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Subcontracting Product Development – Creating Competitiveness through Networking

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Abstract — Product development has become increasingly complex and resource-consuming. Consequently, internal development capabilities can prove insufficient for maintaining a firm's competitive position. External cooperation and networking have been suggested as means for accessing necessary complementary knowledge or resources. In this paper, cooperation is studied as the key to improving competitiveness, especially in case of small firms. Product development distributed across organisational boundaries can also help companies mitigate the effect of uncertainty and turbulence. The empirical part of the study describes supplier cooperation in four case companies. The focus is on software product development cooperation with foreign suppliers. The paper contributes to better understanding of organising product development across a network of suppliers.

Keywords — software development, network, supplier cooperation

I. INTRODUCTION

The demand on innovation is becoming more and more intricate and resource-consuming in almost all industries, leading to increased importance of external organisations in firms' survival [1]. Product development activities are highly complex and characterised by high amount of uncertainties [2]. Resources and skills should be acquired in a significantly shorter time than earlier in order to outdo shortening product life cycles and technological convergence [3]. As a consequence, there is a growing need for flexibility and interorganisational cooperation even within core functions of a firm, such as product development. In addition, it has been proposed that inter-firm cooperation can successfully solve some problems related to international competitiveness [4], a topical issue pondered by many firms. Increasing number of cooperational agreements implies that the attention of the managers has shifted from internal resources to the capabilities of external factor exploitation [5].

Software development is highly dynamic by nature. Thus, companies need to create both formal partnerships and informal collaborative networks to sustain growth, create market penetration, accelerate the time to market, and control constantly growing research and development (R&D) costs [6]–[8]. Software companies are often small and face the problem of limited internal resources. Nevertheless, small firms are known for their resourcefulness and networking capabilities [9]. The prospects of small companies for cooperation of high

organisational complexity, such as alliances [10] and joint ventures [11], are lesser than those of multinational enterprises as these arrangements suppose that the firm is in a position to turn toward partners whose skills are much more advanced and who can readily be mobilised [12], [13]. Such limitation does not denote lower need for flexibility. In fact, flexibility seems to be an important competitive advantage for the SME networks [14].

In information and communication technology (ICT) industry, the knowledge and intellectual capital actually form the main factor of production [15]. The critical resource of software development is skilled personnel and the work is knowledge intensive. The characteristics of the industry and task in question pose different challenges to supplier cooperation as compared to traditional manufacturing. Besides, the literature regarding strategic management or new product development management is mostly founded upon a large company context and cannot be applied directly in smaller companies [16].

The purpose of this paper is to study the use of supplier networks to complement internal product development in ICT industry, with particular focus on software development. The research is descriptive in nature. Its aim is to understand the principal reasons which have led to supplier cooperation in case companies and describe models of such arrangements. The empirical part consists of a case study of four Finnish firms, which provide their customers software products and related services. Each company has been engaged in software development subcontracting from several countries. They represent different branches of the industry with three of the companies being small- and medium sized enterprises (SMEs). The study describes different motivation for engaging in networking and how cooperation has affected the internal processes and operational models of the firms. Despite the general assumption of cost minimisation as the main incentive for international subcontracting, the case study brings forward several other incentives such as access to complementary resources, increased flexibility and dealing with the industry's turbulence. Networking capability can in itself become a valuable asset for the company and improve its competitiveness.

The study aims at clarifying the rationale behind international networking in software product development. The relationship between a firm's competencies and networking strategy is described along with examples of complementarity of different type of supplier networks to a firm's activities. The focus is on understanding motivation

for cooperative efforts between firms producing digital products or services as opposed to manufacturing firms and traditional view of flow of material from supplier to manufacturer.

II. SUBCONTRACTING PRODUCT DEVELOPMENT

A. *Network approach to supplier cooperation*

A network perspective focuses on the net of relations between a focal firm and the outside world. Business networks can be described as complex arrays of relationships between a firm and different actors, such as customers, distributors, suppliers, competitors, and government [17]. The traditional microeconomics-based models assume firms to be free and independent units in a market that has atomistic structure and clear boundaries. The network approach challenges this statement by proposing that a company is an integrated part of a network with arbitrary boundaries and each actor is dependent on other actors in the network [18].

The basic elements of the industrial network model are actors, activities and resources [19], [18]. Actors can refer to individuals, parts of firms, firms, and groups of firms. Actors control activities and/or resources. Resources are controlled by a company either directly (ownership of the resource) or indirectly (close relationships with actors possessing the formal control). Different types of resources of an individual firm include input goods, financial capital, technology, personnel, and marketing channels. Activities are carried out within and between individual actors. Resources are tied to each other by activities. The internal characteristics of an actor can be distinguished into possessed resources, performed activities, organisational structure, and objectives and strategies [18]. These attributes affect exchange between different actors as they transfer resources or perform some activity together.

Networks provide access to the resources needed to build up and exploit firms' competitive advantage [17]. An individual firm is dependent on resources controlled by other firms. Internalising all necessary resources would lead to impossible growth situation in a firm [20]. Network arrangement allows a firm to specialise in activities most relevant to its competitive advantage [21]. Utilising external transactions instead of internalising, results in flexibility and focus. They can be powerful competitive weapons, especially in environment that experiences rapid change [22]. A firm's capabilities and competitive forces can be seen as the main reason for inter-firm cooperation [23]. On the other hand, cooperation can create problems due to increased complexity of handling the process with several actors involved [24].

Strategic network as proposed by Jarillo, imply especial relationships between a hub firm and the other members of the network, where contracting parties remain independent organisations despite asset specificity related to the know-how [21]. The resources possessed by different firms are seen as heterogeneous and interdependent, leading firms to devote resources to investments in relationships [17], [20].

Business relationships between firms are affected by resource scarcity and resource development [25]. The purpose of the firms is to mobilise and deploy both internal and external resources available to them [26]. The external resources can be acquired either through co-operation partners with whom a firm has shared objectives or through other partners or sources, in which case the partners need not to have a mutually shared goal [27]. Instead of focusing on limitations of internal capabilities, managers should realise that their capabilities could be complemented through cooperation with other firms [23]. Lorenzoni sees building a network as an entrepreneur's determined way to obtain the most efficient organisational arrangement to compete on the chosen market [21]. Especially small companies with the high level of complementary capabilities co-operate more intensively with their suppliers in order to develop competitive advantages [28]. In industrial market, buyer and sellers often build long-term relationships instead of arm's length transactions, because the body of potential suppliers is limited [29].

When viewing product development as disciplined problem solving, supplier involvement has been seen as one of the factors leading to better process performance in terms of speed and productivity [30]. Partnering with suppliers can also contribute to innovative performance of a firm through reduction of development cost and time, improved quality and value [31]. To be able to use the opportunities that exist in supplier cooperation, a firm needs conscious understanding, strategic awareness, and realising both opportunities and limitations of such cooperation [32]. Strategic awareness should be reflected in how a firm weights internal versus external development and chooses individual suppliers [32].

Researchers have largely addressed internal and external actors involved in product development, with particular interest paid to the interface between R&D and marketing and customers [33]. Nevertheless, the contribution of suppliers to product development and success of a company, has received only limited attention until recently [33]. The review of international networks of a firm, on the other hand, has often been restricted to sales activities. At the same time, possible input of foreign actors into a firm's internal processes, such as product development, is scarcely documented. The motivation of firms to engage in networking in product development activities and effect of such cooperation on a firm's competitiveness deserves more attention. Taking into account a situational point of view as suggested by contingency theory, further contributes to discussion on organising for success [33]. Different operational environments, organisational characteristics and unique histories of firms require differentiated management approaches and organisational structures. Thus, no universally applicable organisation or management approach to guarantee success exists [33]. This notion also applies to supplier cooperation and their involvement in product development.

B. *Supplier cooperation in ICT industry*

It is not unexpected that interfirm cooperation seems to

increase in high-cost, high-tech market [8]. The number of alliances in ICT industry is growing. The reason for this trend include the need to gain access to new technologies, the need to share risks and costs associated with the development of new products, and the shortening of market opportunity windows [34]. However, also project-based contractual networks can contribute to these issues as illustrated in the empirical part of this paper. Contractual agreements are often referred as tactical; whereas strategic alliances, formal joint ventures and innovation networks are strategic arrangements [35]. In general, the lower the equity involvement, the more limited the alliance control, but the greater the organisational flexibility [36]. High-tech industries are characterised by rapid environmental and technological change, thus there is need for flexibility and lower organisational complexity than these formal forms of cooperation can provide. Consequently, there is need for strategic consciousness of importance of external resources [32].

To preserve its competitive abilities, a firm needs to maintain various types of technological expertise. However, doing everything internally is no longer a feasible solution as rapid technological advances occur on many fronts simultaneously [37]. The natural consequence of such tendency is for a firm to specialise in certain limited areas of development. In addition, it means establishing relationships with other actors, as specialisation does not remove the need for broad knowledge base [24]. The resources of small ICT firms are inevitably limited when compared to larger companies. They are short on the management staff, restricted in terms of available recruitment incentives, and cannot afford to maintain technical specialists in house in narrow areas or ramp up for one-time large projects [38]. These circumstances have provoked significant growth in the use of outside suppliers, with the spectrum of products ranging from routine commodities to specialised development projects, and possible nature of relationships ranging from purely transactional, price-based interactions to highly interdependent partnerships [37].

For ICT industry, the major risks of product development cooperation are leakage of information, loss of control over the process and fear of dependency on a partner [39]. The factors most contributing to success are 1) clear ground rules, 2) personal commitment at all levels, 3) process related factors, especially communication and trust, 4) ensuring mutual benefit, and 5) compatibility of the chosen partner [39].

The tendency to specialise applies to potential supplier firms as well meaning that a certain supplier is compatible with fewer users within a limited geographical area [32]. Therefore, specialisation and scarcity of domestic resources can be seen as natural stimuli for international cooperation and use of foreign suppliers in software development. This trend emphasises the importance of being capable to conduct developmental cooperation in an international environment [32]. The reported reasons for cooperation with foreign actors, in particular, often include seeking for

expertise or lower level of costs. Software development processes are increasingly distributed worldwide and becoming both multi-site and multicultural in search for lower costs and skilled resources [40]. For small or even medium-sized enterprises, global distribution of operations is often possible only in concert with crossing the company's boundaries. Thus, geographically distributed, inter-organisational product development projects are becoming more and more common [41]. Building a competitive advantage requires a firm to be able to replenish its internal resources with the external ones, by engaging in relationships with various domestic and foreign actors. Ability to coordinate and manage this kind of network can in itself become a firm's core competence.

III. CASE STUDY DESCRIPTION

A. *Research design*

A qualitative approach was chosen because of the scarce amount of information on the subject and its complexity with several theoretical disciplines involved [42]. The survey method was discarded because of the aim of the research, which is to provide insight on the studied subject. In addition, there is reluctance among companies to openly bring forth their experiences in offshore (i.e. foreign) subcontracting, which was noticed when case companies were sought for this study. Selection of the companies for the case study was based on purposeful sampling [43]. The criteria were having software product development activities and experience of cooperation with Russian companies as this was the focus of the initial study. Chosen companies were known to have been utilising Russian subcontractors in their software development activities.

The interviews with the representatives of the Finnish case companies were carried out in 2003. The case companies represent different branches of ICT industry. Company Alpha is a communications operator. Company Beta develops Internet based and mobile applications along with location based mobile information management services. Company Gamma is a project organisation, which at that time had a unit specialised in software development services. Company Delta is a developer of mobile games. Three of the case companies can be described as small companies as they have less than 50 employees which is the criterion used by EU for categorising small-sized firms. The experience in subcontracting varies in length between twenty years and a couple of years. All four companies are familiar with subcontracting to several countries.

In each company, the person responsible for strategic decisions, including software development subcontracting, was interviewed. Company Alpha is larger than the others and has a more complicated organisational structure. The person interviewed was an executive, who has substantial amount of experience in contracting out different activities. In the rest of the companies, them being small in size, the strategic responsibilities were typically accumulated to one person. In company Beta, the person interviewed was both the founder of the company and chairman of the board of

directors alike. He was also responsible for operative management. The interviewees in companies Gamma and Delta were the managing directors. All interviews were recorded and transcribed. In company Alpha, the interview material was supplemented with two presentations given by the interviewee. In other firms, secondary material regarding their offshore development activities was not available. Two follow-up interviews were carried out with the representatives of the companies Beta and Gamma in March 2006 in order to update the data and expand discussion beyond Russia.

The main research question and sub questions have been formed on the basis of preliminary interviews carried out in the case companies. The questions of the in-depth interviews were related to the following issues: motivation for sourcing, strategic significance of sourcing, special characteristics of sourcing in knowledge intensive industry, and possible evolving of sourcing activities into partnership. The emphasis of the second round of interviews was on the use of networks in product development and organisational issues in product development distributed across company boundaries. The main research question of the study is how software firms can enhance their product development by engaging external resources located in other countries.

B. Case companies' experiences of subcontracting

At the beginning of the study, it was assumed that the main incentive for offshore subcontracting was cost minimisation. The motivation for engaging foreign suppliers in product development proved to be more diverse. In company Alpha, it was stated that it is neither reasonable nor cost-effective to do everything internally. Alpha's aim is to concentrate on core functions. Suppliers are used as a source of specialised know-how of good quality. In company Beta, sourcing was launched by a need for certain capabilities that were unavailable internally. For them, there are multiple reasons for cooperation: flexibility, regulation of fixed costs, and dealing with demand peaks. Foreign suppliers also provide proficiency in programming. In a similar manner, company Gamma's network was initiated by a need for specific knowledge and skills unavailable internally. Cooperation with suppliers is a mean for keeping organisation lean. For company Delta, the reasons for cooperation were limited internal resources, need for shorter development time, and cost efficiency. Especially for small firms, engaging external resources, instead of hiring own staff, enabled temporary increase in the work force, but was also a way of minimising risks related to changing economic trends and turbulence of the industry.

The level of necessary compatibility of the actors depends on whether sourcing is practised on a long-term or a short-term basis. In the short run, cost efficiency is essential and the complementarity of resources and capabilities is of less importance. However, if sourcing is planned to last for a longer period, other reasons such as know-how and capabilities of the partner become decisive.

The origin of the supplier appeared to be of lesser importance as compared to the resources and capabilities provided by the arrangement. The factors mostly affecting ease of cooperation with a foreign partner were maturity of the partner and similarity in organisational values; whereas advantages of domestic suppliers were seen in having a common language and short physical distance. Factors generally contributing to success or failure of organising product development through international subcontracting are highlighted in table 1. Communication and coordination of offshore cooperation are supposed to pose difficulties to small firms (Carmel and Nicholson, 2005). However, in the case, it was found that such difficulties diminished with growth of trust and familiarity between parties.

TABLE 1
SUCCESS AND FAILURE FACTORS OF PRODUCT DEVELOPMENT
COOPERATION

Success	<ul style="list-style-type: none"> - Complementary skills - Knowledge of business processes - Understanding development process as a whole - Initiative partner - Mutual values - Good communication and problem solving capabilities - Trust
Failure	<ul style="list-style-type: none"> - Rigid operational models - Ambiguity in goals - Lack of commitment - Differences in organisational culture - Poor language skills - Negative attitude of company's customers

IV. MODELS OF INTERNATIONAL COOPERATION

What the case companies have in common is having a network of suppliers that extends beyond the country of origin. It would be easy to assume that the use of foreign suppliers is motivated by either cost or access to market. Nevertheless, the rationale for cooperation is much more multidimensional. Similarly, there is no universal structure for this kind of network.

A. Company Alpha

Company Alpha is larger than the others and has a more extensive network. The foreign subsidiaries of Alpha typically have their own local networks. The company has utilised subcontracting for at least 20 years and the scope has grown over the years. Currently it has hundreds of subcontractors in different countries. The subcontracted entities have become larger and the providers are assigned more responsibilities than earlier. Alpha has both long-term cooperative relationships and temporary subcontractors, which are found on the market and go through a tender. When choosing offshore location or provider for productional sourcing (e.g. routine programming) the price is decisive factor. This type of sourcing has established practices and stable processes, whereas product development cooperation involves higher amount of uncertainty. Typically, there is need for special know-how for individual projects. The level of specification, which is possible to provide, is dependent on the task domain; some

already have formal descriptions and others are yet undefined. In the latter case, there is need for genuine partnership and cooperative development. New projects tend to be started with already existing proven partners. Some of the long-term relationships have continued for more than ten years. For Alpha, the ideal situation is sourcing from a partner who concentrates particularly on the tasks in question and perfection of their efficiency and quality. Innovativeness of the products is seen as a very important factor for the competitiveness in this branch and it is also sought through partners and their know-how. The aspect of trust is vital because the telecommunication industry and the roles of different players have been transforming rapidly and this trend seems to continue also in the future. Thus, there is a risk of current subcontractors becoming future competitors.

B. Company Beta

Over the years, the company has become more focused in its target business segment and also technologically. Internalising all the necessary competences and maintaining them on a sufficiently high level was not considered an option when the company's goal was to develop products for several technological niches. Sourcing of certain product development tasks was used to avoid pressure on optimising the size of organisation according to the profits or number of customers. Consequently, this meant high level of dependency on partners and trustful relationships were strongly emphasised. At this stage, Beta's subcontractors were, with one exception, small firms as well. Their operational models were seen to be better suited for cooperation with a small creative company. Typically, cooperation was based on an already existing personal relationship – academy acquaintances, company's trainees, and colleagues known through third party projects. Small size of partners was believed to be one of the reasons for the success and fluency of company's sourcing. The biggest problem with decentralising development activities was blurred sense of responsibilities as personnel tended to change on both sides. Partly this was due to the fast changes which characterise the industry, as growth and decline occur suddenly.

Nowadays, the network consists of bigger and more settled partners. Because Beta has been able to secure long-term development projects with several customers, its product development process is less affected by uncertainty. The importance of internal learning and continuity has grown at the same time as the incentives for utilisation of suppliers have lowered and the network of strategic partners has tightened.

As the vision of the company has become clearer, this has also affected the structure of its network. The selection criteria of the partners have become more explicit and the emphasis has shifted from personal compatibility to complementarity of competences. Seeking complementary resources has meant crossing national borders. However, because the company aims for global operations, this is not seen as a challenge. Search for excellence in certain field has often led to establishing a relationship with a foreign

partner. According to the interviewee, engaging offshore suppliers gives company more extensive touch of product's potential on the market. At some point, foreign suppliers were also seen as source of specific knowledge of foreign markets or certain customer industries. However, after Beta became more focused, it was decided that this type of strategic knowledge should be developed and maintained in-house to ensure long-term relationships with the customers. Shift of emphasis to building trustful long-term relationships with customers has led to lower level of use of suppliers, although it has not been a conscious decision.

Company's long experience of operating in a network of international partners has created readiness to operate on a global market. With the growth of the company, the attitude towards partnerships has become more systematic. Overall, the current network is tighter and more strategically oriented according to the company's projected growth direction. Certain level of dependency on other parties is still considered inevitable as there are several strategic suppliers and the network is mainly source of complementary capabilities, not volume. Nevertheless, it is likely that as the size of the projects grows, transfer of software development to countries with lower cost level and sufficient proficiency in technical skills will become a topical issue. As the competitors already have offshore development units, such arrangement may become a necessity in order to maintain company's competitiveness.

C. Company Gamma

During the first round of interviews, software projects were an essential part of activities for Gamma and it had a unit specialised in software development services. Nowadays, it concentrates on product development and consulting for construction engineering and energy sectors in Finland. Gamma has trimmed organisation of non-core activities in order to become more flexible. Concentrating on core competence has meant building an extensive network of partners which complement company's internal capabilities. Such organisational model means high level of dependency on the partners, but it is considered the only viable option due to fluctuating demand. With the help of the network, Gamma is able to provide an integrated range of services while keeping internal organisation lean.

The company started to use subcontracting, because it needed specific knowledge and skills unavailable within own organisation. Gamma itself concentrated on such tasks as planning and supervising projects, and contracted the rest of activities out to keep its organisation small. With time, this arrangement has converted into a network-like structure with about ten strategic partners, both research institutions and firms, which are complemented by short-term tactical suppliers depending on a project. These temporary subcontractors are used only if the task in question cannot be contracted to an existing partner.

Each player in Gamma's network has a specific role and unique responsibilities in a project. The know-how and skills of different partners complement those of Gamma's. Product development activities in a network-like structure could not be possible without sufficient trust and mutual

values. Dependency on partners is a substantial risk. Sometimes, risk has materialised in such a way that Gamma had to take additional work load to compensate for a partner's deliberate underachievement. Despite some negative experiences, operating in a network is seen as the only viable option. Offshore subcontracting does not differ from domestic, if both parties are mature enough. Despite different cultures, it has always been possible to talk things through as long as the partners share mutual values.

The difference between situation in 2003 and 2006 is that also software development activities are now carried out by a distinct partner and not through subcontracting arrangement. New organisation encompasses only the entrepreneur himself and former employees have transformed into distinct partners within the network. The reason for this rearrangement was the need for more dynamic organisational structure and flexibility in carrying out different projects. Nowadays, through its network, company can actually tender for bigger entities. The availability of resources through extensively competent network has proved to correlate with shorter product development time.

In the new arrangement, if a project requires some software to be developed, Gamma recommends its Russian partner for implementation of that part. If this partner is chosen by the client, Gamma gets commission. The specification of software development at the customer site is still done by Gamma. Thus, the practical arrangement has not changed significantly for that part. However, the actual implementation is carried out solely by the partner and the responsibility is exclusively his.

D. Company Delta

For Delta, utilising suppliers enabled quick and cost efficient broadening of product portfolio when company was still young and its financial resources were limited. Those relationships that proved successful have been continued, but the company has not actively sought new partners for product development. Instead, it was decided to downsize the network to only couple of proved partners despite higher costs and slower pace of internal development. The added efficiency brought by faster development pace was reduced by additional communication required in cooperation, especially if any problem occurred. Also the training expenses were higher when crossing organisational boundaries. The external resources obtained through cooperation have been similar to the internal ones. Thus, the company is not seeking complementarity but volume, despite the fact that subcontractors' knowledge and competence have enabled Delta to add some good products to its portfolio. In the interviewee's opinion, subcontractors could not provide any knowledge of market or technology additional to the one the company already possesses. In addition, there is always a risk of a subcontractor turning into a competitor.

V. DISCUSSION

Despite the fact that much is written regarding the

international relationships of firms, the emphasis has been on ownership-based cooperation as opposed to project-based and contractual relationships, which are becoming increasingly common. Especially high level of complexity in technical knowledge makes cooperation more attractive than developing all necessary capabilities in-house. Networking can enable a small specialised firm to concentrate on its core competences and create an extensive offering of integrated products and services at the same time. The paper illustrates the use of supplier networks to complement internal product development in a knowledge intensive dynamic industry. Due to the turbulent nature of the ICT industry in general and software development tasks in particular, possessing and exploiting a set of internal resources can prove insufficient to maintain a firm's competitive position. Utilising external resource pool can speed product development for faster access to market or provide complementary resources to enhance firm's own capabilities and competitiveness. In case of software development, products are more or less intangible and transportation or location of production is of minor importance. Thus, cooperative arrangements between firms producing digital products or services have own peculiarities as opposed to the ones observed in the traditional manufacturing industries.

Preference of contractual relationships over joint ventures or alliances is twofold. Firstly, there is turbulence related to the nature of ICT industry and high-technology industries in general. Organisational and cooperational structures are subjects to frequent changes reflecting rapid changes on technology front. Secondly, there is a disadvantage of being a small company, which typically means weaker position for cooperation negotiations. However, due to their limited size, SMEs are less likely to be able to preserve their competitiveness through sole in-house development [44]. By keeping even their strategic relationships on a contractual basis, small firms try remain flexible in case there are sudden changes in their customer base, operational environment or technology. Alternative scenario is for a small high-tech company with valuable technology to be bought by a bigger player.

The motivation for cooperation varies according to companies' goals. If short-term outcomes are decisive, cost efficiency is essential, whereas complementarity of resources and capabilities is of less importance. However, if cooperation is planned to last for a longer period, other reasons such as know-how and capabilities of a partner can become decisive. In fact, for high-tech companies, knowledge and capabilities of a partner appear to be the most important qualities of a long-term supplier. It was mentioned that the organisational culture of a potential partner is more vital for success of cooperation than the partner's nationality. Both trust and mutual values were highly emphasised as necessary criteria for long-term cooperation. Small firms often find their subcontractors through personal networks, prior acquaintance resulting in lower significance of nationality in the actual sourcing arrangement. This is in line with observation that small

companies, operating in highly dynamic markets, believe more in interpersonal trustworthiness than large firms [28]. Vice versa, without existing personal connection, it is much more difficult for a foreign supplier to convince a customer of its qualifications. The meaning of distance and cultural differences grow when product development process is not so structured or involves a lot of creativity as in game development.

In the case companies, the knowledge related to customers and customer industry was preferably maintained in-house. The attitude towards necessary technical competences was somewhat different. Case firms have used networks of actors to access resources or capabilities rather than internalising them as the internalisation would require significant investments. If a capability is not a focal one, it is considered a better option to leave the capability to supplier, who is able to maintain its technical level and further develop it.

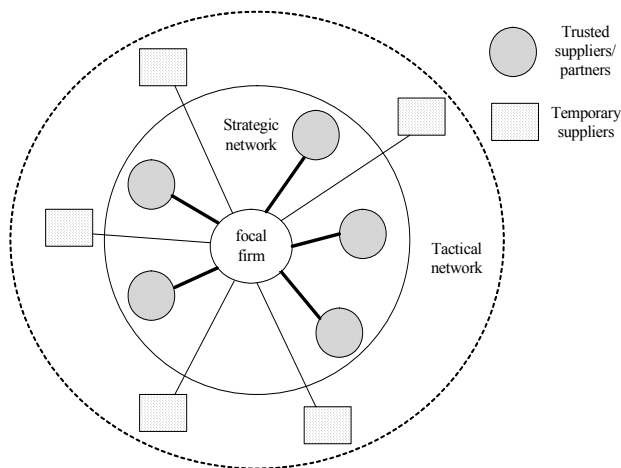


Figure 1: Two levels of subcontracting networks

In this paper, it is proposed that supplier networks can be divided into strategic and tactical level (figure 1). Tactical network consists of temporary subcontractors chosen from a market, whereas strategic network consists of trusted long-term partners. Strategic network provides a focal firm with complementary resources and capabilities. For a high-tech company, such resource can also be knowledge. Scarcity of knowledge or skills on domestic market can be a reason for building a network of foreign suppliers to complement firm's internal product development. On the other hand, tactical network is more likely to contribute to volume, speed or price of development. Location of supplier is affected by the objective of subcontracting. Economising can be pursued through subcontracting from countries of low labour costs, whereas speeding up development is more likely to be sought through closely located suppliers. The focal firm is more dependent on its trusted suppliers than on temporary ones. The relationships with strategic suppliers are of long-term nature and the degree of trust is of significant importance. Complementarity of resources contributes to trust formation between the focal firm and suppliers. If suppliers provide

similar resources, there is greater probability of fear of opportunistic behaviour.

Another assumption questioned is presumed relation between using foreign suppliers and looking for access to a market. Some subtasks of product development (e.g. localisation of products) are likely to involve a natural preference for foreign cooperation. However, not all product development cooperation with suppliers from a particular country is aimed at the market of that country. Companies in the ICT industry often operate on global market. Thus, networking with foreign companies appears to be more natural for them than for firms in traditional manufacturing industries. Similarly, lowering costs is not necessarily the main incentive for cooperative arrangements with foreign supplier, despite the fact that this motivation has received most attention in the press. Instead, the global nature of high-technology products and markets makes the puzzle more complicated. The decisions of what to do and where are rooted in the mixture of elements of knowledge, skills, quality and costs. Thus, it is often more of a question of finding sufficiently high level of know-how at a competitive price, than the cheapest price. In this sense, the traditional views on cooperation based on experiences in manufacturing should be revised for knowledge-intensive high-technology industries. High-technology firms operate in a complex, fast changing environment. Likewise, structures and functions of their networks are far from simple.

VI. CONCLUSIONS

With the increasing amount of uncertainties related to the product development process, there is a growing need for flexibility and interorganisational cooperation even within this core activity. Especially for small firms, cooperation can be the key to improving their competitiveness. Motivation for engaging in a network varies, but it is often seen as a necessary precondition for success or even survival of a firm. Possible reasons for cooperation include access to complementary resources, increased flexibility, economising, and dealing with the industry's turbulence. Ability to coordinate and manage network of external actors can in itself become a firm's core competence.

The findings of the study support the argument that contractual or project-based relationships and distributed product development can contribute to competitiveness of a firm in a dynamic, knowledge-intensive industry. The paper questions the assumption that contractual relationships are used only as short-term or tactical arrangements. Instead, it is suggested that contractual supplier relationships of a firm can be distinguished into two kinds of networks, a strategic one and a tactical one. Retaining relationships on a contractual level provides manoeuvrability while having access to a pool of external resources and capabilities. The limitation to generalise is an inbuilt problem of in-depth case studies [42] and this study is no exception. However, it contributes to the discussion of distributed product development by describing models and practical examples of organising software product development across

company's boundaries.

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