. |
|---------------------|---------------------------------------|-----------|---|----------|-------------|
| Before | 0.537 | 0.13 | 0.462 | 4.126 | 0.000** |
| During | -0.034 | 0.121 | -0.029 | -0.277 | 0.782 |
| After | 0.271 | 0.137 | 0.218 | 1.975 | 0.051* |
| Adjusted R square | 0.338 | | | | |
| F-value | 16.687** | | | | |

*p<0.1;**p<0.05

The risks attached to sustainability in the supply chain may damage a firm's brand, its image and its whole business. The role of supply management is to control and minimize sustainability risks arising from the supply base and ensure that suppliers follow the

guidelines set by buyers. In purchasing decision making supplier selection is critical activity in the context of sustainability (Igarashi et al., 2013). However, selecting the right suppliers is not enough, and continuous evaluation and assessment of suppliers are required. Moreover, continuous evaluation of suppliers' practices related to sustainability is critical in today's business environment. Thus, sustainability issues need to be considered in processes of supplier selection and evaluation. Company's internal policies and purchasing criteria are important in the process of implementing responsible purchasing (Leire and Mont, 2010).

1.4 Limitations

The amount of 97 responses from Finnish companies is rather low for statistical analyses; however the responses represented 37% of the sent questionnaires which is quite general level in business studies (Baruch and Holtom, 2008). Non-response bias was assessed on a number of variables (e.g., industry, number of employees and the year of foundation) by comparing early and late respondents, following the suggestions of Armstrong and Overton (1977), and no significant differences between them were not found. In the survey, single respondents were used which may have led to a common respondent bias. Moreover, the respondents of the survey and the case company were Finnish companies, hence the national context may mean that generalizing the results to different countries and cultures may not be definitive. Finally, the study was limited to an internal view of the firm. However, in business external and environmental factors have a considerable role in creating strategies and organizing. Such factors as competition, market specificity, availability of workforce and its price, scarcity of raw materials and other resources were not taken into account in this study.

2. BASIC INFORMATION ABOUT THE RESPONDENTS

2.1 Fields of operation

The purpose of the survey was to study the current risk and cost management factors and practices in the purchasing situations of project type business in the mechanical engineering, construction and marine industries. Therefore, five fields of operation were selected for scrutiny. The included fields were the manufacture of machinery and equipment, boat and shipbuilding, repair and installation of machinery and equipment, building construction and civil engineering. All of these are engaged in project business in Finland. The biggest group (51.5%) of the respondents was the manufacturers of machinery and equipment (Figure 1).

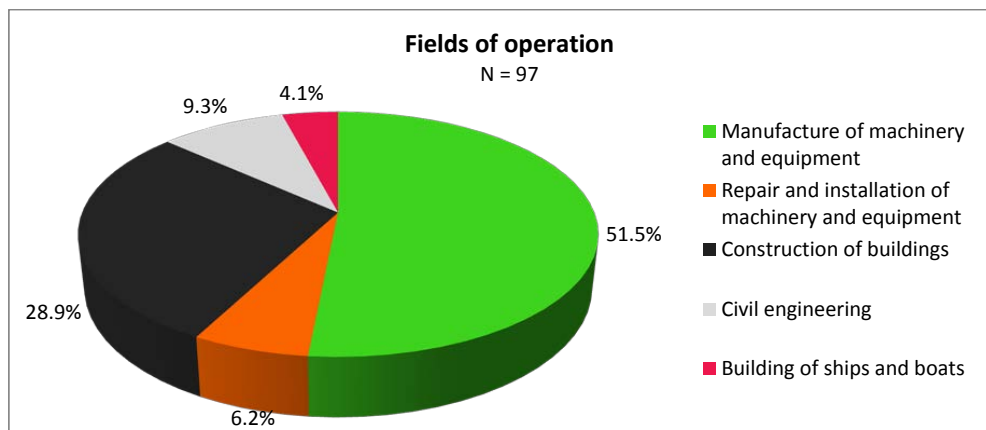


Figure 1. The distribution of the respondents' industries

2.2 The size of the respondent companies

The oldest respondent company was over 115 years old and the newest one was established 3 years ago. On average, the companies were 23 years old. In general, the respondent companies were rather small. The mean revenue was €204,301 t (N=97) and the profit margin percentage 4. Of the respondents, 67% had revenues less than €50 million (Figure 2).

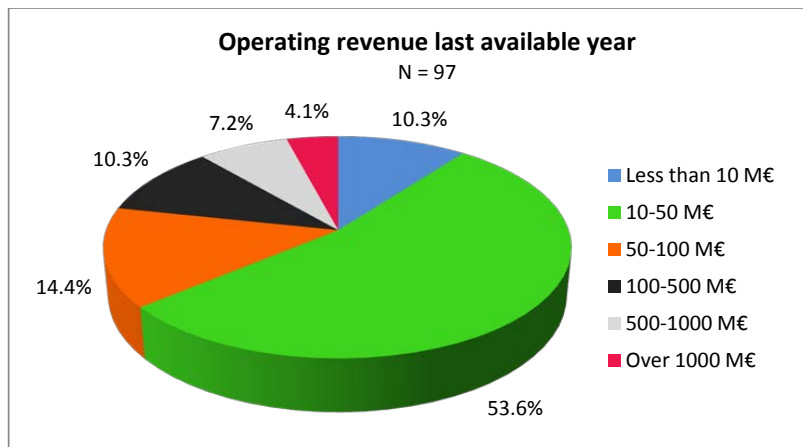


Figure 2. Distribution of turnover in the respondent companies

In the field of mechanical engineering, the average turnover was €231 million, in boat and shipbuilding €43 million, installation and repair of machinery equipment €91 million, the construction industry €230 million, and in civil engineering the average turnover was €115 million. Table 5 shows the summary of the financial figures categorized by field of operation.

Table 5. Summary of the financial figures by field of operation

| Case Summaries | | Turnover | Net Income | Profit Margin % | ROCE |
|---|---|-----------------|-----------------------|----------------------------|-------------|
| Manufacture of machinery and equipment | N | 50 | 50 | 50 | 40 |
| | Mean | 231 652 | 16 937 | 6 | 21 |
| | Median | 35 799 | 772 | 5 | 16 |
| | Min | 4 602 | -20 143 | -16 | -56 |
| | Max | 2 586 814 | 691 369 | 51 | 271 |
| | Std. Dev. | 554 492 | 97 589 | 11 | 48 |
| | Repair and installation of machinery and equipment | N | 6 | 6 | 6 |
| Mean | | 91 588 | 2 097 | 2 | -2 |
| Median | | 26 789 | 1 088 | 5 | 23 |
| Min | | 6 174 | -2 573 | -12 | -170 |
| Max | | 391 219 | 10 238 | 11 | 74 |
| Std. Dev. | | 149 918 | 4 529 | 10 | 89 |
| Building construction | | N | 28 | 28 | 28 |
| | Mean | 230 995 | 1 785 | 2 | 17 |
| | Median | 30 544 | 495 | 2 | 16 |
| | Min | 5 820 | -39 013 | -11 | -76 |
| | Max | 2 303 908 | 44 034 | 10 | 130 |
| | Std. Dev. | 496 814 | 12 413 | 4 | 39 |
| | Civil engineering | N | 9 | 9 | 8 |
| Mean | | 115 826 | -544 | 4 | 21 |
| Median | | 25 353 | 176 | 6 | 10 |
| Min | | 7 559 | -11 219 | -3 | -20 |
| Max | | 493 687 | 2 766 | 9 | 112 |
| Std. Dev. | | 171 695 | 4 112 | 4 | 48 |
| Boat and shipbuilding | | N | 4 | 4 | 4 |
| | Mean | 43 696 | -1 035 | 0 | 83 |
| | Median | 46 329 | 623 | 3 | 25 |
| | Min | 12 651 | -7 394 | -11 | -28 |
| | Max | 69 475 | 2 007 | 5 | 312 |
| | Std. Dev. | 28 702 | 4 307 | 7 | 155 |
| | Total | N | 97 | 97 | 96 |
| Mean | | 199 204 | 9 282 | 4 | 21 |
| Median | | 31 364 | 504 | 3 | 16 |
| Min | | -675 | -39 013 | -16 | -170 |
| Max | | 2 586 814 | 691 369 | 51 | 312 |
| Std. Dev. | | 482 436 | 70 505 | 9 | 58 |

On average, the respondent companies had 543 employees (N=97). The largest company had over 8,000 employees. All companies had at least 40 employees. Of all the responding firms, 65% had less than 200 employees.

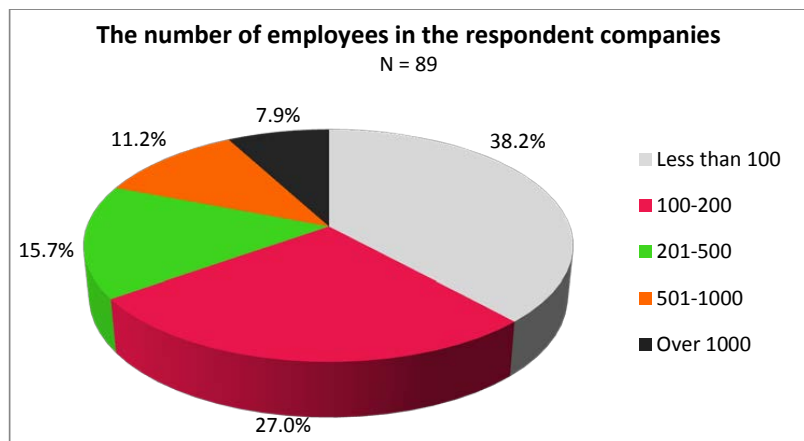


Figure 3. The number of employees

2.3 The respondents

The survey was sent to responsible directors, project managers or purchasing professionals according to the contact information obtained during the first telephone contact. Most of the respondents were in middle management positions (79% of the respondents worked in either top or middle management). The respondents' average overall work experience was 22 years. Of the respondents, 74% had 5–20 years of experience in supply management. Almost half of the respondents (49.5%) had less than 10 years of supply management experience. The average supply management experience was 13 years. In general, the overall work experience was higher than experience in supply management. Hence, it seems that people move to supply management from other tasks.

Long work experience indicates that the respondents are competent professionals in the field they operate in and have good knowledge about project business and the challenges of supply management in it. This increases the validity of the results of the survey. Furthermore, it was found that there were no differences in terms of work experience among the industries (ANOVA test, Sig. 0.120 work experience, Sig. 0.214 experience of supply management). Figures 4, 5 and 6 show the distribution of the positions and experience.

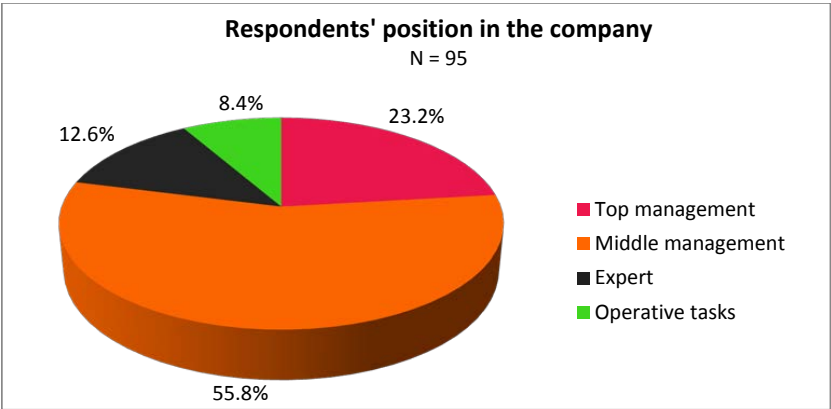


Figure 4. Position in companies

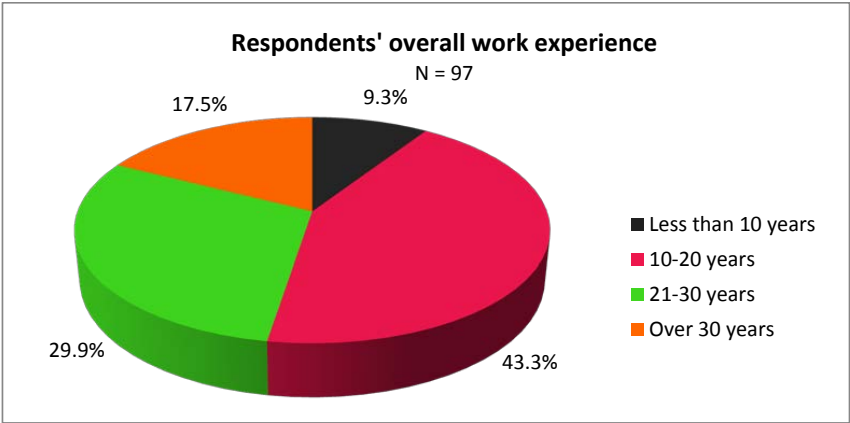


Figure 5. Overall work experience

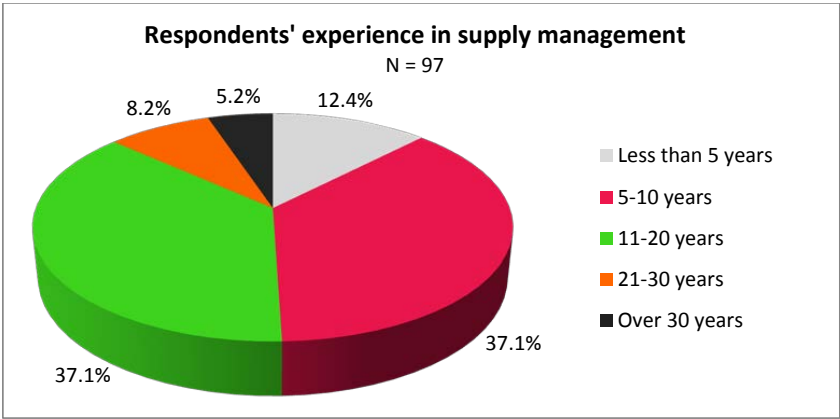


Figure 6. Work experience related to supply management

2.4 The length, size and number of projects

The length of the projects varied significantly among the industries. In the manufacture of machinery the average length of projects was 6 months, in repair and installation of machinery and equipment (i.e. maintenance, repair and operations, MRO industry) it was considerably longer i.e. 14 months. In the construction industry the average length of the projects was 9 months, civil engineering 8 months and in shipbuilding the average length of a project was 12 months. The average length of one project for all fields of operation was 8 months and, for all fields of operation, the projects usually lasted less than 10 months. In civil engineering and repair and installation of machinery and equipment all projects lasted less than 20 months. Figure 7 shows the lengths of the projects in each of the studied industries.

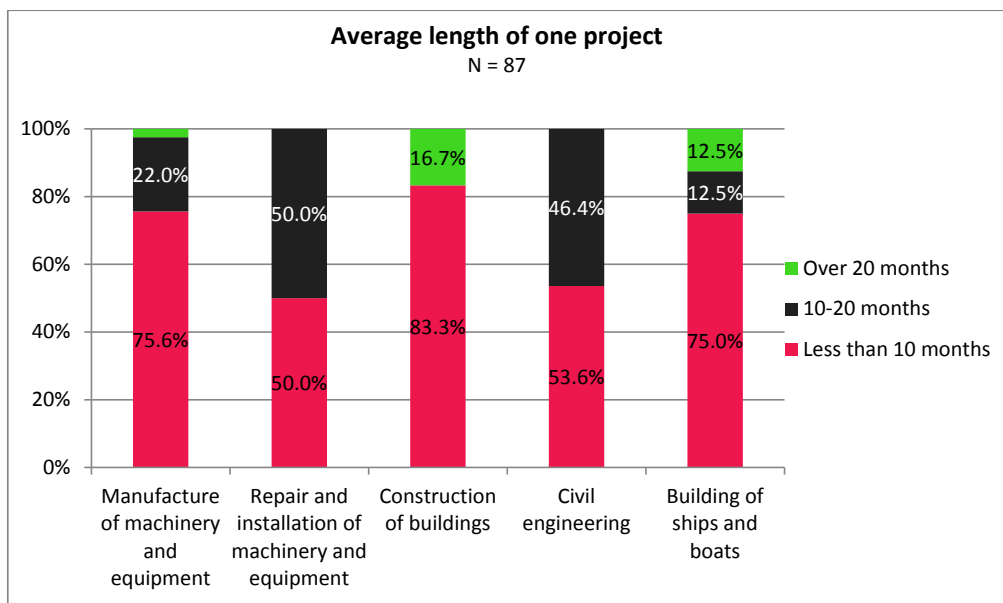


Figure 7. The average length of projects

In general, the size of the projects measured with their monetary value did not vary among the industries. The average monetary value of one project in all fields of operation was €6,700 t. The highest monetary value was in the construction industry (€135,647 t) and the lowest in the manufacture of machinery and equipment (less than €3,000 t). The highest variation among the projects measured in euros was in the field of shipbuilding where the standard deviation between the projects was €84,077 t. For all fields of operation, 43% of the

projects had a value less than €1,000 t and only 9.5% of the projects had a value over €100,000 t. Figures 8 and 9 show the size of the projects by industry and in general.

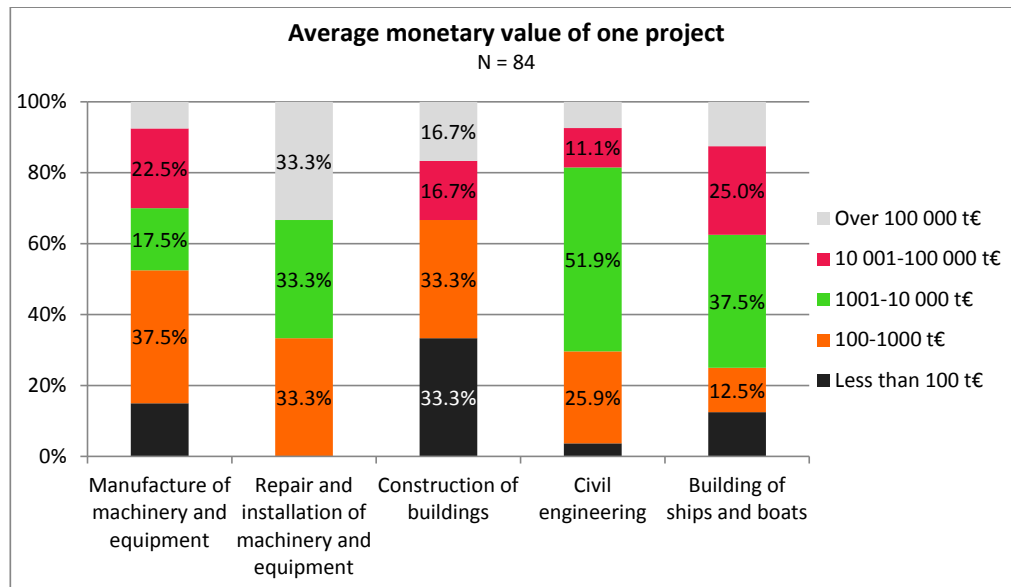


Figure 8. The size of the projects by industry

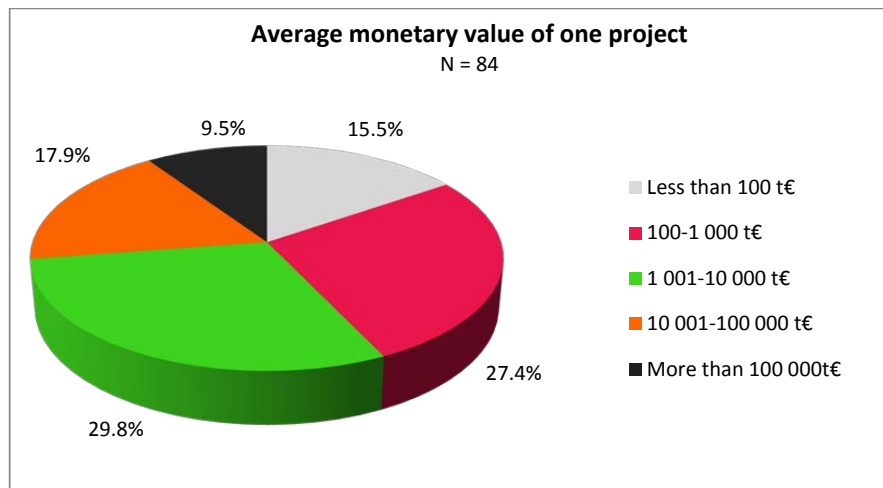


Figure 9. The size of the projects in all industries

On average, 90 project orders were received per year. The number of orders placed varied significantly among the industries. Shipbuilding clearly had less projects (six orders per year on average) than other industries. In the manufacture of machinery and equipment the average number of orders per year was 113, in the field of MRO 199, in construction 58 and

in civil engineering 53 orders per year. In total, 71% of all the respondents had 50 or less project orders a year. Figure 10 shows the division of orders per year among all the respondents.

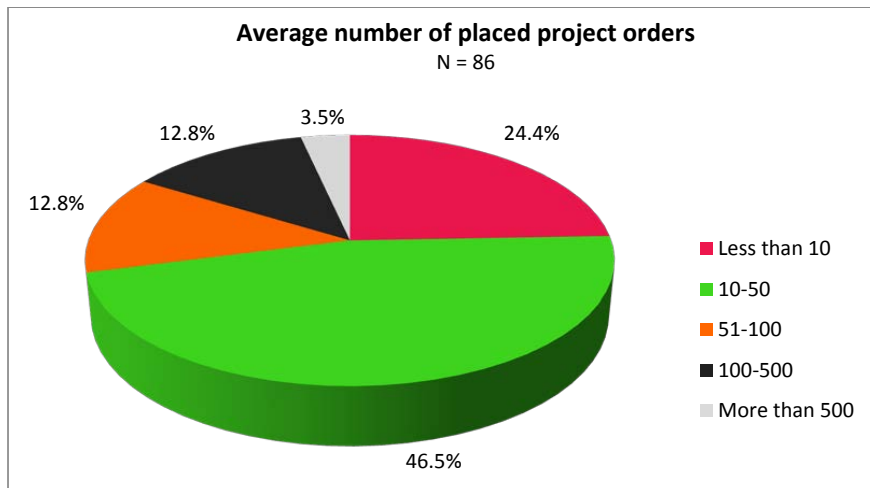


Figure 10. The number of orders

Table 6 summarizes the averages of the project length, size, number of orders and staff by respondent industry. The number of staff involved in one project varied largely. The highest variation was again in the field of shipbuilding i.e. from 4 to 800 people. Interestingly, there was no correlation among the project length, value and number of staff. Hence, each project has its own characteristics and they do not employ people based on the value or the length of the project. Moreover, the long projects are not necessarily high value projects.

Table 6. Project length, size, number of orders and staff by industry

| Project characteristics | Manufacturing | MRO | Construction | Civil engineering | Ship-building |
|--------------------------------|----------------------|------------|---------------------|--------------------------|----------------------|
| Length of the project /months | 6 | 14 | 9 | 8 | 12 |
| Number of orders/year | 113 | 199 | 58 | 53 | 6 |
| Size of the project t€ | 52 842 | 56 888 | 135 647 | 126 297 | 53 000 |
| Number of staff/project | 29 | 21 | 15 | 8 | 221 |

3. INFRASTRUCTURE AND RESOURCES OF SUPPLY MANAGEMENT

The focus of this survey was to examine the role and challenges of purchasing and supply management in project business and the connections of risks and costs in supply and purchasing decision-making. This chapter reports the characteristics of supply management in the respondent companies. The infrastructure, resources and capability of supply management vary among the firms and industries and, therefore, it is important to examine if this variation influences risk and cost management in project business.

3.1. Share of purchases from turnover

Figure 11 presents the value of purchases compared to the turnover of the respondent companies. On average, the share of purchases from turnover was 55%. The highest share 65 % was in the construction industry and the lowest 42 % in shipbuilding. In total, the spend summarized from the respondent companies was €109.5 million (55% x average turnover of all respondents €199,204 t). Table 7 shows the shares by industry.

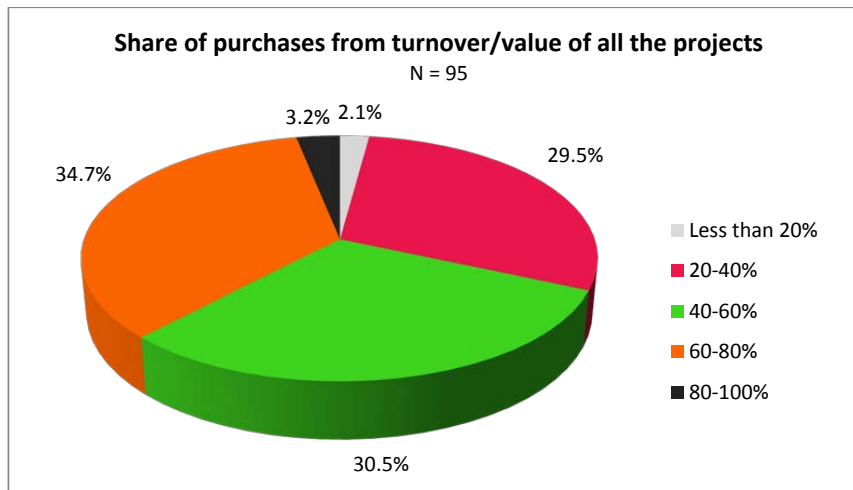


Figure 11. The share of purchases from turnover

From the respondents shipbuilding had the highest rate of purchases from abroad (47%). The MRO (77%) and manufacturing (75%) companies use mainly centralized purchasing department in their purchases whereas civil engineering (58%) and shipbuilding (58%) made their purchases through project organization.

Table 7. Means of purchases in the respondent industries

| Purchases share (%) | Manufacturing | MRO | Construction | Civil engineering | Ship-building |
|-------------------------------------|----------------------|------------|---------------------|--------------------------|----------------------|
| from turnover | 51.76 | 42.5 | 64.73 | 56 | 41.67 |
| from abroad | 34.61 | 29.17 | 8.48 | 10.56 | 46.67 |
| from low-cost countries | 9.85 | 16.17 | 1.19 | 4.44 | 7.33 |
| centralized (purchasing department) | 74.79 | 76.67 | 57.5 | 25.63 | 41.67 |
| project organization | 22.5 | 23.33 | 38.15 | 58.33 | 58.33 |

Of all purchases, 25% were bought from abroad and 7% from low-cost countries. Most of the purchases were centralized to the purchasing department (64% of all purchases) but project organizations bought directly 32% of all purchases. Table 8 presents the distribution of purchases among the industries and Table 8 shows the summary of how purchases were done in all the respondent companies.

Table 8. Purchases in all respondent companies

| Share of purchases: | N | Min. % | Max. % | Mean % | SD. % |
|-------------------------------------|----------|---------------|---------------|---------------|--------------|
| from turnover | 95 | 15 | 90 | 55.08 | 17.87 |
| from abroad | 95 | 0 | 98 | 24.67 | 26.26 |
| from low-cost countries | 93 | 0 | 60 | 7.14 | 10.80 |
| centralized (purchasing department) | 90 | 0 | 100 | 64.44 | 35.17 |
| project organization | 87 | 0 | 100 | 32.36 | 35.06 |

3.2. The number of full-time purchase professionals

Altogether 1,663 purchase professionals worked full-time in the duties of supply management in the respondent companies. However, in general, only few people were responsible of supply management and purchasing in the respondent companies: 68.5% had less than five purchase professionals and 24.7% had only one full-time purchase specialist. In the manufacture of machinery and equipment the average number of purchase professionals was 27, in the field of MRO 11, in construction 9, civil engineering 2 and shipbuilding 6. Figure 12 shows the number of purchase professionals.

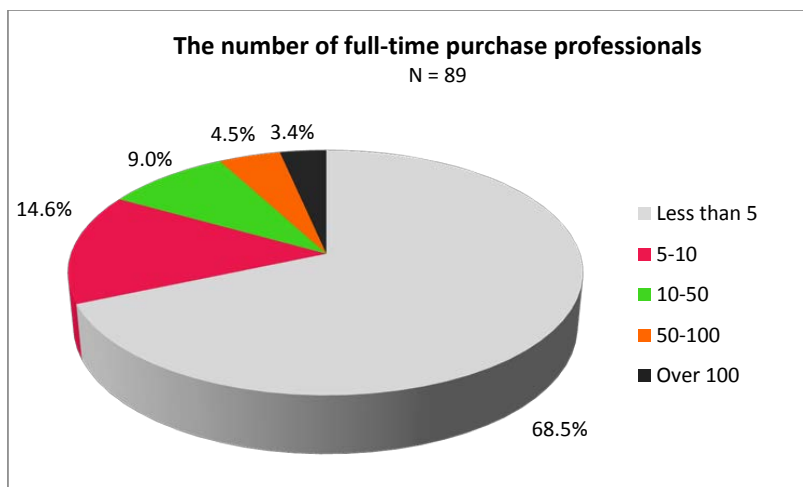


Figure 12. The number of full-time purchase professionals

3.3. Division of purchases

Half of the purchases were products and materials (52%) and half services and integrated purchases (service and material package). However, the differences between service and material buying and integrated purchasing can be unclear and, thus, for a respondent difficult to estimate. Figure 13 describes how the purchases were divided.

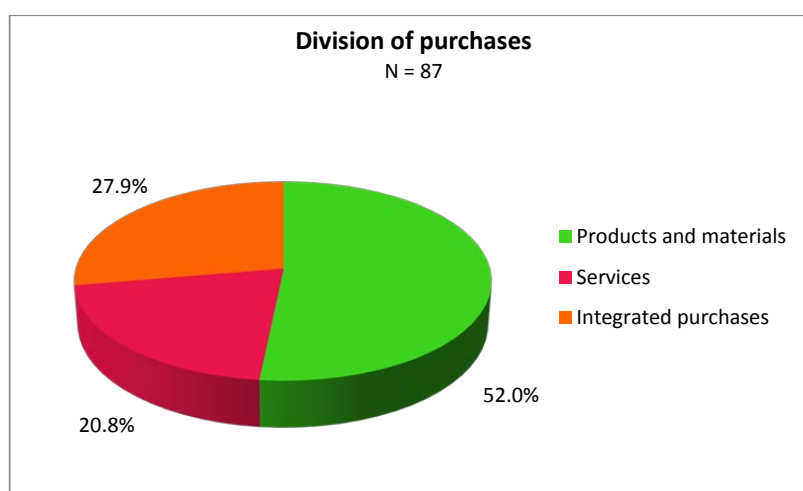


Figure 13. Division of purchases

3.4. Number of suppliers

In total, the respondents had in their registers 207,811 suppliers. On average, the respondents had 2,259 (mode 200, median 400) suppliers in their registers. Of all the respondents, 56.5% had less than 500 suppliers in their registers and 27.1% had over 1,000 registered suppliers. However, the number of active suppliers with whom the respondents had daily business was clearly less. The mean number of actively used registered suppliers was 866 (mode 50, median 150). Of the respondents, 85% used less than 500 suppliers per year and 35% used less than 100 suppliers per year. Of all the registered suppliers, only 38% (78,833/207,811) were active in the respondent companies. Figures 14 and 15 show the numbers of respondent companies' suppliers.

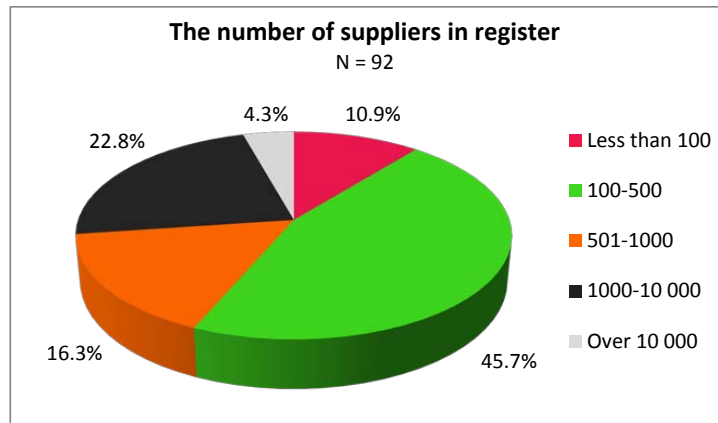


Figure 14. The number of registered suppliers

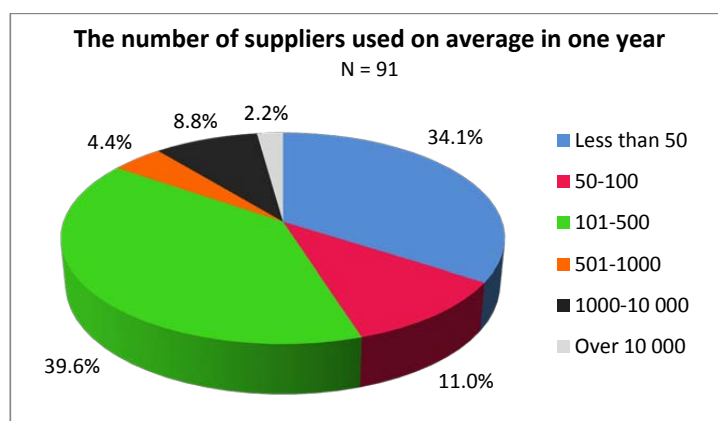


Figure 15. The number of active suppliers registered

In the field of shipbuilding, only 16% of the suppliers were actively used whereas in the construction industry the corresponding figure was 65%. It seems that in the construction industry the supplier base is more optimized than in the other fields. However, it is possible that due to the specific nature of the project business (projects are dynamic and complex activities within a period of time and unique one-off settings) it is more difficult to keep the supplier base updated. Table 6 shows the number of suppliers by industry.

Table 9. The number of suppliers by respondent industry

| Registered number of | Manufacturing | MRO | Construction | Civil engineering | Shipbuilding |
|-----------------------------|----------------------|------------|---------------------|--------------------------|---------------------|
| suppliers | 2 415 | 539 | 1715 | 3 774 | 3 600 |
| items | 28 831 | 2 838 | 20 670 | 1 121 | 9 167 |
| active suppliers | 674 | 234 | 1120 | 1 608 | 567 |

On average, the number of items in the respondents' registers was 22,038 (mode 2,000, median 2,250). 65% had 1,000–100,000 items in their registers and 30% had less than 1,000 items in their registers. Figure 16 shows the number of registered purchasing items.

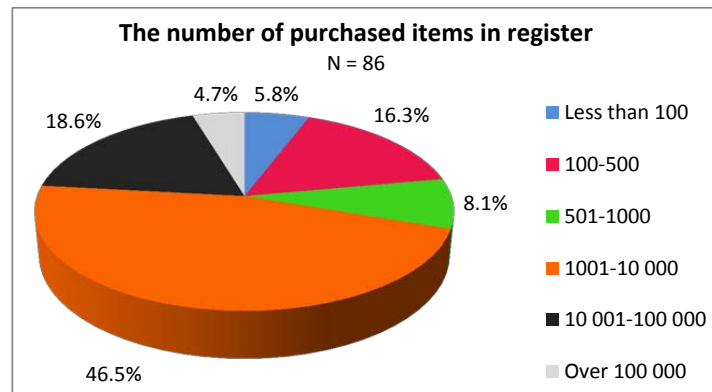


Figure 16. Registered purchasing items

4. SUPPLY MANAGEMENT STRATEGY

Strategic supply management means that the company’s purchasing function is integrated into the company’s business strategy. The supply management strategy should be based on the objectives and strategic principles of the firm. Supply strategies vary from one purchasing situation to another and each strategy has to be tailored according to the characteristics of products and services acquired. The supply strategy consists of several components that define actions in different supply situations, such as the make-or-buy decision, the size of the supply base, the geographic area of supply activities, supplier relationship management and the form of the purchasing organization.

4.1. Strategic role of supply management

The role of supply management in the respondent companies was examined with several statements reflecting the strategic level of the purchasing function. According to the respondents, in the responding companies 56% of the corporate management regard the strategic role of supply management to be high or extremely high, and 79% see that supply management strengthens the competitive advantage of the firm. Figure 17 shows the role of supply management in the responding companies.

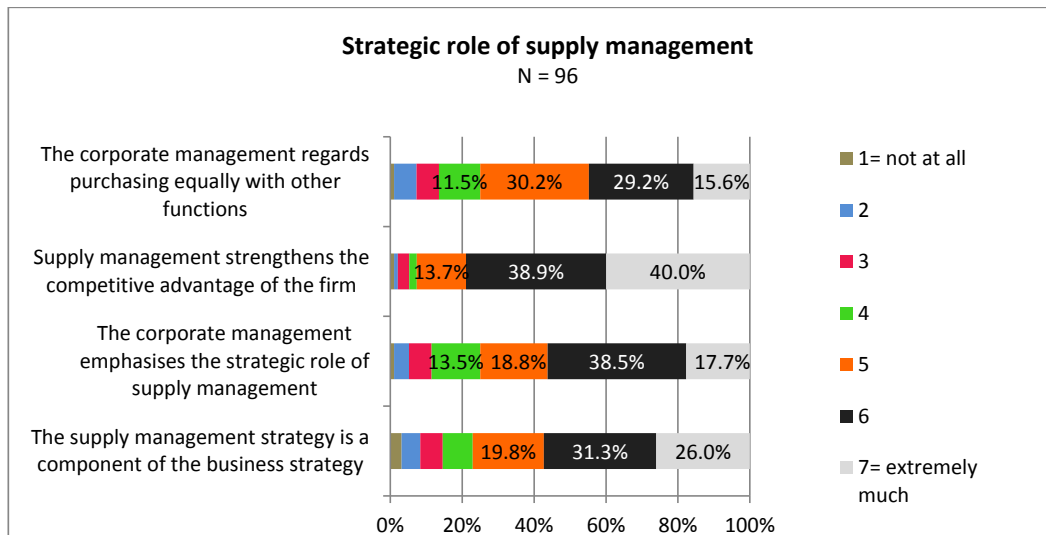


Figure 17. Supply management is seen as an important part of the company’s business strategy

- The strategic role of supply management
 - *The supply management strategy is a component of the business strategy (mean 5.3)*
 - *The corporate management emphasizes the strategic role of supply management (mean 5.3)*
 - *Supply management strengthens the competitive advantage of the firm (mean 6.0)*
 - *The corporate management regards purchasing equally with other functions (mean 5.1)*

4.2. Supply management capability

Supply management capability is the organisation's overall capacity and ability to manage its procurement function and supply base, and to carry out its internal tasks, routines and responsibilities in order to achieve the desired results. It derives from resources, routines, skills and knowledge. It is an organisational-level asset that can influence the competitiveness and performance of the company. The skills and competences of the purchasing staff produce visible outcomes and reflect the existence of the capability.

In general, the supply management personnel are qualified. The competence of supply management is seen to be on a high or extremely high level (mean 5.3, on scale 1–7) in 50% of the respondent companies. However, 22.9% require very little or no continuous education from their supply management staff and 8.3% do not measure, evaluate or document their supply management staff or capability at all. Figure 18 presents the level of supply management capability in the responding companies.

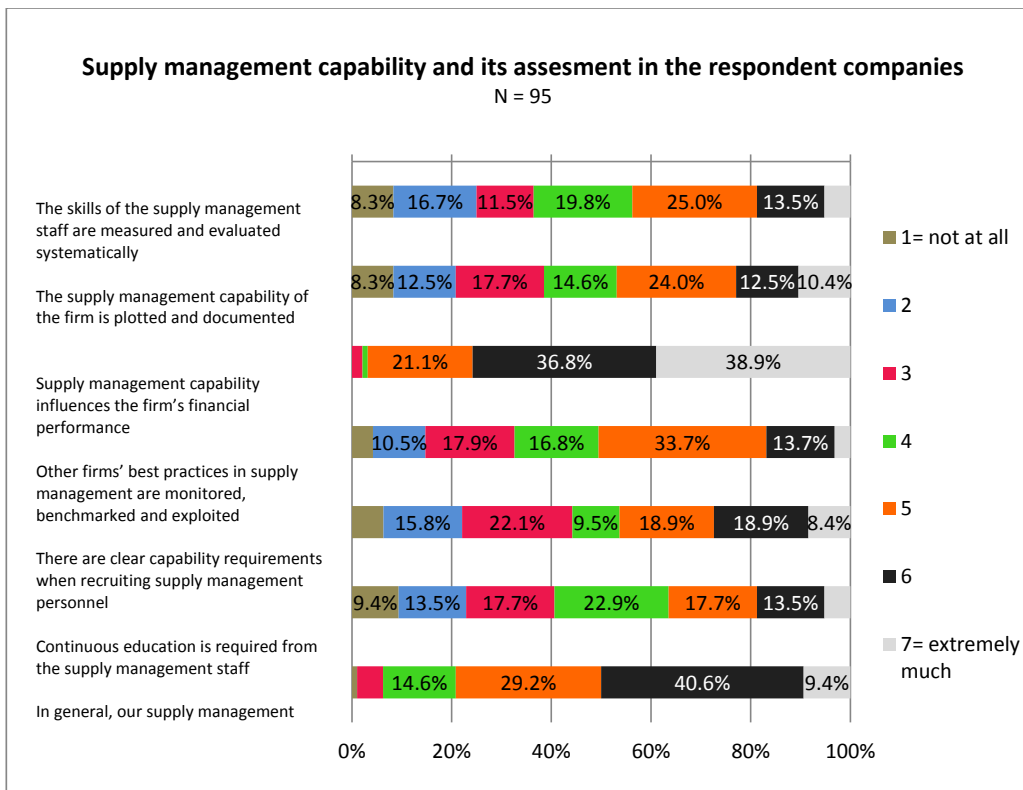


Figure 18. Supply management is seen as an important influence on the firm's financial performance

- Supply management capability and its assesment in the respondent companies
 - *The skills of the supply management staff are measured and evaluated systematically (mean 4.0)*
 - *The supply management capability of the firm is plotted and documented (mean 4.1)*
 - *Supply management capability influences the firm's financial performance (mean 6.1)*
 - *Other firms' best practices in supply management are monitored, benchmarked and exploited (mean 4.2)*
 - *There are clear capability requirements when recruiting supply management personnel (mean 4.1)*
 - *Continuous education is required from the supply management staff (mean 3.9)*
 - *In general, our supply management personnel are qualified (mean 5.3)*

4.3. Supply management's effect on end-customer satisfaction

Supply management bridges the gap between the downstream and upstream supply chain and acts as the interface of the company delivering the end-customer needs and requirements to its suppliers. Supply management's ability to meet the expectations of their end-customers' needs facilitates the formation of customer-centred supply chains. In the respondent companies, the understanding of the importance of end-customer satisfaction was on a high level: 60 % of the respondents stated that they are able to meet their end-customer expectations.

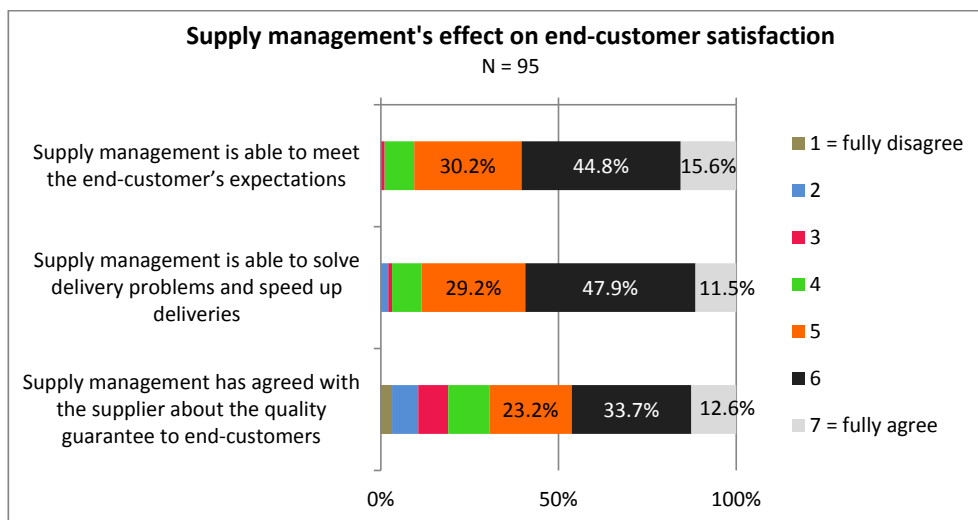


Figure 19. Supply management seems to be able to meet the end-customer's expectations very well

- Supply management's effect on end-customer satisfaction
 - *Supply management is able to meet the end-customer's expectations (mean 5.7)*
 - *Supply management is able to solve delivery problems and speed up deliveries (mean 5.5)*
 - *Supply management has agreed with the supplier about the quality guarantee to end-customers (mean 5.0)*

5. RISK MANAGEMENT

The supply network of the firm is a source of many types of risks. In project business risks can be categorized for example into supply risks, operation risks, demand risks, security risks and environmental risks. Risks can also be on various levels: macro-level risks include political and government, macroeconomic, legal, social and natural risks, meso-level risks e.g. project selection, finance, design and operation risks, and micro-level risks concern business relationships and third party risks. According to the respondents, most attention (74%) is paid on delivery risks (Figure 20).

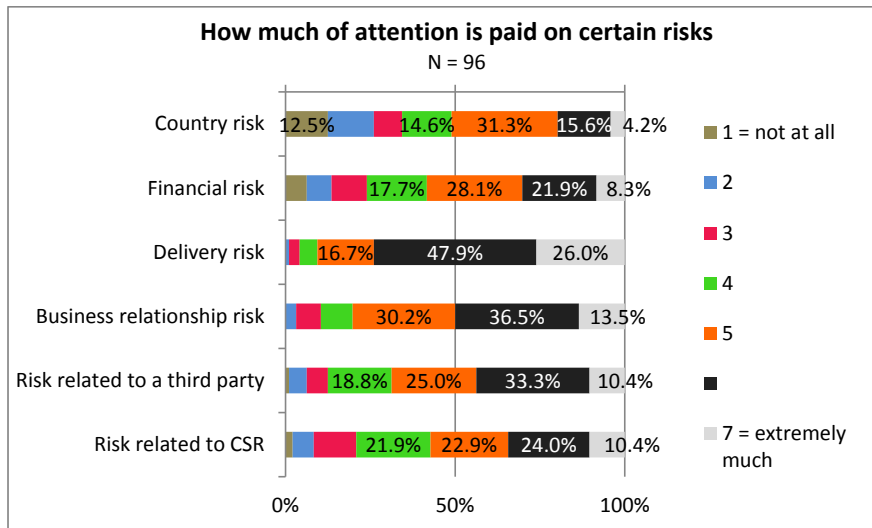


Figure 20. Country risk and financial risk are seen as the least important ones. Most attention is paid on delivery risk.

- How much attention is paid on certain risks
 - *Country risk 4.0*
 - *Financial risk 4.5*
 - *Delivery risk 5.9*
 - *Business relationship risk 5.3*
 - *Risk related to a third party 5.0*
 - *Risk related to CSR 4.7*

There are several risk management actions and strategies that can reduce or transfer the impact and likelihood of identified risks in the supply chains. The traditional actions to manage risks in supply management are ensuring multiple sources for items, safety stocks, and avoiding dubious geographical areas or suppliers in order to reduce supply risks. Of the

respondents, 42% conduct risk evaluations often or very often but rarely aim at transferring risks (36%). Another important risk management element used in the respondent companies was risk identification (38%).

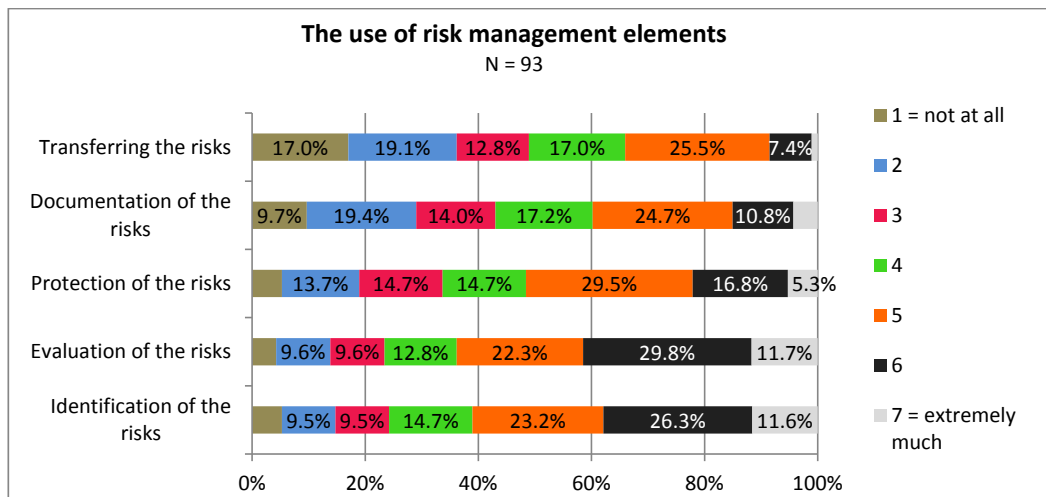


Figure 21. The use of risk management elements in the respondent firms

- The use of risk management elements
 - *Identification of the risks (mean 4.7)*
 - *Evaluation of the risks (mean 4.8)*
 - *Protection from the risks (mean 4.2)*
 - *Documentation of the risks (mean 3.8)*
 - *Transferring of the risks (mean 3.4)*

There can be several barriers that hinder risk management activities in companies. Over half (53%) of the respondents claimed that the company's demands of cost efficiency hinder risk management. Furthermore, there is lack of capabilities and tools to utilize risk management in supply management in Finnish companies. Most of the companies relied on subjective assessment, experience and intuition (mean 5.7) in their risk assessment.

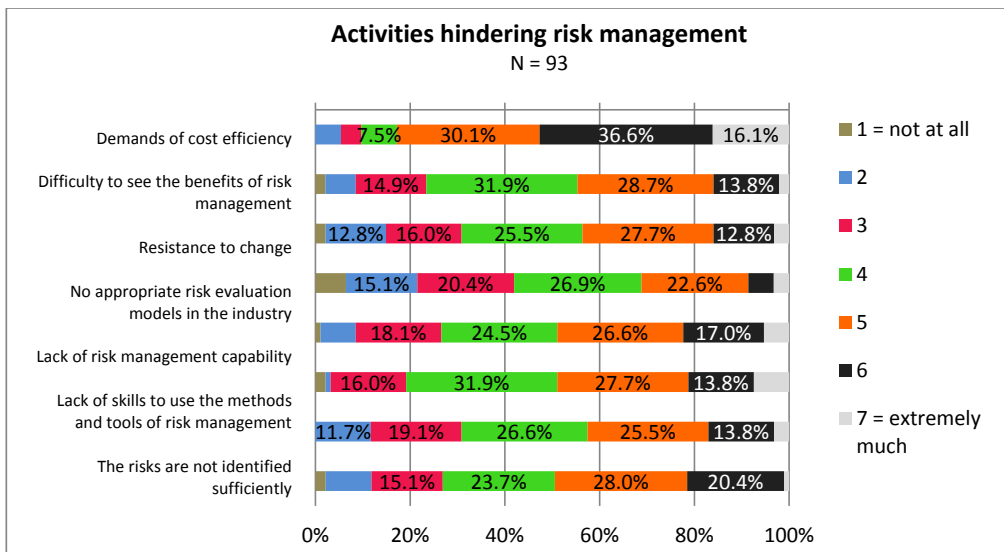


Figure 22. Demands of cost efficiency seem to hinder risk management

- Activities hindering risk management
 - *Demands of cost efficiency* 5.4
 - *Difficulty to see the benefits of risk management* 4.3
 - *Resistance to change* 4.1
 - *No appropriate risk evaluation models in the industry* 3.7
 - *Lack of risk management capability* 4.4
 - *Lack of skills to use the methods and tools of risk management* 4.5
 - *The risks are not identified sufficiently* 4.2
 - *No time for risk management* 4.3

Several risks are arising from the supply base and, thus, the significance of risk management in purchasing and supply is constantly growing. In this survey it was found that the delivery risk is the most significant risk. The availability, quality and reliability of delivery times are under concern in Finnish firms and companies invest in the management of these risks. Secondly, companies use resources and inputs in the management risks related to the dependency on suppliers and thirdly to risks related to the protection of intangible assets, such as conflicts of ownership of immaterial rights and the protection of knowledge, capability, image and brand. Figure 23 shows the inputs in risk management with regard to delivery, dependency and protection by industry.

Inputs to risk management

How much do risk management activities require resources/input/investments/money in the following risks?
(Likert scale 1-7, 1= not at all, 7= extremely much)

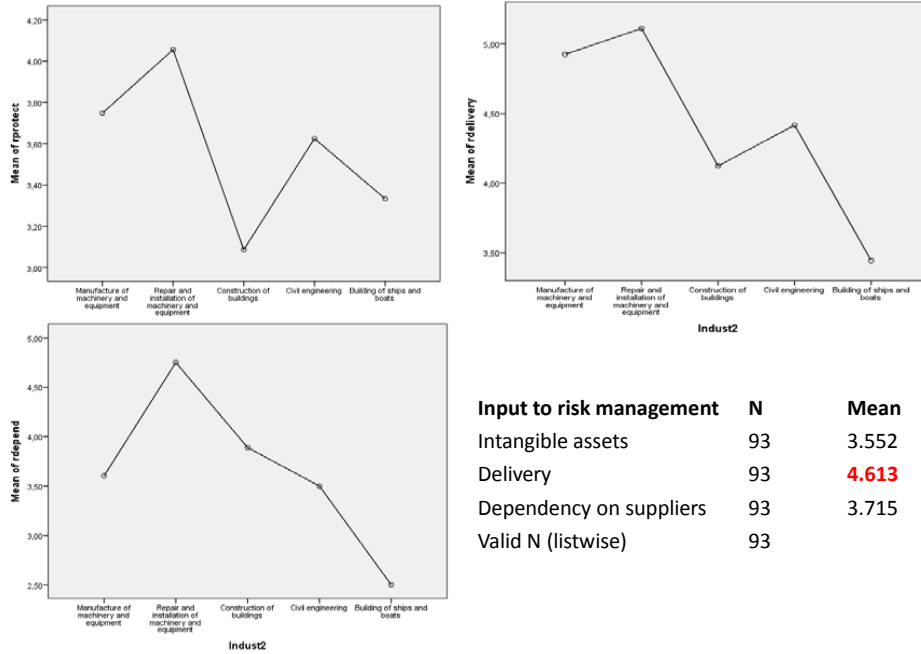


Figure 23. Inputs in risk management by industry

The results of the survey show that risk management in general is on a moderate level in the respondent companies (mean 4.07, Likert scale 1–7). The most influencing factor on risk management is the capability of supply management. The corporate strategy, purchasing policy and cost management have only minor effects on risk management. The project characteristics (duration and size) did not influence risk management significantly.

6. COST MANAGEMENT

In project purchases understanding the total cost of ownership is important. Integrating strategic cost management in the design of products, processes and the supply chain results in better financial performance in terms of cost reductions and improved working capital. Costs occur in the entire supply chain reflecting the price of the finished product in the final market place. Moreover, in project business transaction costs may play a significant role. Long negotiations and heavy bidding processes are typical. Coordination costs arise from costs of exchanging information and connecting the information to the decision process.

Purchasing costs can be static costs, such as price, transportation and regular handling costs, and/or dynamic costs, which occur because of the fluctuation of the demand, stock-outs, lost sales, obsolete materials and inability to meet customer demands. Moreover, purchases may include hidden costs because of the impact of the business environment – costs that are difficult to predict, incur on an irregular basis, reflect general overheads and are difficult to link to individual contracts.

Total costs can be divided into the costs before, during and after purchases. It seems that one third of total costs accumulates before actual purchasing, 38% during the purchasing action and 28% after purchasing. Consequently, over 60% of the total costs accumulate from other cost factors than e.g. price and delivery costs. Figure 24 shows how the total costs are divided in the respondent companies.

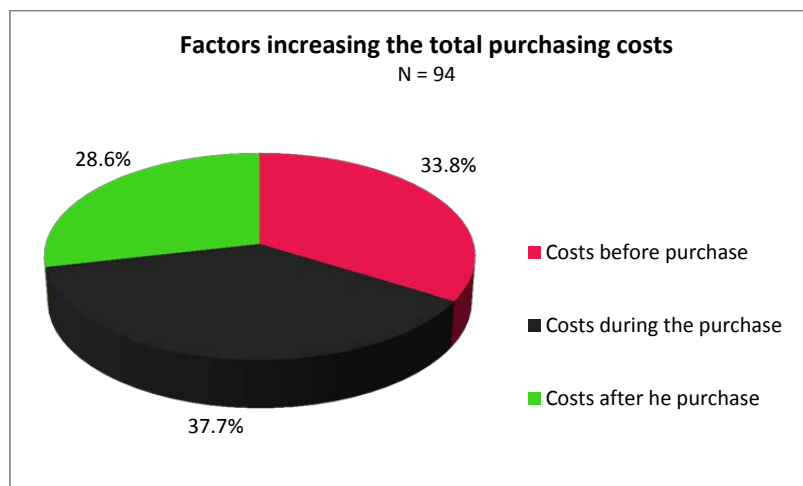


Figure 24. Division of the total costs

All respondents considered the price as an influential or a very influential factor in purchasing decisions. The respondents also stressed other factors, and total costs had the highest mean (6.4 on scale 1–7) whereas ecological and ethical features had the least impact on purchase decisions. Delivery reliability and quality were the next biggest factors in purchasing decisions. Figure 25 shows the division of cost factors according to the respondents.

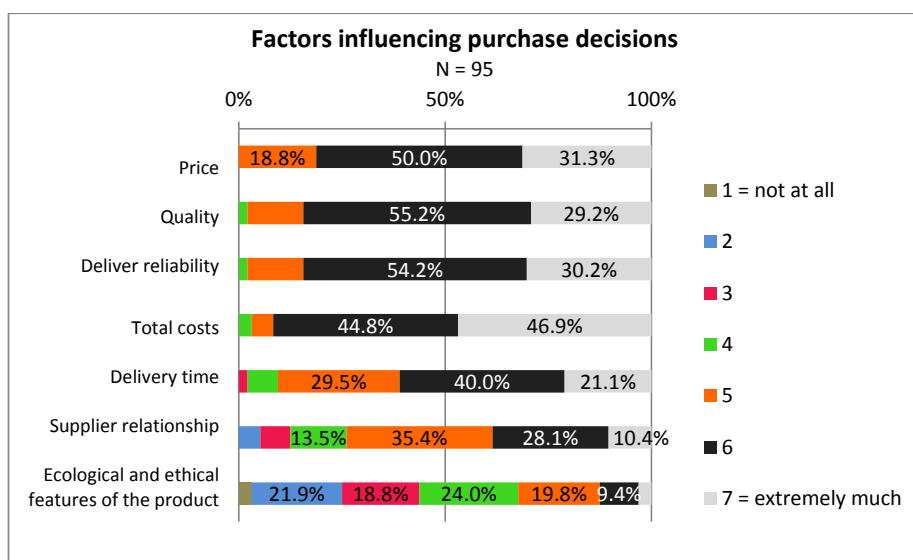


Figure 25. Total costs is the highest factor influencing purchase decisions

- Factors influencing purchase decisions
 - *Price 6.1*
 - *Quality 6.1*
 - *Delivery reliability 6.1*
 - *Total costs 6.4*
 - *Delivery time 5.7*
 - *Supplier relationship 5.1*
 - *Ecological and ethical features of the product 3.8*

The Finnish companies seem to appreciate the possibility to buy the whole service package from one supplier rather than separate components and assembling from various suppliers. Integrated (or systematic) purchasing is the buying of material and service together, and buyers prefer to purchase entities as a whole package. Integration brings together diverse products and services and benefits both the sellers and buyers. Furthermore, the possibility to utilize integrated purchasing may have a significant role in the actual purchasing decision.

For example, integration may provide cost savings, increase convenience and reduce compatibility risks. However, almost 40% of the respondents did not assess or only somewhat assessed total costs when evaluating alternative suppliers. Figure 26 shows much the respondents appreciate the possibility to buy service packages.

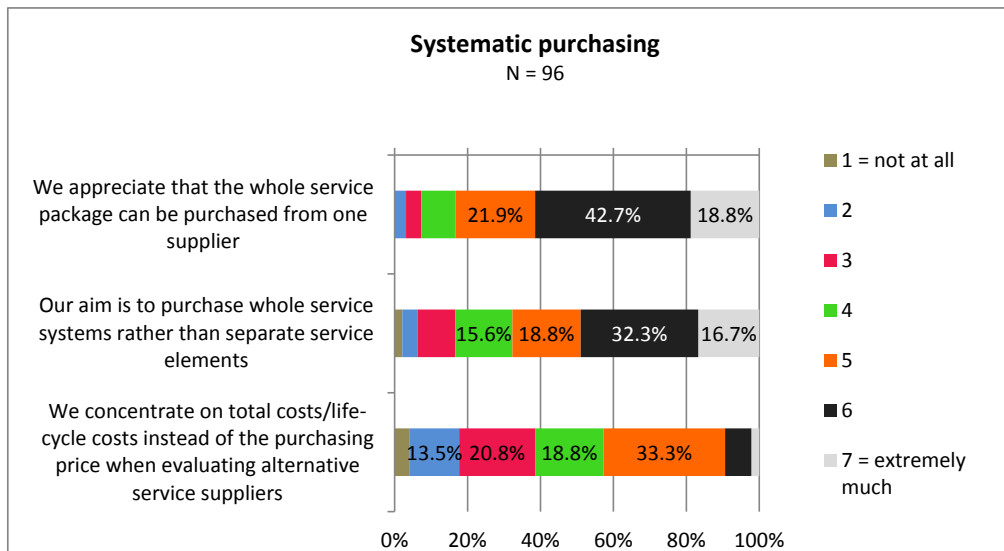


Figure 26. The possibility to buy the whole service package from one supplier is highly appreciated

- Systematic purchasing in the respondent firms
 - *We appreciate that the whole service package can be purchased from one supplier (mean 5.5)*
 - *Our aim is to purchase whole service systems rather than separate service elements (mean 5.1)*
 - *We concentrate on total costs/life-cycle costs instead of the purchasing price when evaluating alternative service suppliers (mean 3.9)*

In the respondent companies the price is the most important purchasing criterion. It came up that Finnish companies do not require top quality in their purchases. In purchasing situations total costs are taken more into account than quality. Hence, the objective in purchases is adequate quality instead of superior quality.

The cost elements in the survey were divided according to the Total Cost of Ownership (TCO) model (e.g. Ellram, 1995) into costs before, during and after purchasing. The analysis

showed that 34% of total costs accumulate before the purchasing action, 38% during purchasing and 28% after purchasing. The influence of price was included in the “during” element. It is important to note that even though the price is considered to be the most influential purchasing decision criterion, it only matters one third of the total costs. Figure 27 shows how the total costs are divided among the industries.

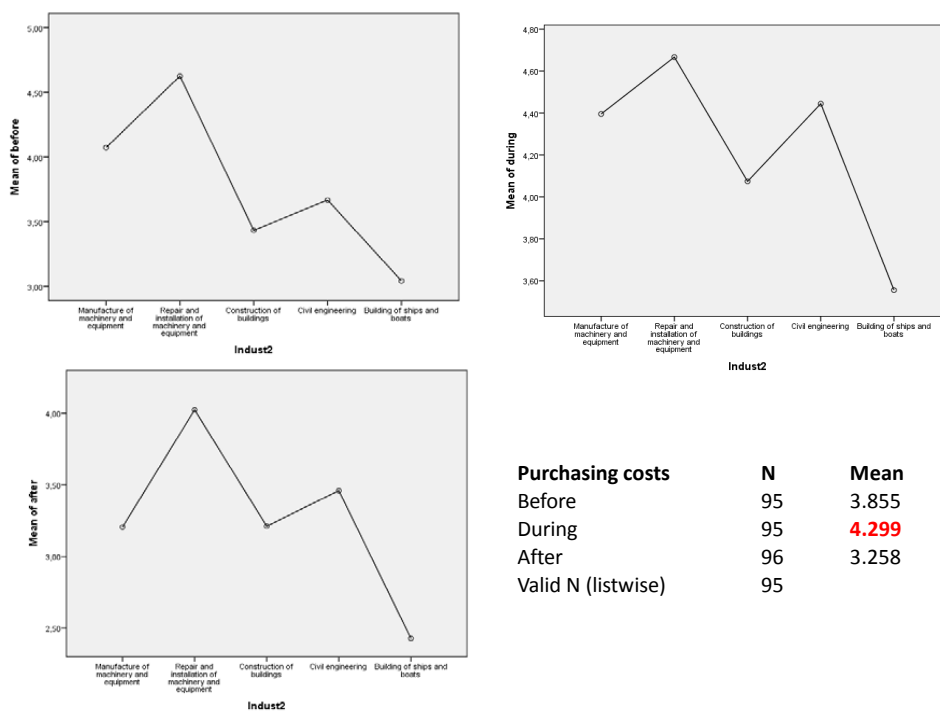


Figure 27. Total costs of purchases

Most of the respondents consider supply management to be strategically important for the company’s business. The high monetary value of purchases and the dependency on supplies and services increase the companies’ vulnerability with regard to supply chain disturbance and risks. Therefore, risk management systems should take into account both the risks and total costs of purchases. Moreover, one of the main results was that the strategicness of supply management and capability influence risk management in project organizations. Furthermore, it can be concluded that from the total cost elements the cost before purchasing and after correlate with risk management in companies. Moreover, project length was found to influence risk management.

It is logical that the probability of the occurrence of a risk incident increases when the project lead time increases. Hence, more efforts should be placed on risk management. In timely and long projects the estimations of cost accumulation must be calculated and sectioned carefully to years and/or months to avoid disruptions in payments and cash flow. Therefore, understanding the total costs in purchasing decisions is essential. In project organizations the problems of coordination and timing of purchases are common and, thus, better understanding of the cost components helps project planning.

According to the respondents, capability and the strategic level of purchasing and supply management increase the utilization of risk management mitigation elements in project organizations. The purchasing decision-makers' awareness of the importance of purchases and their high ability to conduct purchasing and supply management indicate higher risk management performance in project organizations.

7. SUPPLIER RELATIONSHIP MANAGEMENT

Supplier relationship management (SRM) is a policy that defines how the company interacts with its suppliers. The objective of SRM is to control and assess the economic consequences of the supplier relationships and to map changes in supplier relationships. The effective management of suppliers requires firms to identify the types of business relationships they have. Defining the different types of supplier relations forms the basis of the supplier relationship management system. Supplier orientation refers to the organizational activity in managing supplier relationships to achieve the firm's goals, and, hence, it can be one of the possible strategic orientations of the firm. It seems that the respondents have applied SRM activities and nearly 40% develop their business processes together with their suppliers. Only 7.4% of the respondents did not measure their supplier collaboration at all. Figure 28 shows the supplier orientation level in the respondent companies.

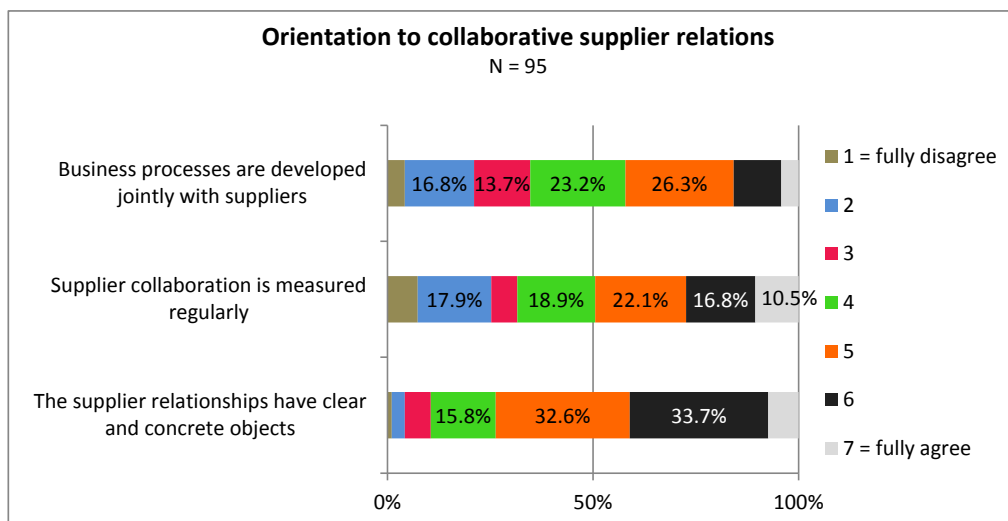


Figure 28. Companies are orientated to collaborative supplier relationships

- Orientation to collaborative supplier relationships
 - *The supplier relationships have clear and concrete objects (mean 5.1)*
 - *Supplier collaboration is measured regularly (mean 4.2)*
 - *Business processes are developed jointly with suppliers (mean 4.0)*

Early supplier involvement is an activity of the buyer firm to integrate its suppliers in the early phases of its new product development. Competition, technology and capabilities of suppliers may drive companies to involve suppliers in product development in an early phase.

For example, the early involvement of suppliers can improve the operational lead times of new products and lead to sharing of new ideas more openly. The results of the questionnaire showed that 29% of the responding companies did not involve their key suppliers in business/strategy planning.

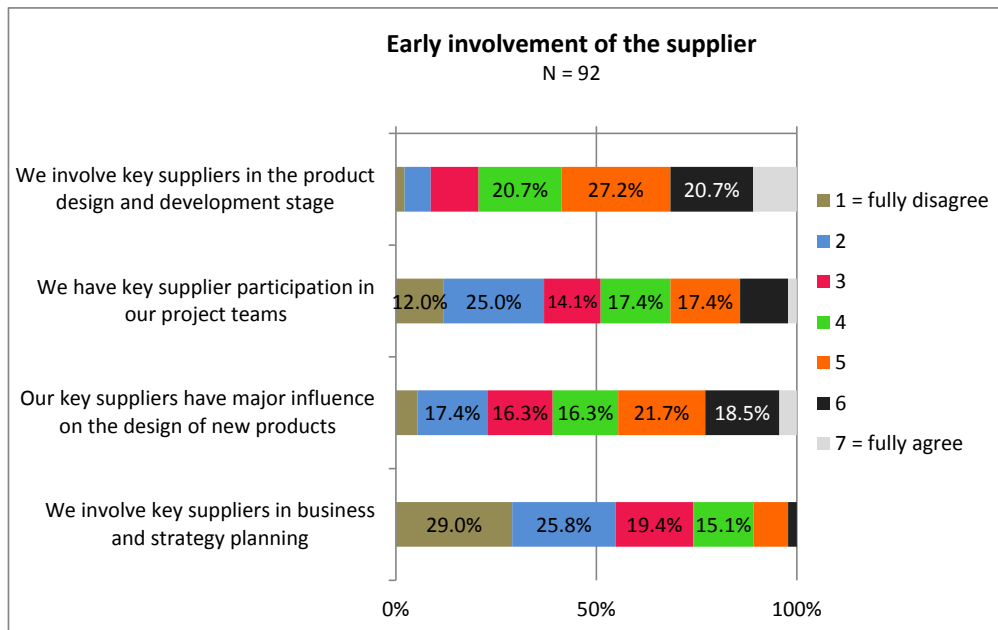


Figure 29. Key suppliers are often involved in the product design and development stage

- Early involvement of the supplier

- *We involve key suppliers in the product design and development stage 4.7*
- *We have key supplier participation in our project teams 3.5*
- *Our key suppliers have major influence on the design of new products 4.0*
- *We involve key suppliers in business and strategy planning 2.5*

Nearly half of the respondents (47%) develop key supplier programmes. However, most of them (82.8%) considered competitive bidding a suitable method when assessing existing suppliers in new projects. Figure 29 shows that supplier base optimization is a supplier management activity in 65% of the companies.

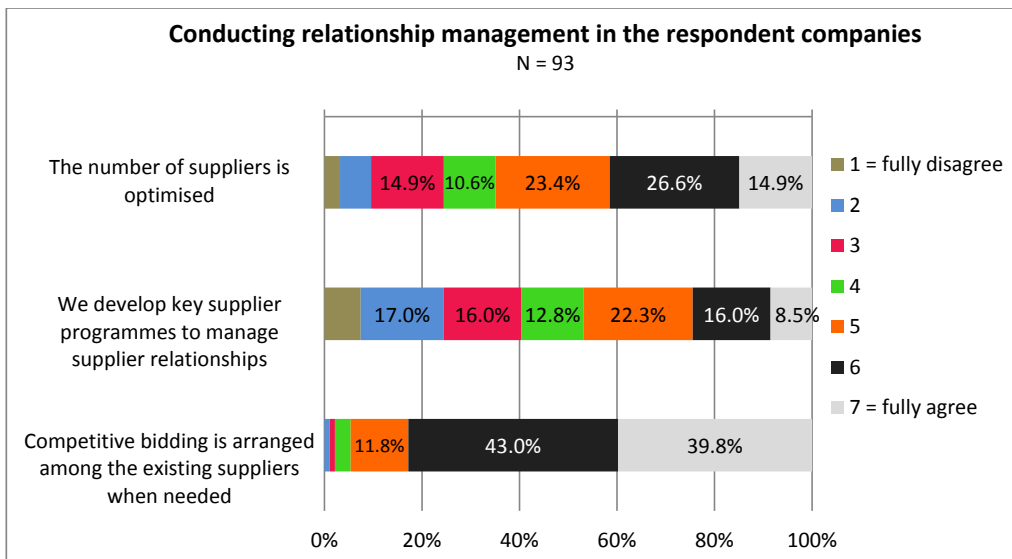


Figure 30. The respondent companies most likely arrange competitive bidding

- Conducting relationship management in the respondent companies
 - *The number of suppliers is optimised 4.8*
 - *We develop key supplier programmes to manage supplier relationships 4.1*
 - *Competitive bidding is arranged among the existing suppliers when needed 6.1*

8. CORPORATE RESPONSIBILITY IN SUPPLY NETWORKS

Supply management is responsible for the management of the firm's supply network and external resources and has a key role in defining the origin of the company's materials, products and services. Consequently, the implementation of corporate responsibility policy relies strongly on the firm's purchasing and supply management function applying responsible purchasing practices. Sustainability and responsibility in supply management can be divided into environmental, social and economic dimensions. The questions of how, under what conditions and with what consequences organizations can demonstrate their social, ethical and environmental aims through their supply decisions are important. The improvement of transparency of the supply chain from the producers of raw materials to the end-customers is a hot topic in most of the manufacturing firms.

There were significant differences among the industries. In repair and installation of machinery and equipment the use of certified suppliers is more common, whereas in boat and shipbuilding the use of certified suppliers is less likely. Figure 31 illustrates the use of certified suppliers in the respondent industries.

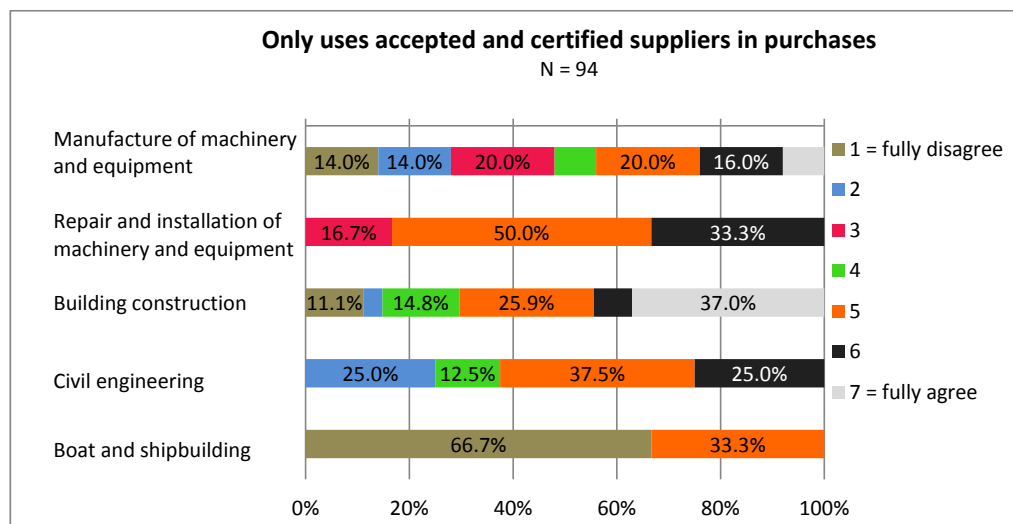


Figure 31. Use of accepted and certified suppliers in purchases by industry

- Only uses accepted and certified suppliers in purchases
 - *Manufacture of machinery and equipment 4.6*
 - *Repair and installation of machinery and equipment 5.3*
 - *Building construction 4.9*
 - *Civil engineering 4.9*
 - *Boat and shipbuilding 3.4*

Of the respondents only 12.8% did not consider any environmental or ethical values in their supply management. Moreover, it seems that the traceability of a product is quite important in supply management. More than half of the respondents (65%) followed international CSR standards in their supply management. In general, responsible buying practices were well adopted in the respondent companies.

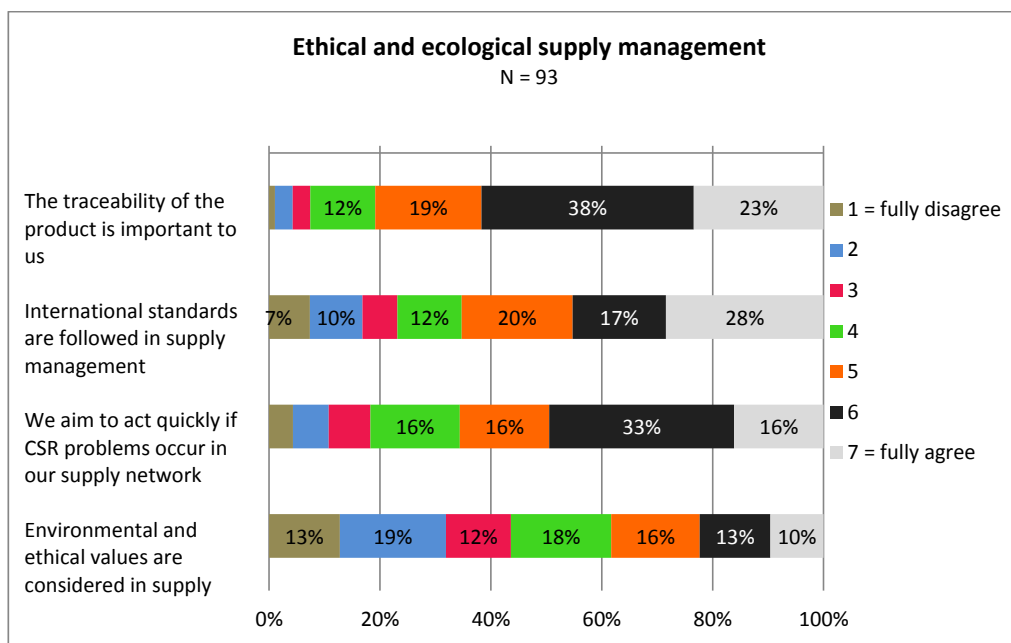


Figure 32. Ethical and ecological supply management is important among the respondent companies

- Ethical and ecological supply management
 - *The traceability of the product is important to us 5.5*
 - *International standards are followed in supply management 4.9*
 - *We aim to act quickly if CSR problems in our supply network occur 5.0*
 - *Environmental and ethical values are considered in supply management 3.8*

9. CONCLUSIONS

In today's turbulent business environment the understanding of the role of cost and risk management in purchasing decisions is essential. Organizations may have problems with the coordination and timing of purchases, quality and delivery of the purchased materials and services, and control and assessment of the suppliers. Especially, in project business purchasing risks and costs are connected to complexity of projects, and high monetary value of project purchases highlight the role of supply management as a strategically important function for the whole project organizations (Ojala et al., 2013). It is obvious, that cost and risk management are intertwined in many ways in purchasing decisions, however, there is still lack of skills and methods how to mitigate risks and integrate possible cost effects of risk realization to the purchasing decisions. Consequently, a better understanding of the total cost components can contribute to planning and design of the projects and business, and managing supply chain risks.

In addition of risk assessment and taking a holistic view over the supply chain, it is also shown that the capability and strategic status of supply management increase the utilization of risk management tools in purchasing decisions. The better the decision-makers are aware of the importance of purchases and the more competence is involved in supply management, the better the risk management is performed. Furthermore, the high performing organizations have both, hard (price, delivery time, quality) and soft (relationship, sustainability) purchasing criteria, involved in their purchasing decisions. Moreover, if supply management has a significant status in a firm and its management emphasizes the strategic role of the purchasing and supply function, the possibilities and the significance of risk management are also more likely to be recognized.

Furthermore, the role of sustainability in business has increased significantly. More than half of the respondents (65%) followed international CSR standards in their purchasing. Sustainability is connected to the control of suppliers and transparency of supply chain. From a risk management point of view supply management has an essential role in ensuring the safety, ethics and ecology of the purchases. Supplier relationship management and the formalization of purchasing procedures to follow responsible purchasing practices are the best sustainability risk mitigation methods and ways to influence suppliers' sustainability and transparency of supply networks.

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