Selecting Software Subcontractor for R&D Projects

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Abstract—Companies have been outsourcing software development activities at an increasing rate lately. The aim of this study is to find information to assist in the selection of software subcontractors, one of the initial steps in software outsourcing process.

This study focuses on software outsourcing for research and development type of projects and addresses, how the nature of the project affects the selection of subcontractor. This study presents subcontractor analysis that is divided to three major parts being: company analysis, software process analysis and know-how related assessment.

Offshore outsourcing is covered as a possibility for outsourcing software and special characteristics of offshore subcontracting are covered. The study also tries to assess, which types of projects are suitable for offshore outsourcing.

Index Terms—subcontractor selection, software outsourcing, supplier, research and development project

I. INTRODUCTION

This paper is a literature study regarding software outsourcing selection of subcontractor for research and development projects.

A. Background

Outsourcing refers to the use of external resources to perform one or more organizational activities. The primary reason for outsourcing is cost efficiency. Outsourcing enables companies to reduce their operation costs and to access new resources such as technical expertise in a more efficient manner. (Kajava et al., 1996)

One of the initial steps in software outsourcing, once the outsourcing decision has been made, is the selection of the software subcontractor. As a term, “subcontractor” can be defined as an organization with business objectives, which are independent of those of the prime contractor. (Lehtinen, 2001)

Selecting the right subcontractor is a decision like any other risk decision for companies and companies have to make good decisions in order to be successful (Östring, 2003).

Research and development projects are generally of confidential and important nature. Therefore, selecting the right subcontractors for these projects is even more important than in other non-core software development projects.

B. Objectives

The goal of this study is to produce useful information for companies planning to outsource their R&D related software projects. More precise objectives of the study are presented in the form of research questions below:

(i) How does the nature of the project affect the selection of the subcontractor?
(ii) What are the criteria for selecting subcontractors for software development?
(iii) What kind of analysis can be made of potential subcontractors?
(iv) Offshore outsourcing as a possibility. What kind of R&D-projects are most suitable for offshore outsourcing and what kind of additional criteria exist for selecting offshore subcontractors compared to domestic ones?

C. Research method

The research method of this paper is a literature study. The selection of suppliers generally for all kind of industrial purposes is a theme covered widely in the literature. In this study subcontractor is thought of as one kind of supplier and literature generally related to selection of suppliers is used to cover issues related to company analysis.

Also literature related to software acquisition is applied to issues related to selection of subcontractors, because criteria for acquisition of modified off the shelf software is not that different from software subcontracting. There are cases where the subcontractor already has some ready-made components to offer.

The aspect of outsourcing R&D related software is not covered widely in the literature. Consequently, assumptions have been made of the nature of R&D projects.

The division of subcontractor analysis to three different categories: company analysis, software process analysis and know-how related assessment is based on Motorola’s subcontractor selection case studies (Nielsen & Miller, 1996).

Of all issues covered by this study the largest selection of literature could be found concerning offshore outsourcing.

D. Scope

This study is focused on research and development projects where software may be the sole outcome or part of the outcome of the project. Although the project may contain additional outcomes to software only software development outsourcing is covered. It is also assumed that the project management for the research and development project in question is not outsourced. This software product or
A component to be subcontracted could, for example, be related to a new product that the company would be bringing to the market or to some old product that the company would be developing further so as to comprise a newer version of the product.

Economic or other possible reasons behind software outsourcing are not covered in this study. It is assumed that the outsourcing decision has already been made.

Contract negotiations related to the subcontractor selection are also out of the scope of this study.

E. Structure

The second chapter of this study focuses on issues related to research and development projects and the way the nature of the R&D projects affects the selection of subcontractors. All the possible effects that a certain project may have on the selection process are not covered. Instead, the issue is covered in a more general level.

The third chapter describes the subcontractor selection process and the phases it can be modeled to consist of.

The analysis involving the most potential subcontractors in order to enable successful selection is described in the fourth chapter.

Offshore outsourcing, a new emerging and exciting possibility to utilize global resources for software development is covered in the fifth chapter.

Answers to research questions are summarily presented in the sixth chapter.

II. THE RELEVANCE OF THE PROJECT FOR SUBCONTRACTOR SELECTION

Projects differ in their nature. The nature of the project should affect the selection of subcontractor for project related software development. The selection can be thought to form a process that may contain company evaluation including analysis etc.

A. Strategic Importance of the Project

Research and development projects aim for the future success of the company. Usually a company sets up research and technology projects to generate products or solutions related to company’s core competence areas. Therefore, R&D projects can generally be thought as core competence projects from the company’s point of view. In other words, R&D projects can generally be considered as strategically important.

First issue to consider when thinking of outsourcing R&D related software development is the strategic importance of the software to be developed. Müller et al. (2000) state that strategic importance of IT part in a project depends on three things: how independent the project’s overall strategy is from IT; does IT play an important role in business differentiation; and to what extent is uncertainty caused or increased by IT?

Thus, the software part to be outsourced in the project may or may not be equally important as the overall project for the company. The software outcome of an R&D project may also be dividable to modules that are not of equal importance for the company.

Confidentiality and core skill concerns may state that strategically important software should be made in-house. (Müller et al., 2000)

Shortage of in-house resources or lacking know-how of IT issues needed in software development may force the company to subcontract even strategically and company core know-how related software development.

It can be concluded that the costs of failure in software outsourcing are increased, if the software, the development of which is to be outsourced, is of strategic importance. On the contrary, if the software part to be outsourced is not as strategically important as the research and development project itself, the subcontractor selection for this kind of component should not differ from general software subcontracting.

B. Risk Factor in Subcontractor Analysis

Risk can be thought as the probability to fail in some function. Risks in software subcontracting can be delays, poor quality of the results, too high costs, breaches of confidentiality, possible loss of customers due to product failures, anticipated loss of reputation, goodwill, sales or revenue etc.

Strategic importance of a project increases the degree of risk for losses, i.e., how much the company will potentially suffer, if a certain subcontractor fails.

Östring (2003: 28) states that risk is a key driver to classify the analysis needed in subcontractor selection. If the potential loss is high, the subcontractor should be analyzed more profoundly. A short analysis or check is sufficient for subcontractors with lower risk.

C. Domain Specific Know-How in R&D Projects

R&D projects usually contain domain specific know-how that may have to be applied in the software development. Accordingly, the requirement for this kind of prior knowledge from the software subcontractors may decrease the number of potential subcontractors.

It can also be thought that, if the domain specific knowledge has to be taught to subcontractor employees, it would be good to be able to use the same subcontractors in other related projects as well. This is despite the fact that it can not be guaranteed that software development employees will stay available in the subcontracting company for future use.

D. New Product Development

Usually R&D projects aim to generate new products or services etc. so that new software will be developed. Therefore, it is important to find out how much of the work of the potential subcontractors actually involves the development of new software (Müller et al., 2000).
When experimenting with new IT techniques, the capacity on the subcontractor market for this kind of development may be low. This is usually an indication that the software actually should not be outsourced (Müller et al., 2000). Sometimes when dealing with this kind of new technology related development, a risky subcontractor with high know-how may be considered by calculating the potential losses and potential gains carefully.

E. Information Security

R&D projects usually deal with confidential knowledge and company secrets that must remain as such. Thus, trust is an important factor between parties in subcontracting. It can be thought that a company, with which the company has previously had successful subcontracting deals, would be a less risky choice. The continuity in the relationship between parties may prevent the subcontractor from leaking out confidential information to competitors. Additionally, infrastructure related matters like communication etc. should be considered carefully when exchanging data between parties.

A company should require its subcontractors to develop their security issues to a required state and then try to monitor the security development. The information security level of a subcontractor should be at least that of inter-organizational unit of the company outsourcing its software development (Kajava et al., 1996).

III. SUBCONTRACTOR SELECTION PROCESS

IEEE standard 1062-1993 recommends practices for software acquisition process. Software acquisition of modified software (MOTS) can be similar in nature to subcontracting software. A subcontractor may use readymade parts of software to create the application functionality required by the client and, thus, it can be thought of as a case of MOTS acquisition. Therefore, IEEE 1062-1993 standard is also applied to subcontracting processes in this study.

The whole software acquisition process can be modeled to consist of phases that are planning, contracting, product implementation, product acceptance and follow-up. This set of phases may be customized to better suite the needs of the software subcontracting. The contracting phase being the relevant phase in this study exists in both software subcontracting and software acquisition.

Subcontractor selection process is part of the contracting phase in the total acquisition process. This contracting phase is initialized when the request for project proposal is released or when the specifications needed for the software development have been made. In IEEE 1062-1993 standard the steps that form the contracting phase are:

(i) Identifying potential suppliers;
(ii) Preparing contract requirements; and
(iii) Evaluating proposals and selecting the supplier

This contracting phase is essentially the subcontractor selection process.

A. Identifying Potential Suppliers

Potential suppliers may be identified finding the possible companies and then examining them. This examination could consist of going through all the possible previous performance data from prior contracts with the supplier using supplier evaluation criteria represented below. Also user surveys, software evaluation and software definitions could be used in this phase, if the subcontractor uses some readymade software product as part of their offering.

B. Preparing Contract Requirements

It may be challenging to make a good contract between subcontracting parties. There are challenges such as the software crashing every five minutes even though it conforms to the applicable specifications, which include no mention of such an obvious thing as the software not crashing that frequently. In such a situation, it may be unclear whether the crashing constitutes a defect as the issue is not mentioned in the specifications. To avoid this kind of issues and many more similar problems it is of paramount importance to precisely determine contracting requirements.

IEEE 1062-1993 states the following requirements that should be determined in the contracting phase.

(i) The quality of the work;
(ii) Payment and how it is made;
(iii) Non-performance remedies; and
(iv) Contract provisions

It would be good to review issues with a suitable legal counsel as well. Other issues that should be considered at this stage are contract provisions specifically related to acceptance mechanism, warranties, transfers and licenses of intellectual property rights in the software and other results and thereto related intellectual property indemnities.

In addition to issues stated in normal contracts with their requirements, there are also additional commitments that could be specified in the contracting phase. Especially in the case when something completely new is being developed with possibly inadequate specifications, additional commitment specifications might be beneficial for the success of the project. These commitments can be specified to refer to goals, forms of co-operation and the responsibilities that the parties agree upon (Kontio et al., 1998).

Kontio et al. (1998) present following commitment specification topics that can be defined in the contracting phase: underlying motives for the project; project’s goals; process specification indicating how the project is to be performed and risk and problem management issues for the project.

A company should focus on commitment topics that are most relevant and can be specified (Kontio et al., 1998: 488).

For a high risk project such as the development of
completely new software with inadequate specifications, a good strategy might be to focus on commitments like underlying motives, process specification and risk management. In other words, in high risk projects one should focus on how the project is to be performed instead of defining explicitly project goals representing schedule, cost and project output issues. (Kontio et al., 1998)

C. Evaluating Proposals and Selecting the Supplier

The proposal often responds to a request for quotation having been earlier sent to the supplier. This proposal might suggest schedules and costs for the production of software development.

The objective of this stage is to ensure that a suitable supplier is selected. IEEE 1062-1993 standard states the following steps.

The minimum activities needed in this stage of subcontractor selection process involve:

(i) Evaluating supplier proposals;
(ii) Visiting supplier facilities;
(iii) Selecting a qualified supplier; and
(iv) Negotiating the contract

This evaluation phase is the phase, in which the company analysis, software process assessment and know-how related assessment could be done more thoroughly for the most potential subcontractors. This evaluation is explained in the next chapter.

D. Subcontractor/supplier selection criteria

IEEE 1062-1993 standard provides supplier evaluation checklist that contains criteria for supplier selection and also questions related to these criteria so that fulfillment of the criteria can be evaluated. The main criteria for supplier selection are:

(i) Financial soundness of the company;
(ii) Relevant experience and capabilities of the company;
(iii) Development and control process standards, practices, documentation and testing;
(iv) Technical assistance for the possibly developed/purchased software component;
(v) Quality practices;
(vi) Maintenance service for the possible product/component;
(vii) Product usage, if the component subcontracted is based on a readymade product;
(viii) Product warranty;
(ix) Costs; and
(x) Contracts.

Contracting phase ends in signing a contract with a supplier. (IEEE Std 1062-1993)

IV. SUBCONTRACTOR ANALYSIS

Before conducting any large-scale analysis for subcontractors an initial search should be made of the potential companies. If there are many potential subcontractors, the number thereof should be diminished by initial investigation. There is no reason to exhaust the analysis makers by all the possible subcontractors, if the number thereof is high. A strategy to further diminish the amount of potential suppliers is to ask them to respond to a request for quotation. Then the subcontractor candidates for complete analysis could be determined based on their responses relating to costs, proposed solutions, and past experience. (Nielsen & Miller, 1996)

The analysis to be made for most potential software subcontractors can be divided to three categories, which are company’s business and financial analysis, software process assessment and know-how criteria. This categorization is the same as the one used in Motorola’s software subcontractor selection for a complicated and large engineering project presented by Nielsen and Miller (1996).

A. Business and Financial Analysis

Business and financial analysis of a company can be called as the corporate analysis. This analysis can be made internally or it can be done with external resources like credit-rating agencies, banks, financial communities and research houses. Corporate analysis creates a picture of a supplier’s capability as a company and answers the question, whether the supplier is a solvent and profitable company that will stay in business also in the future.

Corporate analysis can be divided to quantitative and qualitative parts. Quantitative analysis comprises the financial aspects of the company. Data used in financial analysis can be found from company’s financial statements. Financial statements for a company are the balance sheets, statement of income, and the cash flow statement. These financial figures and certain financial ratios like revenue growth, ROA (return on assets), liquidity, leverage and efficiency can be used to analyze the company’s current status and historical operations. These key ratios make the companies “measurable” by indicating risks and giving warning signs of financial difficulties.

Company’s financial figures may not stay the same in today’s rapidly changing business environment. A forecast for the future may be done using historical patterns and future assumptions as a basis for prediction. These assumptions made can be company’s technological success, competition, management decisions and future economic condition. It is preferable to have financial statements at least three years back to be able to get better business trends for the company. If the company is a start-up or growing really fast, then the traditional methods for future prediction using the financial data from previous years has little or no use at all.

Qualitative analysis, the other part of the corporate analysis,
A software process can be defined as a set of activities, methods, practices and transformations that people use to develop and maintain software and the associated products like project plans, design documents, code, test cases and user manuals. As an organization matures the software process becomes better defined and more consistently defined throughout the organization. (Paulk et al., 1993)

There are situations when potential subcontractors are required to use the software process of their customer. One reason for this might be that a potential subcontractor does not have a sufficient software process of its own. In this situation there is no use conducting the software process assessment. Perhaps the best approach in this case would be to inquire the willingness of the subcontractor to use the software process required by the customer and then follow its implementation once the subcontractor has been selected.

The software process assessment can be used to predict whether a particular supplier is able to deliver the required product on time, within budget and with the standards of quality and reliability that the project needs. The software process assessment may be done the SEI Capability Maturity Model as a basis. This was done in Motorola’s case that is described in the fourth chapter of this study. (Östring, 2003)

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requested in the companies that were selected as subcontractors. Follow-ups of improvement efforts were conducted.

C. Know-How Related

Domain expertise is a criterion that is investigated, if the company passes the business and financial analysis and the software process assessment (Nielsen & Miller, 1996).

Domain expertise and special software technology capabilities are not currently addressed in the CMM model and consequently it is important to cover these things separately. Also managerial issues such as: how to select, hire and retain capable employees, are out of the scope of CMM. (Paulk et al., 1993)

V. OFFSHORE OUTSOURCING AS A POSSIBILITY

Offshore outsourcing is essentially outsourcing abroad. This study is focused on software subcontracting and there is a possibility to select subcontracting companies from abroad. This broadens the scope of potential available subcontractor candidates.

Companies have started to develop and maintain their software offshore extensively during the last decade. The enormous amount of programming needed for Y2K transition increased the use of offshore outsourcing and it was noticed that many of the offshore companies had transformed from the early 1990s and did high-quality work and had sophisticated application management processes to do it (Amorbieta et al., 2001).

Reasons for offshore outsourcing are usually savings in money and time. Herbsleb and Moitra (2001) present several factors contributing to the extended use of globalization in software development. The following list states few of these factors that could be also used as reasoning behind offshore subcontracting:

(i) the need to use cost-competitively scarce resources wherever located;
(ii) the possible business advantages of proximity to market; and
(iii) severe pressure to improve time-to-market by using time zone differences in “round-the-clock” development.

General criteria for subcontractor selection remain valid even when selecting subcontractors from abroad. But there are special issues to consider when thinking of subcontracting R&D software development abroad. The suitability of project for offshore outsourcing and selection criteria characteristic to offshore subcontracting is covered in the following chapters.

A. Project Suitability for Offshore Outsourcing

As with domestic outsourcing, a software project with low strategic importance and high market capacity of workforce is an indication that the software project could be outsourced.

Communication between parties is one of the biggest challenges in offshore outsourcing. Because of this a precondition for offshore outsourcing is that there should exist highly structured specifications and only a low number of changes to be made over time. Amorbieta, et al. (2001) states that early phases of project tend to be poor candidates for offshore outsourcing, because of said communication problems and the fact that early phases usually involve more business logic than technology.

Set-up costs for offshore outsourcing are high so that offshore outsourcing works best with large and complex projects. The offshore subcontractor should be involved in the project as much as is useful. Müller et al. (2000) state that the offshore partner should provide at least 30% of the work effort with respect to specification, programming, testing, analysis and design. This means that the reins of a project should not be given to an offshore company. Instead, the number of software interfaces should be minimized between offshore subcontractor and the possible developers of the customer in order to avoid misunderstandings. Highest cost savings when using offshore labor can be realized in the most labor-intensive phases of the project like coding and testing. (Müller et al., 2000)

Good project choices for offshore outsourcing companies include re-engineering efforts for software systems. These re-engineering tasks can be rewriting code, re-architecturing systems etc. These re-engineering efforts may not be appealing for domestic developers. (Amorbieta et al., 2001)

Dedene and Vreese (1995) present a study suggesting that offshore outsourcing would be a good choice for large scale re-engineering projects. This conclusion is based on two case studies where certain companies managed to get better contracting deals with non-western software companies. These contracting deals with foreign companies were not time-material based contracts like contracts typically offered by the Belgium software companies. Instead, these contracts that foreign companies offered were based on “no cure no pay” concept.

B. Subcontractor Selection Criteria Related Especially to Offshore Outsourcing

When the decision to outsource abroad has been made there are a few questions to be answered. The basic selection criteria for offshore subcontractors are the same as for domestic subcontractors. The following paragraph presents selection issues characteristic to offshore subcontractors.

Müller et.al (2000) presents the following criteria.

a) Choosing the Country/Area

Clashes between different languages, cultures and work practices can make collaboration with offshore developers challenging (Amorbieta et al., 2001: 132).

India, Eastern Europe and East Asia are the most common offshore outsourcing areas for software. India has been the long-term number one area for software outsourcing by offering good quality with low costs. (Müller et al., 2000)
Amorbieta et al. (2001) presents that quality of supply measured by CMM level is highest in Israel, India, Ireland, and Singapore. From these “higher quality” suppliers only India belongs to the low cost supplier group. The above costs refer to labor costs where also taxes, insurance and cost risks associated with particular country have been taken into account.

Low costs are documented to be also in countries like Russia, China, Philippines, Malaysia and Hungary. India seems to have costs higher than in China, but lower than in Philippines (Amorbieta et al., 2001).

A country’s economic and political environment affects a company. In an unstable environment even an otherwise highly rated company faces difficulties. In an unstable country the company should not get a better rating in company analysis than its country (Östring, 2003: 41).

(1) Language

Language is an important component of national cultural distance. Many companies hesitate to collaborate with nations where English is not spoken widely. This has increased the success of offshore IT work in countries with strong English language capabilities like Philippines, India and Singapore. (Carmel & Agarwal, 2001)

(2) Culture

Country-specific traditions, beliefs, or religions may affect co-operation between parties in subcontracting (Kobitzsch et al., 2001).

Therefore, cultural factors have to be considered when selecting subcontractors from abroad in order to prepare for the possible communication misunderstandings that may arise during subcontracting and also during the selection process. The factors that will be determining in a particular cooperation will depend on the nationalities involved (Smith and Blanck, 2002).

Different cultural ideas and values may cause difficulties when formulating contracts with a foreign subcontractor so that contract formulation may take a lot of time, money and effort.

Cultural factors may determine how thorough the specifications for the developed software should be and what kind of guidance the developers in the subcontractor site might need to accomplish the task. This particular cultural factor is mentioned as “uncertainty avoidance”-factor in the cultural factor list presented below. This “uncertainty avoidance” cultural factor, for example, might influence the subcontractor selection by making companies from countries where uncertainty is not avoided better candidates for development of completely new software with inadequate specifications, which requires a lot of initiative from the subcontractor.

Factors that help in understanding differences in cultures are summarized by Duarte et al. (1999):

(i) Power distance, extent to which followers defer to the leader;
(ii) Uncertainty avoidance, degree of task structure desired;
(iii) Individualism-collectivism, preference to act as individuals versus a group;
(iv) Masculinity-femininity, relative emphasis on material versus “caring” values;
(v) Long term-short term, balance of long-term versus more immediate gratification; and
(vi) High-low context; amount of context required along with the facts.

(3) Time Zone

Differing time zones between client and subcontractor may present challenges in communication. The business hours for video/telephone conferencing suitable between parties may not exist so that consideration has to be taken how to arrange these meetings.

Time differences may enable a 24-hour development process, but this kind of development is usually not the most suitable for subcontracting purposes between legally different entities. (Kobitzsch et al., 2001)

b) Know-How Related Criteria

Experience with the technology to be used in the software project is essential for the subcontractor. It would also be good, if the subcontractor had domain specific capabilities related to the project in question.

In order for the projects to be successful it is good to find out if a particular subcontractor has previous experience in offshore outsourcing. It would be also good to know some reference clients the company in question has worked with. (Müller et al., 2000)

c) Infrastructure Related Criteria

Especially when co-operating with subcontractors located in the less developed countries it is essential to find out that the needed infrastructure to effective communication and software development are available for and in use by the company (Kobitzsch et al., 2001).

C. Information Security and Intellectual Property

In R&D software outsourcing information security is generally an important matter as was mentioned in the first chapter of this study. Cultural issues and political atmosphere in the subcontractor’s country may affect how confidential information is handled. Corruption may be more common in some countries and information may, for example, be sold to competitors.

Laws about intellectual property rights concerning the developed software differ depending on the country in question. For example, in some countries like Finland the
employer automatically gets copyright in the software code developed by its employees when performing the work, irrespective of whether the employee and the employer have agreed on the matter. The same does not apply in many other countries. What this means in practice is that also the company using the subcontractor may need some basic knowledge about the intellectual property rights legislation of the subcontractor’s country of domicile.

VI. SUMMARY

The following paragraphs present a summary version of answers to the research questions presented in the beginning of this study.

A. Type of Project and Selection of Subcontractor

R&D projects can generally be thought to be strategically important and aim for the company’s future success. Thus, selection of subcontractors for software development related to this kind of projects can be considered to be even more of an important decision than selection thereof for other non-core projects. This should also influence the depth of the analysis to be made with respect to the potential subcontractors.

Factors that should be especially taken into account in the selection of subcontractors for R&D related software are:

(i) Information security between parties in subcontracting;
(ii) Domain specific know-how of the subcontractor; and;
(iii) The amount of software development work relating to entirely new products the subcontractor has previously done, if there are intentions to develop a completely new product.

B. Subcontractor Selection Criteria

There are lots of criteria to consider when evaluating subcontractors. The main subcontractor selection criteria for software subcontracting are: financial status, experience and capabilities of the subcontractor; development and control process status and quality practices used by the subcontractor; maintenance service and technical assistance for the possible product; and prices and contracts obtained with a particular subcontractor.

C. Software Subcontractor Analysis

The analysis presented in this study to be made for the potential subcontractors consists of three parts being: business and financial analysis of the subcontractor, subcontractor’s software process assessment and know-how evaluation. Software process assessment should be used in cases, where the customer does not want the subcontractor to implement the customer’s own process.

D. Offshore Outsourcing as a Possibility

Communication is usually one of the biggest challenges in offshore outsourcing. Accordingly, projects that have good specifications and do not change much over time are good candidates for offshore outsourcing. Set up costs for offshore development are usually high and, thus, the component to be developed should be large and complex to create cost savings compared to domestic development.

The basic selection criteria for offshore outsourcing are the same as with domestic outsourcing. Additional things related to the location of the subcontractor to consider when selecting offshore subcontractors are country of domicile, culture, language and time zone of the subcontractor. Also issues like infrastructure for effective communication has to be considered when co-operating with companies in less developed countries. Information security and intellectual property rights legislation are also issues to be taken seriously when operating with foreign companies. Also cultural issues and political atmosphere may affect how confidential information is handled and how the results of the outsourced software development work are treated from the intellectual property rights’ point of view.
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