LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
Department of Information Technology
Laboratory of Information Processing

Selected Aspects Related to Pre-development Stages of International Software projects. Case of Finland and Russia.

Master of science Thesis

The Department Council of the Department of Information Technology confirmed the topic of Master's Thesis on 12.11.2003

Supervisor:	Prof. Jan Voracek
1st examiner:	Prof. Jan Voracek
2nd examiner:	Prof. Vladimir Botchko

Author: Daria Palitsyna
Nalichnaja str 36-7-462
199226 Saint-Petersburg, Russia
phone +7812-356-39-27

Lappeenranta, Finland
26.11.2003

Abstract

Lappeenranta University of Technology
Department of Information Technology
Laboratory of Information Processing

Author: Daria Palitsyna

Thesis title: **Selected Aspects Related to Pre-development Stages of International Software projects. Case of Finland and Russia**
Master's thesis
November 2003

Number of pages: 67
Number of figures: 20
Number of tables: 9

Supervisor: Jan Voracek, Prof.
1st examiner: Jan Voracek, Prof.
2nd examiner: Vladimir Botchko, Prof.

Keywords: pre-development project study, pilot project, feasibility study, prototype, requirements engineering

The question of Pilot Project creation, due to support pre-development stage of software product elaboration, nowadays might be used as an approach, which allows improving the whole scheme of information technology project running. This subject is not new, but till now no model has been presented, which gives deep description of this important stage on the early phase of project.
This Master's Thesis represents the research's results and findings concerning the pre-development study from the Software Engineering point of view. The aspects of feasibility study, pilot prototype developments are analyzed in this paper. As the result, the technique of Pilot Project is formulated and scheme has been presented.
The experimental part is focused on particular area Pilot Project scheme's implementation– Internationally Distributed Software projects. The specific characteristic, aspects, obstacles, advantages and disadvantages are considered on the example of cross border region of Russia and Finland. The real case of Pilot Project technique implementation is given.

Lyhennelmä

Lappeenrannan teknillinen yliopisto
Tietotekniikan osasto
Tietojenkäsittelytekniikan laboratorio

Tekijä: Daria Palitsyna

Diplomityön aihe: **Valikoituja näkökulmia kansainvälisten ohjelmistoprojektien esikehitysvaiheeseen. Case Suomi ja Venäjä**

Diplomityö
Marraskuu 2003

Sivuja: 67
Kuvia: 20
Taulukoita: 9

Ohjaaja: Professori Jan Voracek
1. tarkastaja: Professori Jan Voracek
2. tarkastaja: Professori Vladimir Botchko
Hakusanat: projektin esikehitysselvitys, pilottiprojekti, esiselvitys, prototyyppi, vaatimussuunnittelu

Diplomityössä tutkitaan ohjelmistoprojektin esikehitysvaihetta keskittyen esiselvitysvaiheeseen ja prototyypin kehittämiseen. Lopputuloksena laaditaan ja esitellään suunnitelma pilottiprojektimenetelmää varten.

Nykyisin käytännön ohjelmistokehitystyössä esiselvitystä käytetään esikehitysvaiheessa projektin kulun edistämiseksi, kehitystyön laadun parantamiseksi ja projektin epäonnistumisriskin pienentämiseksi. Tekijän tutkimuksen mukaan kuitenkin toinen menetelmä – pilottiprojekti, joka perustuu alkuperäisen prototyypin mallinnukseen – sopii paremmin tähän tarkoitukseen. Informaatioteknologialle (IT) tämä tutkimustehtävä on erittäin ajankohtainen, merkittävä ja sen näkökulma on tärkeä olosuhteissa, joissa teknologiaa kehitetään, kansainvälinen yhteistyö lisääntyy ja toimintaympäristö on myrskyisää.

Teoreettisia tuloksia ja tekijän kehitystyötä sovelletaan case-esityksissä, jotka käsittelevät kansainvälisiä ohjelmistoprojekteja. Pilottiprojektisuunnitelman käytännön sovellusta tarkastellaan suomalais-venäläisen rajat ylittävän ohjelmistokehityksen projektiesimerkin valossa. Työssä tarkastellaan rajat ylittävän IT-projektin erityispiirteitä, näkökohtia, esteitä, etuja ja haittoja sekä laaditaan tyypillisiä käyttäytymisskenaarioita.

Acknowledgments

From the very beginning of work with this Master Thesis appeared, I have got significant support of number of people. I want to acknowledge professor Jan Voracek for all constructing and encouraging comments from his side and Master's Thesis supervision. I also would like to thank professor Vladimir Botchko for his time and favour to be my examiner.

I also owe thanks to Daria Chistokhvalova from the Department of Industrial Engineering and Management. Daria gave me plenty interesting and crucial ideas, which helped me to understand specific aspects of the research area. Your support was very important for me, and being especially on the final stages of this work. I need to give a special thank for been kind in and your exerting any effort to make this paper readable.

I also want to thank my friends and colleagues from Lappeenranta University of Technology: Irina Lishchina, Albert Sadovnikov, Denis Dyakov. You made my stay in Finland enjoyable and I appreciate your attempts to change my evening study sessions style. I want to say special thank to my dear flat-mate Diana. Our kitchen sessions gave me really a lot and helped to create a new simple vision of complicated issues. It is great pleasure to have you support and to know that I can relay on you. I would like to tender a special thank to my friends Katja and Elmira. I am glad that time and remoteness could not break up our friendship. I want to acknowledge my German friends: Carsten Störman, Simon Mullender, Sebasian Gassner, and Dennis Benkmann and all international community for been with me during the most hard first few months of my study in Finland and making it more bright and colorful. I need to say a special thanks to Tobias Tenner for his inexhaustible creativeness and coffee session, which gave me a lot new for life understanding.

Finally, I would like to thank all the members of my family. I wish to thank my parents, Tatiana and Alexander, for education they provided me with. I also like to thank my dear brother Grigory. You are the greatest example of the smart, purposeful, and honest person, I have learned a lot from you and I appreciate all of your advices. Every moment of my stay in Finland I felt support of my dear family, in spite of the border and distance. A great thank you to all of you.

Abbreviations

CBA –Cost/Benefits Analysis

CRM Customer Relations Management

FS –Feasibility study

GUI – Graphical User's Interface

ICT – Information and Communication Technologies

IDP –Internationally Distributed Project

IM - Information Management

IRR - Internal Rate of Return

IT- Information Technology

NPV - Net Present Value

PEM –Project Evolution Model

PLC – Project Life Cycle

PMBOK - Project Management Body of Knowledge

PP – Pilot project

PS –Pilot study

QAS - Quality Assurance System.

R&D –Research and Development

RAD –Rapid Application Delivery

ROI - Return of Investments

RUP- Rational Unified Process

TC&A - Technology Creation and Application

TEA – technical and Economic Analysis

DBMS – Data Base Management System

Table of contents

1. INTRODUCTION

Software development process has a high risk due to the specific of the Information Technology (IT) field characterizing by rapid changing of the technology environment. Success of the particular software (SW) project does not always mean that the whole project's process had been realized correctly and without obstacles. Most part of the projects in the IT area start from the analysis and requirements engineering, but quite often the initial preliminary study of the project is skipped due Project Life Cycle shortening. The role of pre-development phase in Product Life Cycle is to support the whole project and to determine possible challenges on the initial stage. And on my opinion, it has a great influence for the whole project. Plenty of the existing methods and techniques of the pre-developments study are based on feasibility study in most cases. However, specific aspects of the software product development, like for whole IT industry, also need to be taken into consideration on this stage. The other problem is to determine the target group of projects, where the implementation of the adopted pre-development study technique is more reasonable. In such way, pre-development study and its aspects investigations the Software Engineering point of view nowadays is quite actual and perspective issue.

Objective of this research is to define pre-development stage of software development projects, based on the preliminary systems' prototype modeling. The main task of this Master's Thesis is to demonstrate aspects of the Pilot Project development as a way of pre-development stage. Software projects requirements engineering, feasibility study methods, trust model, pilot prototyping technique are going to be discussed. Due to this fact, several key questions are considered:

- What is a pre-development stage?
- What are the reasons and groundings for preliminary study from the Software Engineering point of view?
- What are the specific aspects for pre-development study of software projects?
- How should be the pilot project realized?
- In which projects, cases, and circumstances the pilot project technique has sense to be implemented?

Due to illustrate the author's findings, concrete scenarios of SW project engineering are presented. Case of Russia and Finnish co-operation, focused on SW development, is considered as an example of auspicious variant for proposed technique demonstration.

The report is organized in follow: Chapter 2 of this Thesis is focused on the most typical models of software project development. Characteristic of the prior stage of project is given here. In Chapter 3 aspects of the pre-development preliminary study are considered. Main questions of trust model, initial requirements gathering requirements; feasibility study elements and technical aspect prototyping on the initial stage are reviewed and discussed. In Chapter 4 the model of pre-development pilot project for software projects is presented. Chapter 5 gives a summarized description of the theoretical part and introduces the author's opinion about possibilities of particular scenarios for SW development projects implementation in respect to specific characteristic of the projects. Chapter 6 includes the empirical results, focused on cross border cooperation between Russia and Finland. The issue of the pre-development study, and, especially, pilot project creation, is raised in this part. Chapter 7 describes an example of typical project for Russian-Finnish area, which is considered from the prior pilot project point of view. Main common obstacles and advantages are discussed by this part. Chapter 8 concludes the author's findings on the aspects of pre-development study for software projects.

2. INTRODUCTION TO SOFTWARE PROJECT PLANNING

2.1. Business Environment in IT Industry

Information Technology (IT) developer-companies within the process of software engineering and new product creation should be oriented on the key aspects such as:

- Adequacy of the product and requirements,
- Fixed time limits,
- Funds limits,
- Quality management on the all process,
- Reliability of partner relations [7].

During the processes of project management different factors should be taken into consideration. Successful result of software project depends on possibility of the company to implement above-mentioned key aspects during the development. More over, it is important to analyze both technical and economic sides of the project, make preliminary study. Information, which was got on the stage of pre-development analysis, can be taken as a basic for further construction of the system, architecture design. Developers companies avoiding it, increase total risk of project [1].

A potential difficulty is, that even inside one company, running certain project, few departments can exist. Each department or team has its own part of the project and task. In this situation, even small software project needs to be planned carefully to avoid significant obstacles during development process [32]. It is natural, that for the international distributed projects (IDP) the risk of the whole project is rising, and the problem of trust for such project becomes especially important. The practice shows, that earlier determination of predicated challenges in part of cases allows to minimize risk of fail and to decrease the cost of possible changes.

2.2. Software Project Life Cycle

There is no doubt, that it is necessary to introduce Project Life Cycle (PLC) concept in the framework of SW development with the purpose to clear the role of pre-development study.

Project - is a changing dynamic time-limited system with determined requirements for results, quality, recourses, and specific organization structure [45]. According to Burakov "project is a time-limited activity with fixed start and end points, focused on achieving unique purpose" [7]. Literature research shows that project in IT field also can be defined as "activity, which is directed towards (1) product or service development, (2) modification of the information system, (3) re-engineering of process "[40].

Different approaches exist to present Project Life Cycle. Most of them are based on business models and do not show the specific technical aspects from the software engineering point of view.

2.2.1.Project Life Cycle: Business Model

According to business management theory, both mass and unique customer's tailor-made projects can be characterised by the Project Life Cycle (PLC). PLC is determined as a sequence of time defined stages, which are pointed out for better control and management of the project [26].

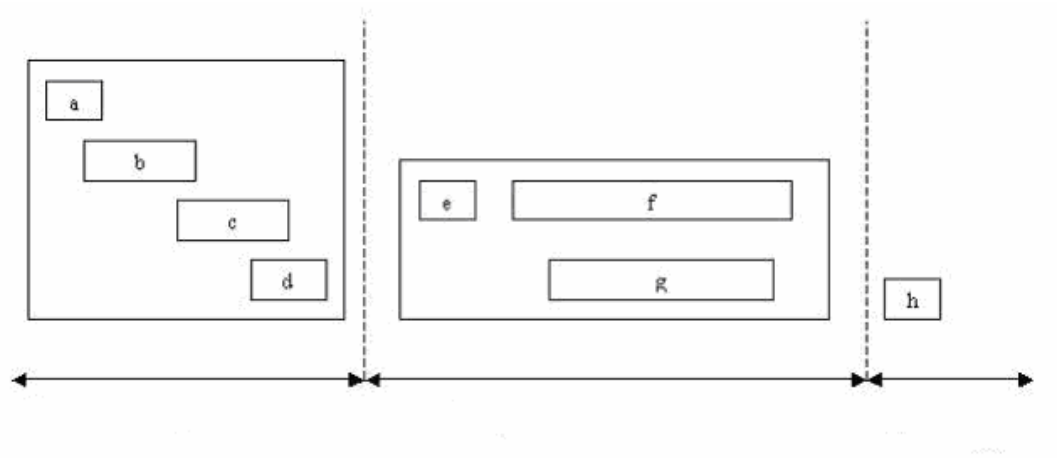

Figure 1. Project Life Cycle: Business Model

Source: Vasuxin, ?., Golubev, ?., Pavlova ?., Economic investments' estimation, SPb, 1998, p.34

Taking into consideration this explanation, it can be presented in the following way:

a) Marketing and specification of requirements for SW,
b) Design of SW product,
c) Programming (code),
d) Testing, validation and verification,
e) Spreading of SW on the market,
f) Exploitation,
g) Maintenance of SW,
h) Reject of SW, maintenance's refuse [45].

Marketing and specification of SW is directed to the examination of requirements for creating product, such as:

- Purposes of the system,
- User's require setting for Graphical User's Interface (GUI),
- Setting of technical requirements,
- Resource estimation (material, human, financial),
- Preliminary estimation of life cycles stages duration [25.40].

To my opinion, at this juncture it is important to set formalized target. For the case of software product's market release supposed, marketing analysis is necessary:

- Analogy-products' and competitors' analyse,
- Global users requirements for product,
- Analysis of potential market capacity,
- Price costs, sales volume forecast.

Additionally, at this point, for the product, developing for the unique customer, the main task is a correct formulation of requirements' documentation. Incorrectly has been interpreted mission can lead to mistakes: wrong costs estimation, objectionable results during the process of SW design and construction.

Following items could be used to describe the *Design of SW architecture*:

- Algorithmization of data handling process,
- Function's detailed elaboration,

- Design of SW product structure (architecture of program modules), database structure,
- Selection of methods and tools for SW development [42].

Programming, testing, debugging stages are related to the technical realization of the project and are handled with a help of chosen tools (algorithmic languages and coding methodic). Used instruments for design, validation and verification play a great part because they influence on the laboriousness of work, costs, and quality of final result of the project.

Documentation is a mandatory part of work, which usually is done not by developer but, for example, by person, who is engaged in process of broadcasting, product's implementation and training. Document includes information about installation and reliable work of the product; sets up the process of proper interaction with other software. At the machine level, as a rule, are created:

- Automated context-sensitive help,
- Demo-versions, which train user on-line (electronic textbook) or off-line (reel or cartoon film) to demonstrate functional capabilities of SW and its technology [37].

Broadcasting means "presentation of the result product to the mass user"[25]. This stage of PLC must be as short as possible. For SW product promotion the following marketing approaches could be applied: (1) advertisement, (2) increasing realization channels number, (3) creation of dealers and distributors network, (4) pricing (discount), (5) maintenance and after-sale service [25,32].

Exploitation is a process, which goes parallel with a maintenance process. However, program running and maintenance process can be independent. Quite often during the process of exploitation debugging is going on [7].

Taking product out of sale or refuse of maintenance usually occurs because of changes of the company's technical policy, inefficient use of product, irremovable bugs, moral old of the product, no customer's demand.

Business model of PLC is focused on the companies' strategies and marketing of the final product; the application of this model to the SW project development is quite poor from the technical point of view

2.2.2. Project Life Cycle: Technology Creation & Application Model

In order to describe Software Project Life Cycle within Technology Management framework, Technology Creation & Application Model (TC&A)(Figure 2.) could be presented [23].

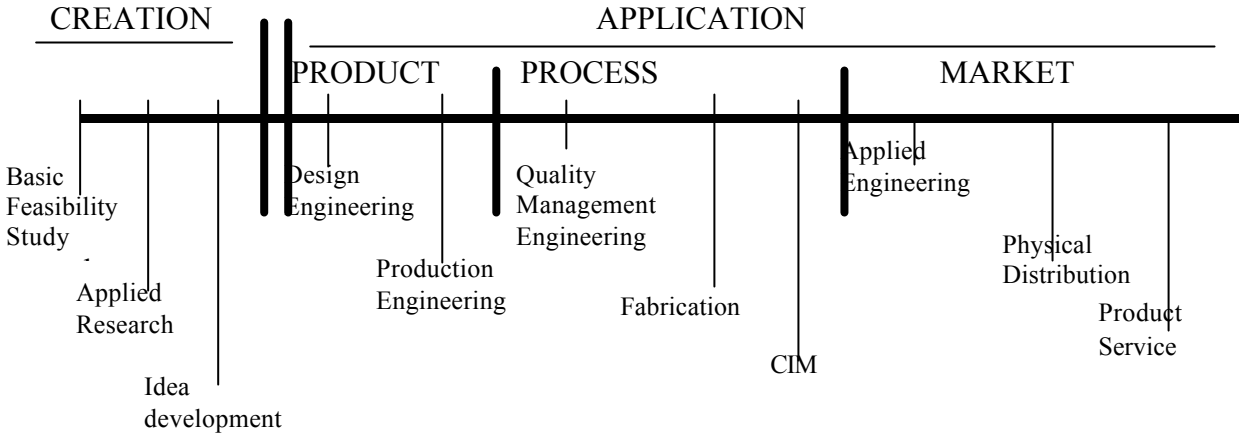

Figure 2. Project Life Cycle: TC&A Model

Source: Kassi, T., Management of Technology, course material part1, LUT, 2003, p.2.

It is obvious that, TC&A model per se is based on the "product- process theory"[37]. However, in this model the difference between phases of the project from the technological point of view are underlined: it emphases the division between Creation and Application phases. The first one is oriented on research and development (R&D) and particular idea's expansion, where the second one presents procedure of ingenious product design, manufacturing and introduction it to the market promotion [23]. In respect to software engineering (SWE), Product-phase is in the line with software development process [37]. Creation-phase of TC&A model is more connected to the requirements engineering (RE) process. The relationship of software requirements and activities of the Creation stage are presented on the Figure 3.

Unfortunately, here I have to admit, that both above-mentioned models of PLC, mentioned above -: Business model and Technology Creation & Application model -, do not consider the process of pre-development study of software projects. Typical situation is that just quite short, surface feasibility study supports requirements engineering stage [26]. However, not all projects need to separate pre-development

stage, but still some aspects should be examined to determine the niche, where this theory could be implemented.

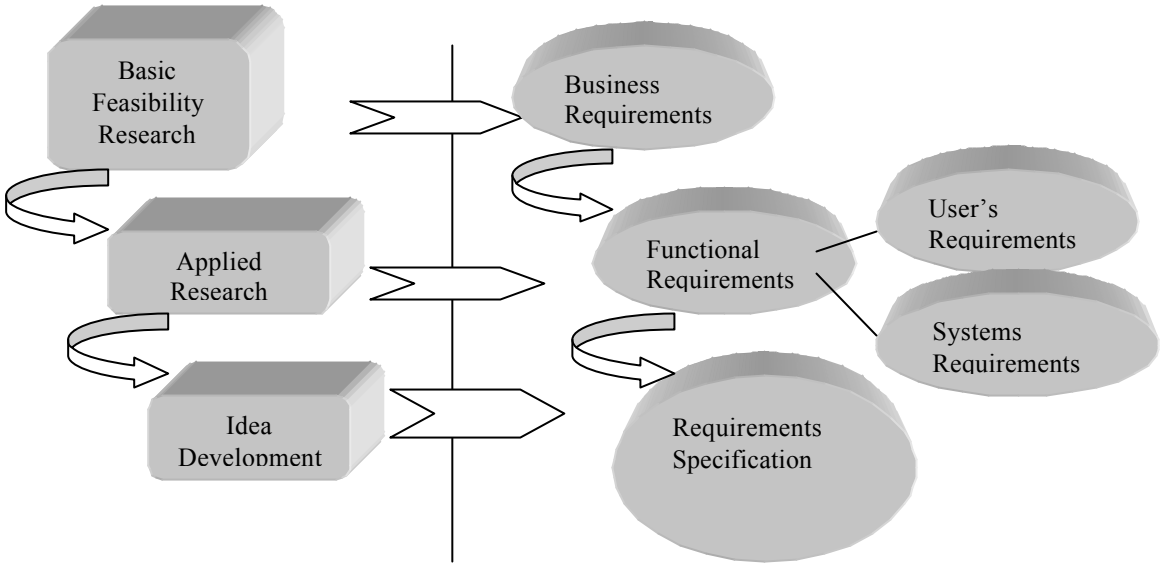

Figure 3. Relationship between Creation stage of TC&A and Software Requirements Engineering Activates

2.3. Project Evolution Model (PEM)

For the research purposes, I need to introduce a Project Evolution model [40]. In comparison with the above-mentioned models, PEM represents software PLC, covering pre-development stage. Project realization can be shared into 4 components:

1. Feasibility study stage
    - Analysis of alternatives in order to draw attention to the concrete investment project,
    - Decision basing due to make final decision about technical or economic prerequisites for the project's realisation, viability of the project,
    - Project estimation and decision-making, business-plan writing [40].
2. Decision making.
3. Investment stage:
    - Documentation,
    - Design,
    - Program realization,
    - Validation and Verification (V&V),

- Implementation [26].

4. Exploitation:

- Maintenance,
- Research for next version of product [6].

The general structure of Project Evolution Model is shown on the Figure 4.

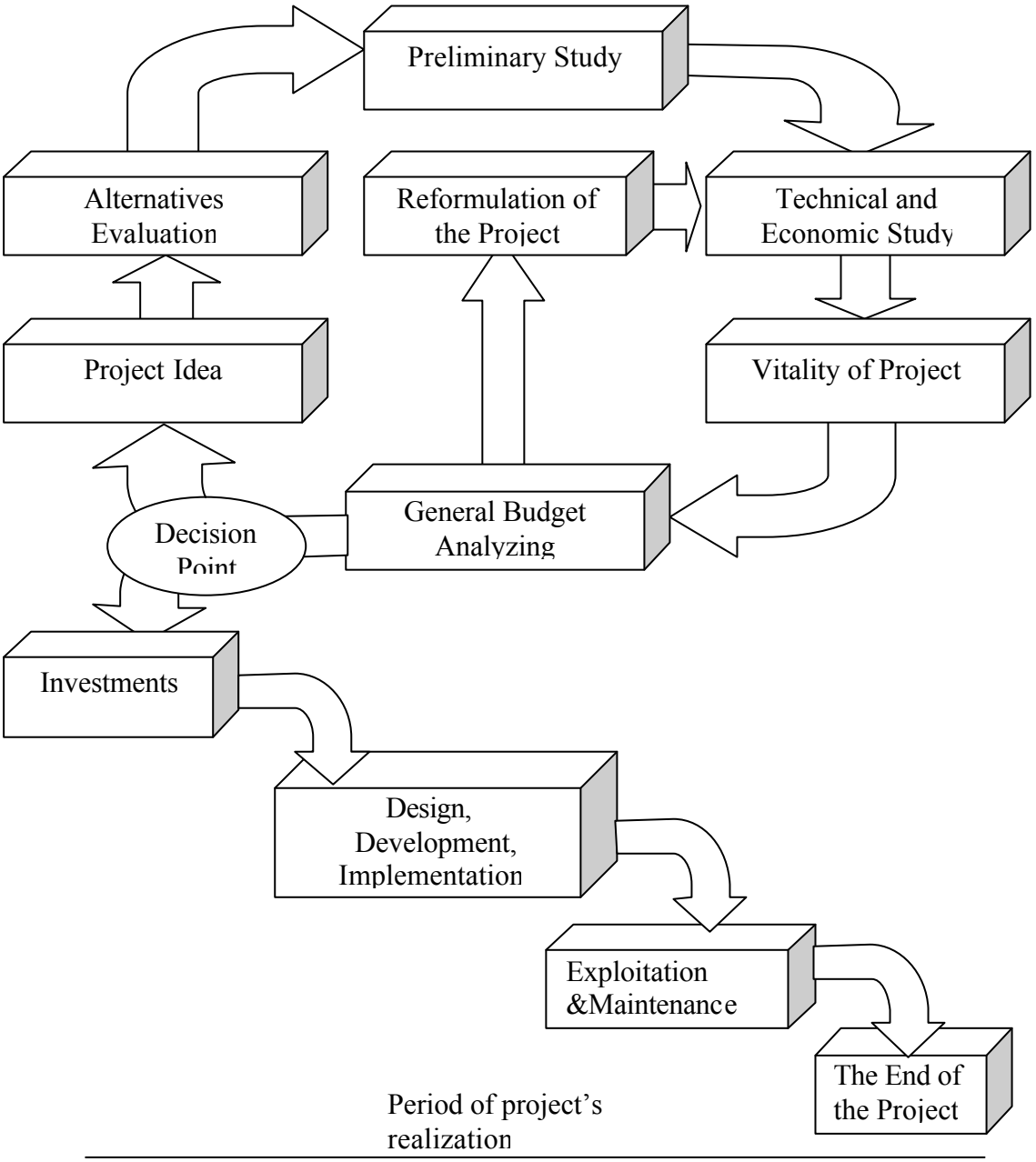

Figure 4. Project Evolution Model

Source: Savchenko, N., Technical and economic analysis for projects, Exam, SPb, 2002, p.14.

The model presents the initial stage of the project, where idea goes through the prior study and all relevant information should be gathered and processed. Then proposal should be checked for viability, possibility of technical, economic, and organizational realization. If the risk is too high, the project might be reformulated [5].

There are few aspects, which inherent for management of software project. IT industry is a fast changing environment [26]. Due to this, quite often developers try short-term project life cycle by cutting off prior study activities. According to my opinion, that can lead both to positive and negative results. The sticking point here is a comparison of efficiency - time, funding, recourses – and the risk level [40].Obviously, set of criteria could be pointed out, with which this ratio might be estimated: (1) size and duration of the project, (2) technology characteristic of the project, (3) experience of the company (4) co-operation model within project (5) trust and etc. That becomes more important for international business, and, especially, to management of International Distributed software projects.

2.4. Characteristic of the Software Project Pre-development Stage

When dealing with software project, I should mark out, that project management depends on the particular features and characteristics of the project such as (1) specific technical field, (2) size of the project, (3) technology limitations, (4) time and recourses limits. The main impact is given by permanent changing technological environment [26]. It is one of the factors, giving a chance to consider software projects different form others.

Failure risk in information technology field is high. Predicting obstacles and minimizing danger - are the main tasks, of feasibility study of the project and whole pre-development study [42]. However, here two opposite views exist. Practically some IT companies do not like to waste time for deep preliminary study. They ground this by minimization of (1) costs, (2) time recourses, and (3) humans recourses [7,45]. The other opinion is that pre-development stage is a starting point of project, and it has effect on the whole project of software development and its result [3]. Under the above described, I consider 2 main issues need to be determined. Firstly, the correct type of project should be chosen for pre-development stage implementation. In this study the group of project can be pointed out due to the high risk and low trust factors:

(1) Large scale projects,
(2) Joint projects,
(3) Geographically distributed projects,
(4) New partnership projects,
(5) New technology projects.

Secondly, the scheme of the project preliminary study mast be realised in proper way in respect to software specific characteristics.

Resume

- Almost for every IT company there is set of key aspects, influencing the result of the project: product and requirements matching, time and funds limits, quality assurance system (QAS), reliability of the partner. Well-planned Project Life Cycle allows avoiding obstacles of the above-mentioned issues.
- Project Life Cycle is time limited set of activities with fixed start and end points, focusing on the achieving unique purpose. Two basic models of PLC have been considered: Business Model and Technology Application and Creation Model. They both do not consider the process of pre-development study for software projects.
- The structure of a preliminary study of the project can be described by Project Evolution Model (PEM), consisting of 4 parts: feasibility study stage, decision point, investment stage, and exploitation. But still, this model does not describe the specifics of software development.
- Set of aspects were determined, which are at the heart of the pre-development stage: size and duration of the project, technology characteristics, co-operation model, risk level, profit focus of the project, trust, and costs estimation.
- Two main issues concerning preliminary study for software project are determined: the type of project, which suits better for pre-development study stage, and the preliminary study procedure in respect to software specific characteristics.
- In respect to proposed aspects, pre-development stage is suggested to be included to the next types of projects: large scale, joint projects, geographically distributed projects, new partnership projects, new technologies projects.

3. ASPECTS OF PREDEVELOPMENT SOFTWARE PILOT

3.1. Trust Aspect Within Software Engineering Framework

3.1.1. Trust Model

Trust issue can be pointed out as a base for the business activity within IT framework [30] and it "can and should be raised already on the preliminary stage of the projects"[40]. Trust is an important aspect of interpersonal and interorganizational relationships [37]. Trust is the foundation for any business activity and should be established on the starting point of the project and is maintained within the whole of the project life cycle.

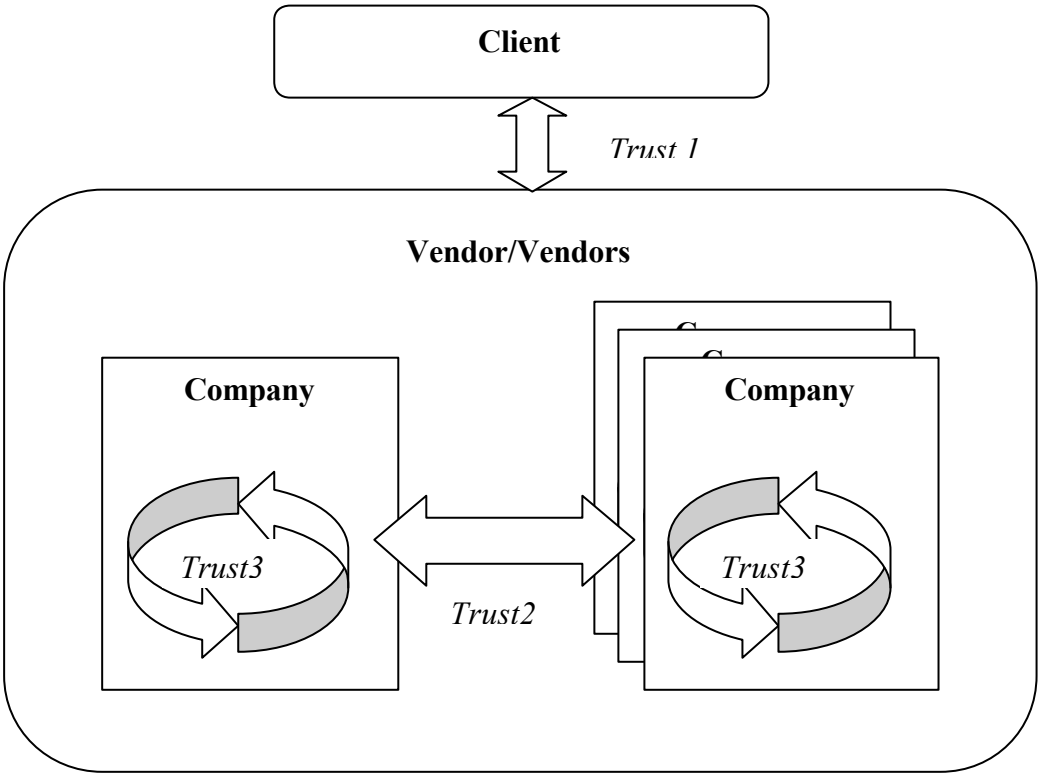

Figure 5. Levels of Trust Model

Figure 5. presents trust within software project. Firstly, for any project we can emphasize level of "customer-vendors relations", characterising by the confidence of the both sides to each other (Trust Level 1). However, I can determine aspects,

describing company as a business unit: (1) capacity to keep obligations (2) competence in the field, (3) desire and readiness to cooperate [39]. As a key attributes are taken:

- Company's age,
- Ownership of the company,
- Specialization of the company,
- Size of the company,
- Market place and share,
- Number of existing partners/clients,
- Number of ready projects,
- Financial stability (parameters),
- Quality assurance system,
- Corporate culture/language,
- Project management approach [19, 30,39].

Secondly, relationships between vendor-companies exist and present a key issue for distributed projects (Trust Level 2). Obviously, the value of trust on the "vendor's level" is added to the previous level. The aspects, described above, should be added by ability to cooperate within the project. What means the possibility to manage the project and follow created business model and business proceeds, which have been terminated between sides [39]. Trust attributes for this layer could be extended by:

- Cooperation model,
- Project management approach,
- Project management tools,
- Monitoring and control process [39].

Thirdly, trust inside the company or particular department has it is own value, which is based on the reliability of the created model and process (Trust Level 3). Organization always should take into consideration the possibility of failure-determined model for task realisation. Key characteristic could be:

(1) Number of ready solution in the same field,

(2) Prototype presentation [39].

According to the levels of Trust Model, describing trust for cooperation within one project, each trust level increases the total value of the trust in the project. However, considering problem of international cross-border project, it is necessary to

point out the second level. Here simply could be seen basic characteristics, which are a foundation for determination of key criteria for pre-development study, and global support of the whole project from the management and organizational point of view. Additionally necessary to point out that prototype as a technique allows the same time to cover all three levels of trust model mentioned above.

3.1.2. Trust Classification

Sabherwal shares trust into four groups and indicate specific mechanism, leading to increase of trust level [7]. Firstly, trust can be "based on the knowledge" of the partners about each other, including existing experience co-operations (1) in similar projects, (2) between same companies. The purpose is to gain the credibility with the partner before starting the project. Methods, which could be implemented, are:

- Research of experience,
- Team delegation to the assumed partner.

The next is "identification–based" trust, oriented on settlement, clarifying of the shared goals of partners companies [37]. Unfortunately, stakeholders have different goals and it is difficult to make them to match with the profitable result of both sides. Technique, which can be applied to hold it, includes building a team, which presents the objectives of one side with the respect to other partner of the project. That could be achieved by discussions and cooperation on the initial part of the project.

Third, "calculus-trust" - is a concept of relationships between concrete customer and vendor within particular project, which is based on

- Reporting mechanism,
- Frequency,
- Change-management procedure,
- Client-involvement plans,
- Communication set-up [37].

This issue, on my opinion, becomes especially important for project (1) between new stakeholders, who had no cooperation experience before or (2) geographically shared companies. Successfully realised project could be a good start of long-term

relationships between partners, which is one of the main target company's strategic planning.

Finally, "performing trust" has a direct connection with human trust towards already existing results. Demonstration of the completed part of the product, or prototype allows to improve cooperation and increasing reliability to the whole project: created model, co-operation between vendors' and clients' partnerships [37]. Owing to this fact, two methods might be proposed:

- Periodic prototypes,
- Pilot project creation or feasibility study.

The first one is used to control already running projects by monitoring the development process. Prototype – is a model of information system, which is created, tested and remade until suitable version is received, from which complete system can be developed [2]. Usually this method is used to reduce risk of failure SW product delivery [22]. The second approach is used on the pre-development and initial stages of the software process development, aiming to make feasibility study and to evaluate viability of the project via standard projects attributes. As it was mentioned already, prototype development is one of the techniques, which allows covering all three levels of the trust inside the particulate project. Trust aspect is software development projects is a global framework for the whole preliminary study.

3.2. Requirement Definition

In fact, one can say that requirements engineering is a heart of a software project. RE can be determined as a process identification system's purpose, gathering, business and systems needs, analysing system's background [31,38]. So I can conclude that, requirements are "bridge" stage between environments, customer's wishes and SW company's capabilities [15]. Requirement engineering is a crucial part of SW project. It's quite natural, that even pre-development study of the project can't be started before initial requirement are gathered. Quite often that is the only preliminary input information flow.

Few types of requirement can be determined for RE stage in software engineering:

1. Physical – includes the requirements for hardware and its external environmental restrictions,
2. Interfaces – describes the possibility and ways of interrelations of software with other system: output and input,
3. Technical Functionality- technical aspect of system's work, operational characteristics: speed, time of response,
4. Users factor – includes the characteristics of the users groups and it's specific individual features,
5. Documentation - includes the characteristic of the documentation support for the system,
6. Data – includes prescription of data format, period of renewing, data flow size,
7. Recourses – time, material, financial, human recourse, place,
8. Security - description of secure: access, backup,
9. Quality: reliability, availability, maintainability, security, bugs fixing [35].

Pre-development stage of the project is not able to carry out without requirements study. But, taking into consideration initial character of the investigation, Pilot study usually can be based only on: Physical, Technical, Recourses requirements.

3.3. Feasibility Study Concept

Under the above-described circumstances, it's essential to pay attention to the preliminary stage of the project development. I suppose, this step has great influence on the whole duration of project. As it was mentioned above, company can use Feasibility Study (FS) to prove the project viability and reduce the risk [10].

It is suggested, that Feasibility Study usually takes place on the starting stage of the project and can be a part of requirements engineering stage [37], but in the same time it can be carried out as an independent part of project, aiming to analyses of viability.

Pressman specifies Feasibility Study in four main dimensions: Technology, Finance, Recourses, and Time as independent part from other recourses [37]. According to my opinion, such classification is not full, because it doesn't present aspects of law regulation, marketing research and exploitation analysis.

General structure of Feasibility Study analysis includes main 6 sections:

Technical feasibility study includes description of:

- Customer's technical base,
- Already presented in the market tools and programs,
- Specific details of data handling,
- Convenience of data input and output,
- Possible ways to solve tasks [2].

Resource analysis of the project covers main categories of used resources description, exploitation, and preliminary costs estimation:

- Time resource,
- Budget funds,
- Humans resource,
- Equipment [2,3].

Economic feasibility study for the preliminary investment stage evaluates possible costs for the project and possible benefits. Usually it is based on the resource costs estimation Set of criteria should be taken into consideration such as:

- Break-even – is the difference between fixed and variable costs for the project and benefit for determined value of the products (break-even-point on the graph),
- Lowest coast - all possible costs are evaluated and the lowest selected,
- Payback period – is based on evaluation of costs and benefits as a cash flow; variant of fastest return of investments (ROI) is selected,
- Net Present Value (NPV)- determine the sum of the present value of cash flows (determined in time income cost and outcome flows),
- Internal Rate of Return (IRR) – the discount rate which gives NPV=0, and the project is considered to be better if costs of it's capital is more then its IRR [40,45].

As the result such analyze can reject the project in spite of the fact of the presence of possibility to implement all technical features.

Law regulation analysis raises problems, which can occur during software development process from the law point of view. Program products protected from unapproved access by Act of copyright and patents. Intellectual property rights support some specific author's right, one of such is right for making copies of a product. Buying of

SW - is a buying license for its use. License for SW gives an official right to use the program. Terms of license are fixed in the Licensing Agreement of final user. [13]

Marketing research is needed for SW, which are going to be used for broad casting and should include:

- Potential user's characteristics,
- Consumer's demand estimation,
- Market description and capacity,
- Competitors analysis, its position, market share,
- Competitors-products, features, prices,
- Own price estimation [25,29].

Operational analysis examines difficulties, problems, costs, which can occur during exploitation stage and, consequently, can influence the decision making of the whole project [37].

The structure of Feasibility Study element's interaction is presented on the Figure 6.

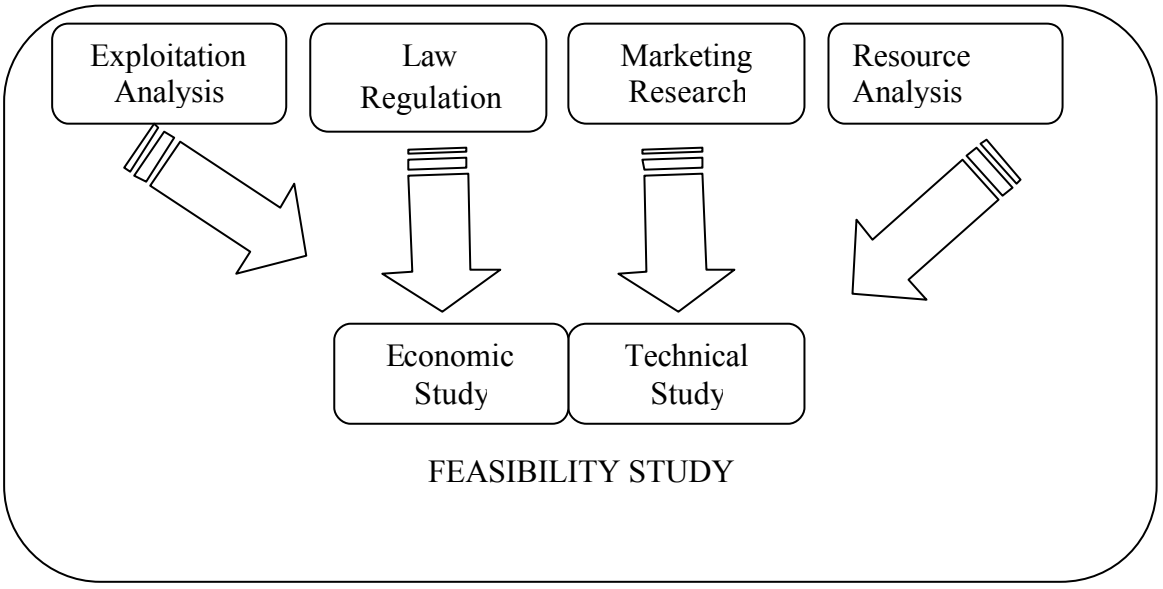

Figure 6. Feasibility study element's interaction

3.4. Prototyping Approach for Pre-development Analysis of Software Projects

As soon as initial requirement has been determined, they could be used no only for feasibility study procedure, but might be used for initial prototype of the system or

it's part construction. That allows not only to increase the trust of the whole project, but additionally to support the technical part of preliminary feasibility analysis.

There are many of definitions of prototypes and prototyping could be found in different sources. Mainly, we can consider that all of them are based on "modelling" concept - is a prototyping process of building product, that is identical in form and shape, but in smaller scale comparing with the final product [37]. It is tested, reworked, if necessary, until acceptable suitable version is received, from which complete system can be developed [2] Prototyping evokes producing early working versions of the future applications system and experimenting with them [6,28]. Due to this, we can underline prototyping as not only starting point for conversation between stakeholders, but also as approach, which allows to adopt software construction to the base of real experiment. Additionally, prototyping has plenty advantages are: (1) software development process control, (2) technical aspects of project realization, (3) determination of specific requirements, (4) GUI specification, (5) visual presentation of future product, (6) simplification of large-scale systems development [11].

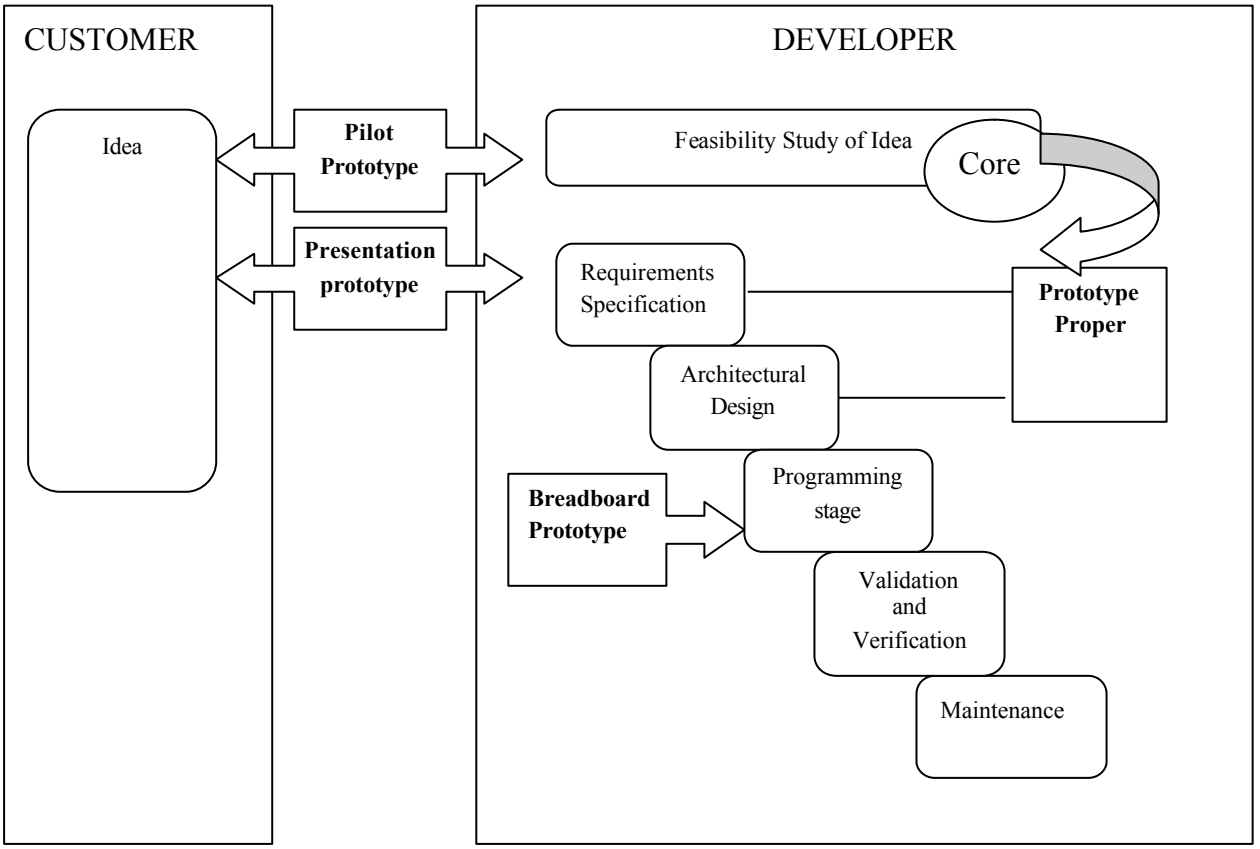

Figure 7. Prototypes classification

Prototypes in software engineering might be divided in four main classes based on the project's objectives [28].

"Presentation prototype" is intended to convince the client that project is possible to handle with the respect to users requirements: functional, GUI, handling and etc

"Prototype proper" purpose is to illustrate and clarify specific features of requirements: operational and functional. Usually prototyping process is going parallel with information system's modelling.

"Breadboard prototype' is used to maintain creation of the product [28,31]. Figure 7. illustrates this classification model.

Prototype approach is suited not only for development stage of the project, but and on the pre-development stage – this type is called Pilot Prototype (PP). PP is based on the initial input requirements [26]. The purpose is to test experimentally the idea of feasibility and achievability of tasks set. I can conclude that for Pilot Prototype creation is possible on the base on any type of prototype: paper-prototype, demonstration model, architectural prototype, requirements prototype [8, 31]. As a fact, only the particular area of IT can limit project. Logically accomplished test-version could be used later as a core of the system for any stage of the development process [28]. Set of the prototyping advantages is significant to point out here. Firstly, visual presentation of future system, allows determining clearly the possibility of project realization both from technical, economic and organizational points of view. It becomes more important for large-scale information systems development or internationally distributed projects. Secondly, such a prototype gives support or rejects the idea about project and it's financing. Thirdly, in case any kind of pilot system has been already developed, it can decrease time for the whole system creation and save from repeated processing of customers requirements, which is common for "open-end " prototyping [15,37].

Resume

- Considering pre-development stage of SW project, trust aspect has been mentioned as a foundation for any business activity, which should be established on the starting point and be maintained within the whole duration of the project.

- The tree levels trust model describes main characteristics, considering the project due to increase customer-vendors relations' trust, vendors level, inside company trust.
- Taking into consideration trust classification the main methods and techniques for trust's rising could be emphasised: research of experience, reporting mechanism, communication set-up, prototypes or pilot project creation, where the last one easy can be used on pre development stage of software project.
- Crucial part of any SW development process takes requirements engineering, which can be described by a set of types: physical, interfaces, technical functionality, users factor documentation, data, recourses, security, quality. I proposed physical, technical functionality and recourses as classes, which can be included easily into pre-development study of SW project. This information is input information flow for the pre-development stage.
- Feasibility study is a processing of the initial requirements and presenting this information in economic and technical view.
- As additional aspect of SW development pilot prototype development has been examined. Pilot prototype already has been discussed above in the contexts of trust issue. Here I underline the advantage of technical reuse and visually.

4. PILOT STUDY TECHNIQUE FOR SOFTWARE PROJECTS

4.1. Pilot Study Process

In order to improve the productivity and quality of the Information and Communication Technology (ICT) organizations, reduce the risks of SW projects, and predict possible problems, each company uses its own business models. Turbulent environment is a high risk factor practically for every project in IT field. To reduce risks, developing a Pilot Study is to be made to estimate project feasibility before investment decision is made. Pilot study combines both Feasibility Study and Pilot Prototype techniques. Pilot Study is a small-scale project, which runs for the observation of different factors [16]. Based on the Pilot Study, the decision to launch full-scale project is made. On this background we consider Pilot Study as an approach, which allows reducing possible harm, estimate and evaluate feasibility of the project before any crucial investments. Term "Pilot Project" is used with the purpose to show the result of pre-investment Pilot Study [4,34].

The system of Pilot Study is presented on Figure 8.

According to the practice of ICT companies, basically two challenges exist. As far as idea occurs, project team of experts and specialist starts Pilot Study, sharing mainly in two parts: Pilot Prototype production and Feasibility Study& Research, which go parallel and support each other. Based on this, (1) project manager has a peril to switch attention on the product and do not support feasibility study. As a result, the trustworthiness of the pilot project is descending. However, it influences quite negative on the result of the whole project, especially in area of high technology. The other problem, that has been determined, is (2) failing of connection between Pilot Project results and process of conducting the project. [16]. Additionally, I can determine the problem of (3) lack of experimental part in Pilot Study as well.

As R.L. Glass defined, "Pilot Study is the series of steps that follow can help insure the achievement of the goal" [16]. On the base of nature and implementation, he shared Pilot Studies in 3 classes: (1) rigorous/ strict (2) moderate (3) informal. At the heart of this classification is the evaluation of the visibility, criticality and impact of the project to the outside systems [16].

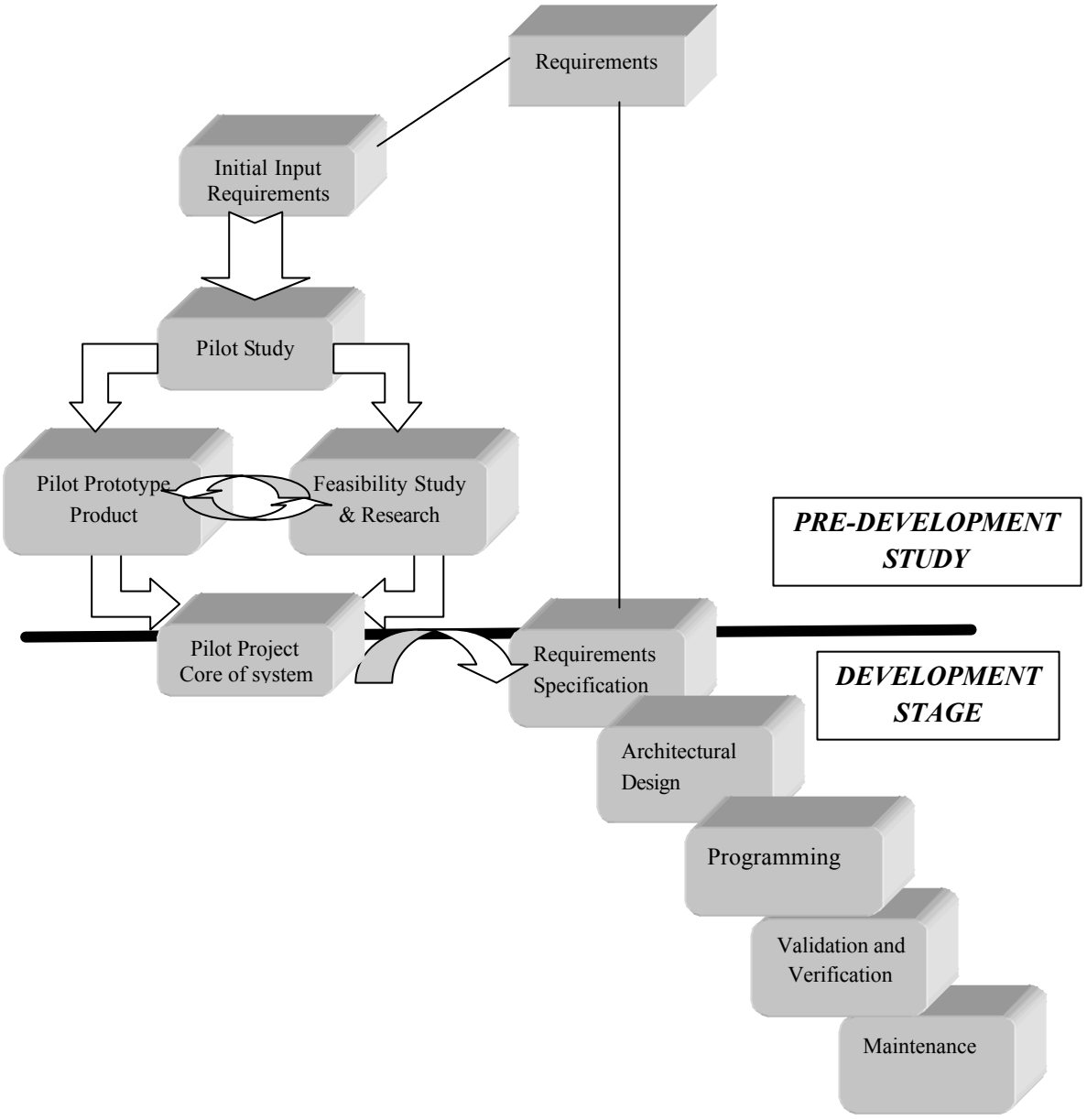

Figure 8. Scheme of Pilot Study process

The whole pre-development activity – Pilot Project – has approximately typical SW development structure: planning, design, creation, evaluation, use [16,37]. Still, the main difference is in understanding of the phases. For Pilot Project, evaluation- and use-stages are the most important. Analysis of

information, focused on practicability and achievability of whole project is carried out; whole concept of the project is checked here. Use-stage is the "bridge" to the starting point of the project. Pilot Prototype later can be transformed as a core part to the final system development. The most common dilemmas for pilot study are: (1) smattering analysis of alternatives or its absence, (2) lack of clear success criteria and control variables, (3) shortage of experts' opinions [9,16].

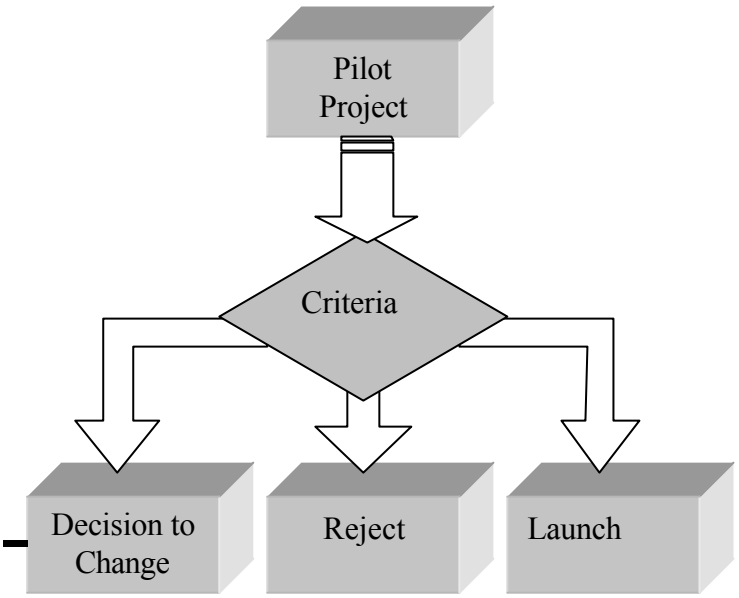

Figure 9. Pilot Project's results evaluation

On the base of Pilot study estimation of the whole project success can be done. At the heart of this decision set of criteria is putted.

- Possibility to match the time requirements,
- Possibility to match system and users technical requirements and functionality,
- Estimation of the efficiency for the whole product use,
- Possibility to solve the task in respect to fixed funding,
- The difficulty of maintenance and exploitation of the system (if necessary).

Based on that, investment decision is made, otherwise the idea of project is renewed or the project is rejected (Figure 9.).

4.2. Software Pilot Project Scheme

Taking into consideration all the above mentioned about pre-development phase Pilot Prototype development, I can define more accurately descried the Figure 8. with the following more detailed Software Pilot Project Scheme:

1. *Planning stage* is focused on analyzing the question: if Pilot Study and whole Pilot Project fit the problem, which is going to be solved.

- Problem definition is extremely important for IT field because of technology changing background, other way money can be spend for the solution which does not the match tasks,
- Initial requirements definition (business, system, and user) in order to support technical feasibility,
- The purpose of alternatives examination is to choose the most reliable and profitable. They are based on the cost and benefits analysis (CBA), technical-economic background as well as recourses, marketing, law regulation analysis. Quite often implementation of not optimal solution are higher than for examine of alternatives,
- Success criteria of a project need to be identified in advance. That leads latter to the correct and reliable conclusion of Pilot Study: economic, technical and operational feasibility.

2. *Design of the pilot study* covers following issues:

- Definition of tasks according to the plan gives possibility to make the scheme of development more stable,
- Techniques of data and requirements definition, processing, checking correct evaluation, controlling should be determined in order to avoid the failures on this stage. Other way it can be considered as having no data,
- Participants of the project, whose impact could be relevant to the project, should be taken into consideration, other way the lack of information from the side can lead to additional obstacles.
- Method of results evaluation should be cleared out and planed beforehand,

- CBA is one of the most effective ways to determine the most reliable alternative on the stage of pilot study,
- Definition of milestones and deadlines for the project, time limits,
- Scheme of pilot study management settlement [14,38].

3. *Conduct stage* covers:

- Pilot Prototype development in cooperation with gathered initial data and Feasibility Study results,
- Test of Pilot Prototype,
- CBA of Pilot Project in respect to created Pilot Prototype and Feasibility Study,
- Identification of the any defluxion,
- Gathering all data, that can influence future development of the project [38].

4. *Evaluation process* is based on the results of the two previous stages and includes:

- Explanation of design and conduction (evaluation mechanism, milestones),
- Defluxions' description,
- Success and failures factors,
- Recommendation report and critique[2,10,38].

5. *Implementation*

- Evaluation of Pilot Project result,
- Recommendation for Final project development,
- Comparing Pilot Project results with the latest on-going alternatives can give positive results even are spite of more expensive solution as a result,
- Transportation off all useful parts of pilot project to main ICT project.

Resume

- The whole SW project can be shared in two logical parts: Pre-development Study stage (or Pilot Project) and Development stage.
- Pre-development stage can serve for large-scale, complex, internationally distributed projects, which have high risk and low trust within the project.

- Pilot study, which is realized on the pre-development stage, can include Feasibility Study and additionally Pilot Prototype development. The last one is used to check technical and economic (TEA) viability of realization. Besides typical advantages Prototyping, Pilot Prototype let for internationally distributed projects to establish and check co-operation relations within the project and solve problem of trust, reliability and management, which are crucial.
- For Pilot Project scheme, which is based on the parallel Feasibility Study and Pilot Prototype development, three main obstacles has been pointed out: lack of experimental part, lack of study and research part, and no use of Pilot Project results for the final project.

5. INTRODUCTION OF THEORETICAL CONTRIBUTIONS

This chapter summarized all the above-considered theoretical aspects and presents my findings concerning the influence of the project type on the scheme of project management, taking in to consideration pre-development Pilot Project creation.

5.1. Project Classification

With the purpose to clarify the decision of the above mentioned pre-development study for different kinds of projects, let's put classification according to discovered characteristics.

1. *Size of project*: small, medium, and big

Sizing of project is one of the fundamental points in software engineering. There is set of approaches exits for evaluating the size of the project: line of codes (LOC), duration, functional points (FP) [37]. The last one I consider the most suitable for size estimation on the pre-development stage of project. Functional points represent functionality aspects of the task, getting from initial requirements. FP is based mainly on initially measured parameters such as: number of user inputs, outputs users inquires number of files, external interfaces. The whole project complexity is evaluated on its base [7]. As well, the person-hours per project estimation can be taken as a ground for sizing of the project. According to practice, it is considered that 1-6 person-months – small project, 6 –12 person-months –medium project, more than 1 human-year- is big complex project [20]. It is quite obvious that medium and, especially big project need to have more deep investigation and preparation.

2. *Type of project*: research, industrial

Research projects mainly are focused on examination and investigation of technologies. Usually universities, research centers, or particular research departments of companies run them. Such projects have quite narrow specialization and are considered to be not commerce projects. Research project often is a preliminary stage for industrial projects.

Industrial projects are focused mainly on commerce and realize the ideas, which already have some experimental foundation. Here could be both tailored and not tailored projects, specified for particular customer or for global market release.

Specific of research project is that both results are acceptable: successful and failure. Industrial projects usually are based on great funding and need to be planned properly. Quite often one of the approached is feasibility study, which is quite difficult and sometimes not possible to apply for research projects.

3. *The idea or origination* of the project also can be putted at the heart of projects classification.

"Evolution project" includes the expansion, improvement or updating already existing product or information system in the same field, but without any crucial changers of technology (new version release).

"Combination projects" suppose new system is developing from the set of already running independent components, technologies without any significant new procedure and technique implementation. Most part of software development project can be referred to this category.

"Mixed projects" assume join of existing components, products and systems with development of new part and technologies, which give new crucial functionality for the whole product.

"New development" project is based on innovative technique implementation, original product creation, which modern one comparing with the previous analog products. Usually such project has higher risk average and need predevelopment research or viability study

4. Significant characteristics, and especially for internationally distributed projects, can be *partnership co-operation type.*

One company project is managed within particular company without any additional staff and human resource bringing in. But, nowadays, cooperation becomes perspective issue. Due to this fact, I can determine few different types of projects.

- Staff augmentation means, that short-time employees are provided by one company to other to solve particular problem. Usually such project does no need specify management because augmented team is working inside the project group.
- Subcontracting/ outsourcing project suppose that one company gives a commission to the subcontractor for part of project realization. The problem of

shared control determined in this case due to independent management of subcontracting team.

- Joint projects involve two or more partners, having the equal rights within the project. Task is distributed between participants, and cooperation is managed by regular feedback, on-site meetings. The main problem here is shared control and management of the project, which might take a turn for the worse in case of international distributed partners.
- Offshore Development Centers suppose a long-term partner ship project. One side provides a stable core project team for the duration of the whole working period. That leads to accumulation of customer-specific business knowledge. But the question of remote control and requirements understanding can be raised for this issue, especially, for first co-operation project establishment [43].

5. On the base of the above mentioned classification we can point out two significant types of software projects:

- Inside company project;
- Geographically distributed projects:
    - New partnership,
    - Old partnership.

6. Risk factor can be putted as a base for sharing projects for high risk, medium risk and low risk projects.

Different types of risks might be considered, such as:

- Project risk, which identifies basically customer, recourses, requirements, schedule and funding of the project,
- Technical risk, which covers quality and timelines: implementation, verification, maintenance,
- Business risk, which is about viability of the product: market, sales, management, budget strategic [37].

For the case of co-operation projects (see item 4.) I can point out additional partner risk factor as specific characteristic:

- Business needs understanding,
- Geographical distance,
- Culture difference,

- Foreign language,
- Control and monitoring [9].

I need to admit, that for internationally distributed project partner risk factor is significant for the classification of particular project. According my opinion, often pre-stage - pre-development study or pilot project - can make the risk of the whole project less. Typically, project between companies, which had had no relations before, has larger risk and lower trust.

I suppose, that classification of projects according industrial key (ecology, education, electricity, manufacturing and so on) or particular branches of ICT (communication, software development, e-business etc.) has no reason. During the practical experiences' examination, there was determined no significant correlation between particular project category and specific management and development approach.

5.2. Scenarios Elaboration

Projects classification, expressed above, can be taken as a foundation to support the decision-making about software project structure and, especially, explanation of necessity for pre-development study. Figure 10. introduces the idea of the dependency between project types and organization structure of project. Based on the described above classification, I determined, that project might be graded according main 6 characteristics: sizing, type, idea origination, relationship within project, partner co-operation type, and risk of project. In this work I raised a question of pre-development study and, particular, Pilot Project creation: what are the motivations for this, why should it be carried out, how should it be organized. Important issue is to determine possible situations to apply PP technique of software project management. On the Figure 10. with dark-gray color project categories are showed , where the pre-development stage is recommended. White color points out categories, where, on my opinion, pre-development stage of project could be skipped due to no obvious complexity. Light-gray color describes the situation, where PP is not extremely necessary, but feasibility study on the pre-development stage could be included. This case needs more details of particular projects. For the situation of not clear classification of project, expert's evaluation should be included. Each project classification type gets

its weight according to the experts' knowledge concerning the project. Based on those values the total grade of particular project can be calculated.

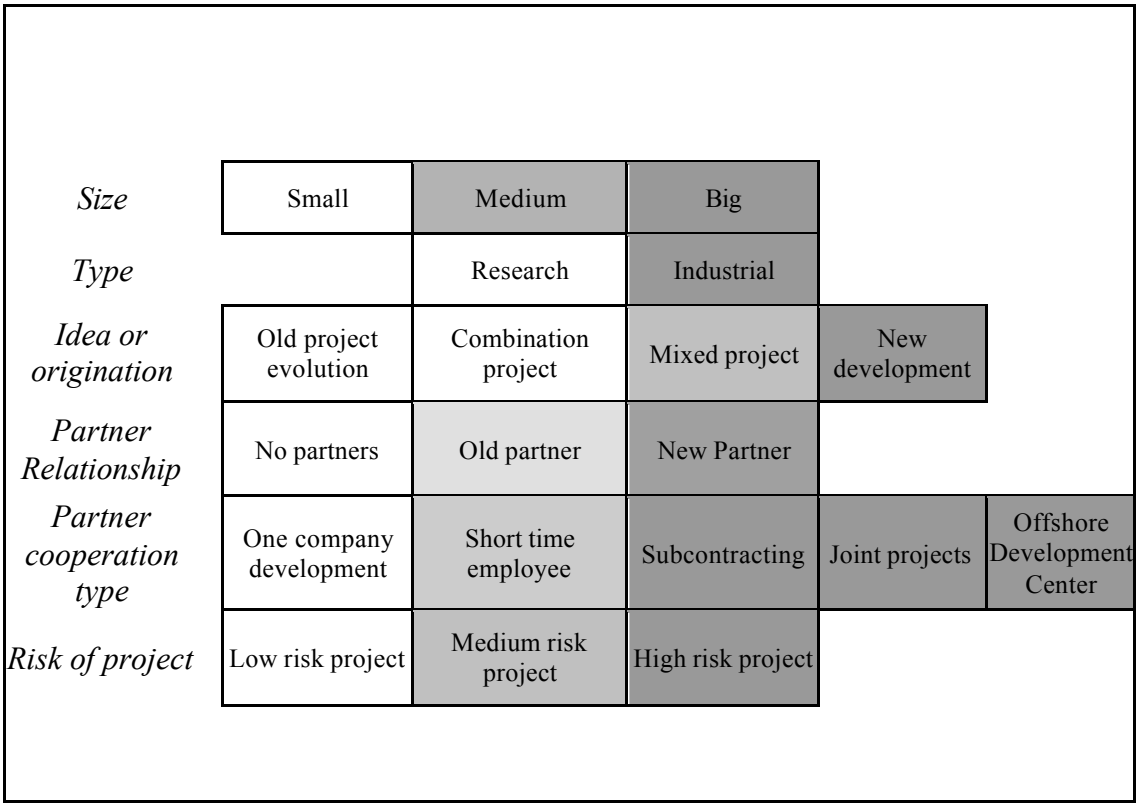

Figure 10. Pre-development study and project type dependency matrix

Here I am going to describe few scenarios with purpose to show some most common situations.

Table 1.Scenario 1

#	Project classification	Type of project
1	Size	Big or medium project
2	Type	Industrial
3	Idea or origination	New development
4	Partner cooperation type	Join Project, ODC
5	Relationship	New partnership or old partner
6	Project risk	High risk

Scenario 1 is typical for international co-operation, especially cross-border region such as Russia and Finland. Statistic shows, medium and large projects takes about 80% of all project in this particular cross border region, there most part of them (87%) are industrial [20,27]. Due to low costs of high educated IT specialist in Russia, closer developed courtiers, like Finland and Sweden, find this region attractive for staring long term co-operator with interest to new technologies and development. Number of new partnership relations is growing in cross-border region [17,27]. Additionally, typical problem of culture, trust and geographical remoteness for joint projects can be point out [12]. All together, on-my opinion, that leads to wish of decrease risk of the project. Here the pre-development study could be included as a stage, and pilot project as a particular approach.

Table 2. Scenario 2

	Project classification	Type of project
1	Size	Big or average,
2	Type	Industrial
3	Idea or origination	Combination
4	Partner cooperation type	Subcontracting
5	Relationship	New partnership
6	Project risk	High risk

Scenario 2, comparing with the scenario 1, has two specific characteristics. Subcontracting nowadays is the most popular way of co-operation, which takes about 47% in IT area [20]. According to latest research, the largest part of subcontracting project takes development, based on combination of already existing and running technologies [12,27]. Due to the new partnership, total management complexity for such project is high. That is why the Pilot Study is reasonable to be carried out in this case. That might help companies, who start relations with new partner, to increase the reliability and to avoid communication problems as well.

Scenario 3 gives one more description of typical case for Russian Finish IT sector: co-operation between companies, which have partnership contacts already and passed the prior stage of management establishment. However, the difficulty in this case is in large-scale projects, which are running by subcontractor [21]. Additionally, here I can notice the factor of non-stability: mixed project, which supposed new technology develop.

Table 3. Scenario 3

#	Project classification	Type of project
1	Size	Big or middle
2	Type	Industrial
3	Idea or origination	Mixed project
4	Partner cooperation type	Subcontracting
5	Relationship	Old partner relations
6	Project risk	middle risk

Table 4. Scenario 4

#	Project classification	Type of project
1	Size	Middle or big project
2	Type	Research
3	Idea or origination	New development
4	Partner cooperation type	Joint project and ODC
5	Relationship	New partner
6	Project risk	Middle or high risk

According to matrix on Figure 9, it was for research projects it is considered not mandatory to have the pre-development Pilot Project. But in spite of this fact, new development as an idea origination often has large weigh. For example, for Russian-Finnish cross-border region, where research project in IT takes about 8 % [27], the most common situation is new partnership within joint project, which usually goes between universities of special laboratories. Overage risk of such project is increased by geographical remoteness and quite often (74%) language and cultural aspects [43]. That is why I suppose such projects also could be managed with the pre-development pilot study.

Table 5. Scenario 5

#	Project classification	Type of project
1	Size	Middle or small
2	Type	Industrial
3	Idea or origination	Evolution
4	Partner cooperation type	Short-time employee or Subcontracting
5	Relationship	Old
6	Project risk	Low risk

On the Figure 9. white color presents projects, which could be manage without significant pre-development study due to low complexity. As illustration, in Russian Finnish region that could be middle or smaller industrial project (36%), focusing on evolution of the exiting system [27]. To clear requirement, usually such projects are carried out by shore-time employee attraction or subcontracting. Common situation is that companies do not prefer to start any new partnership [9]. Because of no new co-operation and small size, meaning low budgetary support, such projects do not have any significant difficulty and could be managed without strong and deep preliminary study.

Table 6. Scenario 6

#	Project classification	Type of project
1	Size	Big or middle
2	Type	Industrial
3	Idea or origination	Combination
4	Partner cooperation type	Subcontracting
5	Relationship	Old partner
6	Project risk	High risk

For part of projects, basing on already exiting old co-operation relationships, and which are not necessary to be run by Pilot Study (Figure 9.), I need to make an exemption. Still for big and middle industrial projects (46%), which, for example are dominant in cross border region [20], subcontracting scheme of development is used. It is considered to be one of the less reliable techniques and preliminary, basing on presented scheme of Pilot Project, for such projects may lead to improving the whole characteristic of the project.

Resume

- In this chapter the theoretical part's conclusion is given by my findings in opinion about cases, where Pilot Project method could be implemented.
- Classification of software project has been given according to characteristics: size, type, origination idea, co-operation type, relationship, risk of project.
- In respect to the above-mentioned classification of projects, the suggestion about the necessity of Pilot Project implementing in particular cases has been proposed.

6. ASPECTS OF INTERNATIONALLY DESTRIBUTED SW PROJECTS

6.1. Pilot Project for Internationally Distributed Projects

Proposed scheme of Pilot Project management and the whole idea of separate Pre-development study can be applied software project as for individual company, as well for any partnership relations [9]. But, taking into consideration the findings of theoretical part (Fifure10.), I consider, that internationally distributed projects (IDP) have more reasonable factors. Let's illustrate this opinion with some results of empirical study. Due to evaluate the necessity of pre-development stage, basing on experience in industrial software project management, set of attributes groups were pointed out:

Project:

- Duration of the project,
- Scale of the project,
- Technology complexity,
- Tasks and requirements clearness.

Company:

- Company's experience of the in particular technology,
- Company's competence.

Co-operation:

- Partnership's kind,
- Co-operation experience,
- Trust and reliability.

Project Management

- Experience of shared projects.

In addition, for IDP it is important to mention, that Pilot Project on the pre-development stage allows to clear scheme of co-operation, management system, to point out significant obstacles: difficulty of reporting mechanism, way and terms of communication, documentations aspects, shared project management tools. It is quite important, because the result depends on quality of mutual co-peroration and organisational system.

6.2. Cross-Border Projects

Cross-border projects - is more narrow part of IDP. According to the research in cross-border regions [20] middle and large-scale projects take the biggest share (up to 70%). That is natural fact, because for set of countries still it is easier to manage such projects [9].

Comparing with others, cross-border project in IT area has it's own specific positive features. They allow using distributed resources in more effective way: use more experience specialist with lower costs. At the same time geographically close partnerships allow to organize co-operation in proper and effective way. That is one of the reasons, why large-scale and complex projects are dominant in cross-border region. It is natural, that companies in this case are looking for long-term relations; try to organize joint projects and subcontracting [9].

Four main possibilities of co-operation have been determined in this cross-border area:

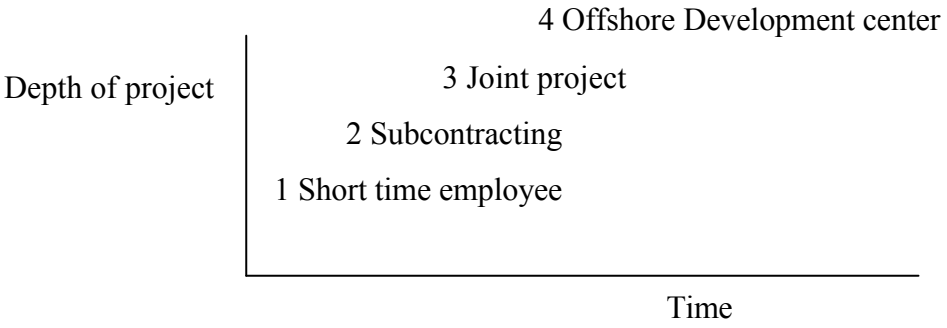

Figure 11.Ppartners' relationships in cross-border area

The main tendency has been determined: the depth of cooperation corresponds to the project duration (Figure 10)[20].

As it is seen in Table 1, for cross border projects the target groups are medium and large scale projects, which are running by Join co-operation or Subcontracting [27].

Table 7. Share of Software projects in Cross-border regions

Co-operation	Project			Total
	Small	Medium	Large	
1.Short time employee	9%	5%	3%	16%
2.Subcontracting	9%	**22%**	**15%**	47%
3.Joint project	2%	**14%**	**18%**	34%
4.Ofsore Development Join center	0	1%	2%	3%
Total	20%	39%	38%	100%

For small projects (20%) the most common co-operations alternatives are short-time employee attraction or subcontracting. That is quite natural, because company can run the project in quite short time and does not need additional efforts for management of the project. Medium and large projects take approximately the same parts of the whole number of projects: 39% and 38% correspondingly. But for all of that, subcontracting and joint projects are dominants as a way of international partnership. As it can be see from the Table 7., subcontracting is more common for medium projects (22%), as well as joint project when dealing with large-scale system development. It is usually based on of time, trust, risk and complexity aspects. Creation of joint center (3%) in partner country is still not popular, and often companies prefer to use one of the above-mentioned variants [20,27].

To conclude, I can underline 3 main *purposes for co-operation in cross-border regions*:

- Company's mutual financial profit,
- Long-term business relationship,
- High technical competence [20].

Still a lot of *obstacles* exist when dealing with cross-border region:

- Cultural aspect – in spite of the fact, countries are close to each other, still difficulties in enterprise culture exist, such as language aspects, time-management [9].
- Lack of mutual understanding consists in tasks, requirements interpretation and difficulties

- Unreliability and distrust to geographically remote partners is higher because of monitoring, control, and risk [9,20]
- Non-formal process of business is typical for every cross border region. Obviously sometime it makes cooperation simple and fast, but the same time can lead to misunderstanding and high expectations.
- Difficulties in join project management system is connected with monitoring and way of project organization, which sometimes can be different in different countries
- Taxis, Legislation, government support can also be obstacles for IDP management because of cross of different law aspects [20, 21].

To summarize all this facts, I can underline, that implementing the method of Pilot Project for IDP and especially cross-border area, probably give a good result. As it easy seen, almost all obstacles of cross-region co-operation could be covered by advantages of this presented PP mythology realization

6.3. Cross-border Co-operation between Russia and Finland

Taking into consideration Russian-Finnish region, I can notify that it is developing region, and the problem of new partnership within IT projects is still actual. Currently, I can determine the following situation in the sector of internationally distributed projects.

According to empirical study, which had been carried out, Finland has co-operation and joint projects with the eleven counties (see Figure12.). As it easily can be seen, about 61% of all projects are taking place in Cross-border region. The reason behind this could be explained by the geographical proximity, cultural aspects, easy communication and monitoring [9]. Due to that facts only 23% of companies co-operate with USA, India or China [20,27].

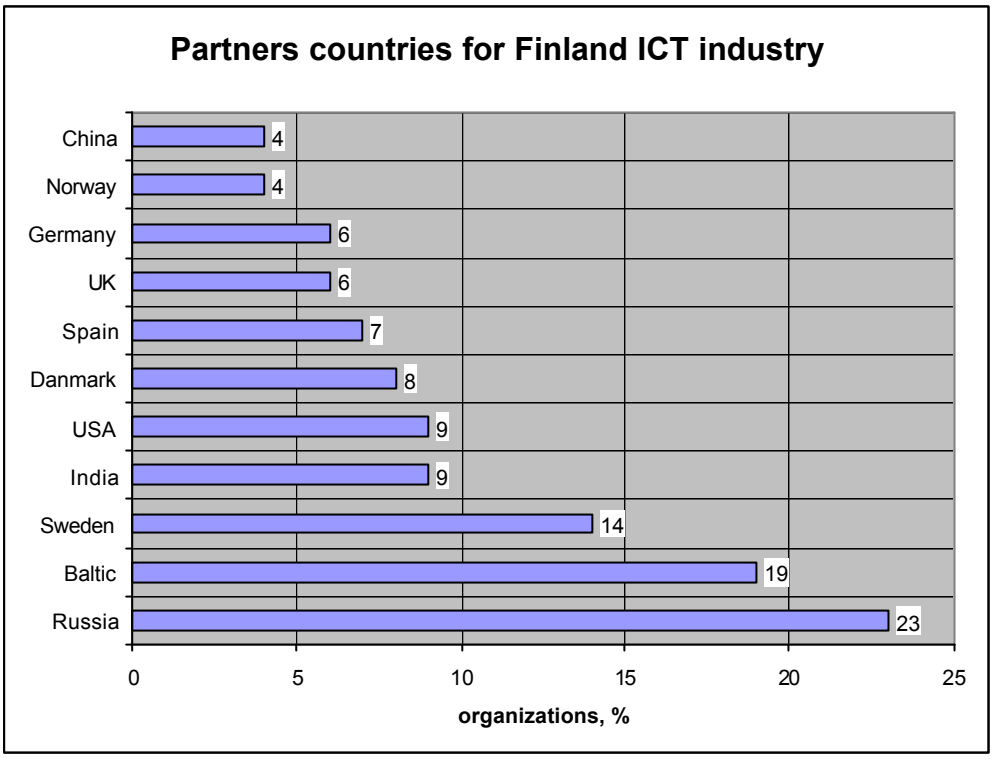

Figure 12. Partner in cooperation with Finland

The research of Russian-Finnish cross-border cooperation region clearly recognized the set of key business domains, there ICT- business takes the third place and is about 19% [27] in all amount of projects (Figure13.).

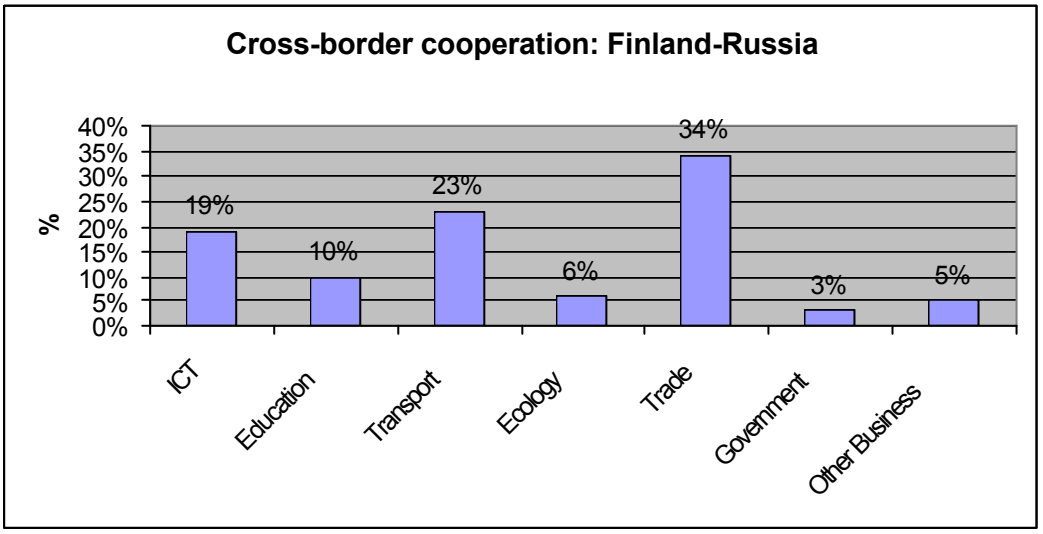

Figure 13. Business areas in Russian-Finnish region

The forecast for ICT industry of the cross border region is quite optimistic: number of projects is expected to increase by 14.5% at average. More over, the most perspective domains here are supposed to be: information management (IM), customer relation's management (CRM), electricity engineering, and E-business. This fact can be explained by technical complexity and absence of competent IT specialists to handle them.

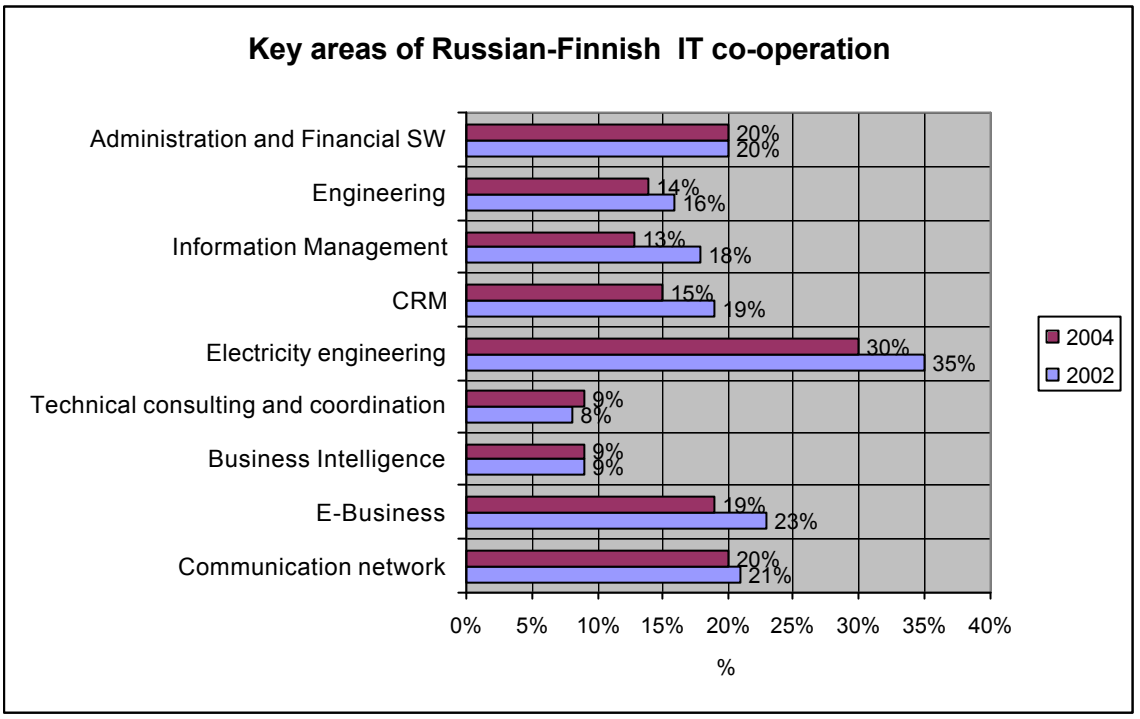

Figure 14. Key fields of Russian-Finnish IT-cooperation

On the Figure 15. detailed description of main ICT fields is given.

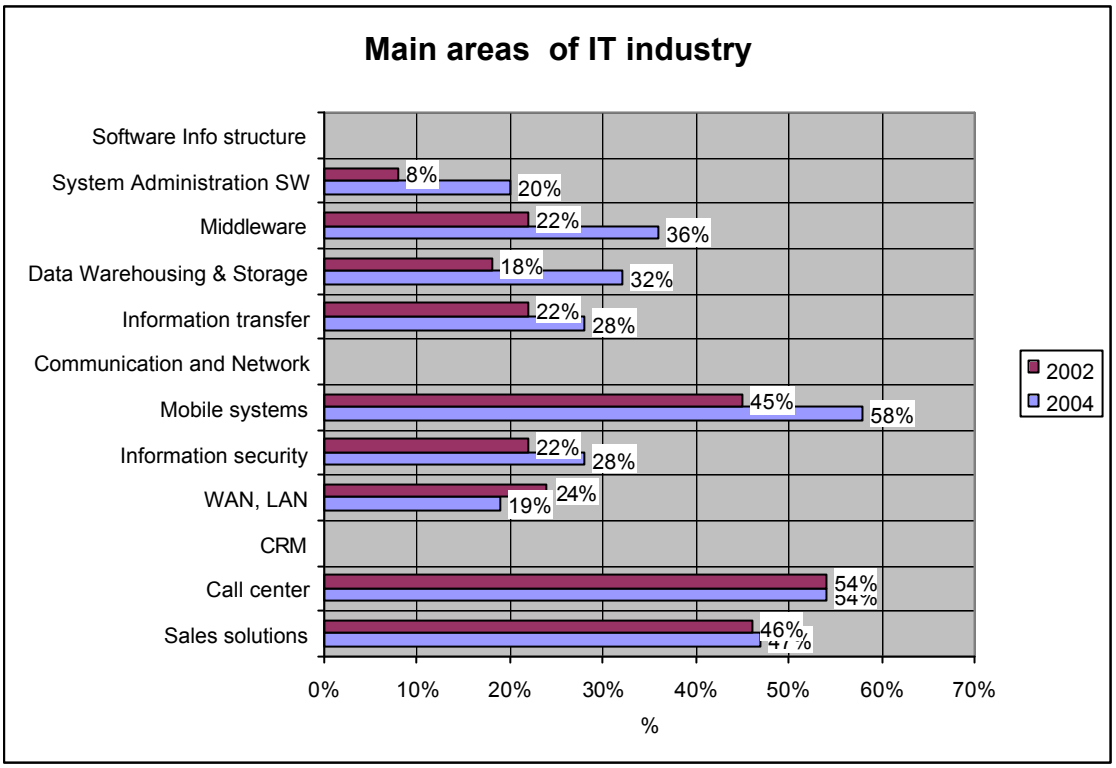

Figure 15. Most significant branches of ICT for Russia Finnish co-operation

According to the survey, in cross border regions middle and large-scale projects take the first place (70%)[20].

Taking into consideration the theoretical contributions of this research work, I can conclude, that this fact might have influence on the decision about management structure of the project. Just a first view has showed, that Russian-Finnish region in IT could be one of fields, where the Pilot Project technique could be implemented with obvious perspectives.

There are few positive and negative issues could be pointed for this narrow branch of internationally distributed projects additionally.

1. Cost savings still is one of the reasons to cooperate with Russia. About 64% of companies within cross border co-operation expect at least 10-20% of cost saving [17,43]. High experience technical specialist on Russian IT market is quite attractive because of low costs (Figure16.).

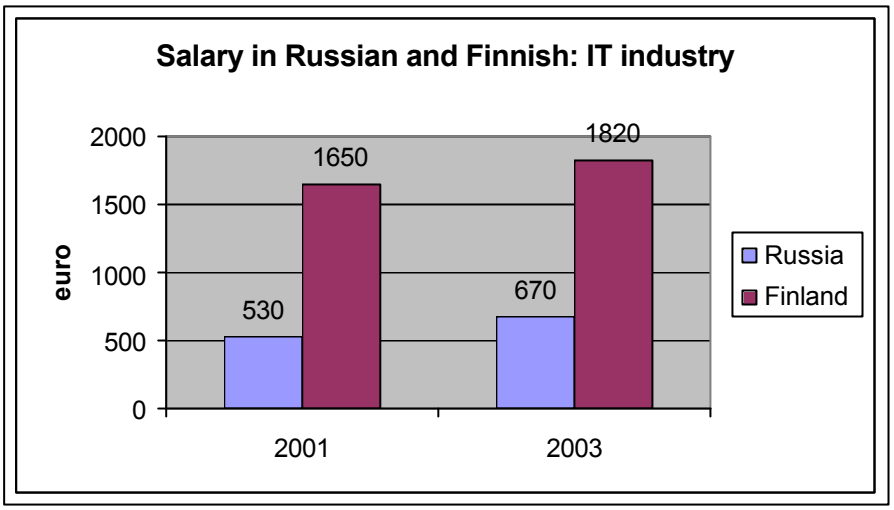

Figure 16. Comparative level of salary or IT specialist in Russian-Finnish region

2. The next problem is cultural difference of Russia and Finland in spite of geographical closeness. Negative attitude of Finland toward Russia still exists, this influents the issue of trust of the relationships.

3. The difference of management approaches also exists in Russian–Finnish region. Russia is considered to be the country with high technical background, but very low management. Only 27% of all Russian companies has more then 2.5 years certification and experience of management tools: RUP, RAD, PMBOK, and PJM [20,43]. The same figure for Finland is 89% [43]. That fact has a great influence on the whole project development and, especially, communication setup on the initial stage of relations.

4. The economic and political situation in Russia in the same manner influent the trust and reliability.

5. Almost for 95 % cases Finnish side is initiator and leader of SW development projects. Often Russian companies take a part of subcontractor (60%)[9,27]. Still, there are few joint projects in this cross –border region.

Table 8. Russian-Finnish region. Classification of projects

Co-operation	Project			Total
	Small	Medium	Large	
1.Short time employee	8%	5%	3%	16%
2.Subcontracting	8%	**36%**	**16%**	60%
3.Joint project	2%	10%	9%	21%
4.Offsore development join center	0	1%	2%	3%
Total	20%	39%	38%	100%

On the base of the experience of companies, involving in cross-border Russian-Finnish co- operation, few future wishes were pointed out:

- Clear management system of project - 77%,
- Better communication between sides- 72%,
- Initial stage of cooperation and mutual understanding- 57%,
- More stability for projects -53%,
- Clear problem definition and target settings -51%,
- Trust and decency - 50%,
- Possibility of R&D - 43%,
- Strategic interest (not one-time) -37%,
- More complicated and large projects- 37%,
- Technology and skills exchange -23%.

Stop-factors were notified also for Russian-Finnish region:

- Lack of stabile and reliable partners – 59%,
- Lack of trust - 54%,
- Monitoring - 53%,
- Lost of control over quality -53%,
- Geographical remoteness - 53%,
- No information about company's possibilities beforehand - 45%,
- No state support - 23%.

Here we can conclude, that management and engineering of cross-border projects takes a lot of efforts and, probably, specific approach should be implemented to makes

partnership more effective. Taking into consideration all the above-mentioned, pre-development study with Pilot Project creation is considered a good approach for cross border co-operation and, especially perspective in Russian-Finnish region.

Resume

In this chapter on the base of empirical study I illustrate aspects and characteristic of particular situation, where Pilot Project could be implemented. Russian- Finnish cross-border region, as a narrow branch of internationally distributed projects, has been presented. It is quite natural, that countries press towards cross border co-operation: geographical and cultural aspects are dominant here. For Finland, Russia is one of the leaders for cross border cooperation a par with Sweden and Baltic countries. ICT sector takes great part in that relations, and supposed quite profitable and perspective. According research, statistic medium and large-scale projects all together take about 80% of the whole information technology sector. For all that, subcontracting and joint project still considered being as the most useful business models for cross-border cooperation in Finnish-Russian region.

7. CASE STUDY.RUSSIAN-FINNISH PROJECT

This project has been taken as an example to illustrate the way of software project software project management and it's specific aspects, based on Pilot study. The project describes one of the mentioned scenarios (Figure 10.), which takes place in Russian Finnish region. In this part I consider the background of the project, reasons for management and organization approach is examined. Later, the scheme of the pilot project, which has been applied, and its specific aspects is covered. And as a conclusion, I l underline advantages and disadvantages of chosen pre-development study, and support this conclusion by already exiting result of the whole project.

7.1. Background of the Project

This cross-border project took place in 2002 and involved 2 stakeholders companies from Finland and Russia: Company 1 and Company 2 correspondently. Within the project Finnish side was an initiator, Russian - a subcontractor. *

7.1.1.Finnish Side

Company1 is Finnish company, focusing on marketing research and Software development in the area of Business Applications: Business Intelligence, Financial Planning and Analyzing, Industry solutions. High reliability of the Management and Finance planning software, effective information uses - all together it makes the company attractive for customers all over the world. Company 2 provides following additional services: project management, consulting, implementation, maintenance, and training. Company has been on the market since 1997 and considered as reliable in studied business area [18].

7.1.2. Russian Side

Company 2 - Russian software development company in the field of Internet-related programming, WEB applications development, application maintenance,

* Due to confidential, companies names are not given and some specific features of the project are not presented

application reengineering, data conversion, E-business solutions. The company has been established in 1993 and nowadays is as member of Fort Ross Information Technology Services. This fact emphasizes the reliability of the Company 2 on the Russian market. Since 1993 company has subcontracting experience in with USA companies, in 1998 started relationships with Europe: Scandinavia, Baltic, Germany [5].

7.1.3. Relation's background

Both companies had no experience of co-operation with each other before. First contacts were based mainly on private-relationships of the heads. In spite of the fact both sides are quite experienced in their particular technical area, Finnish side has identified lack of trust, the project requirements unstable and unreliability – as the constraints for cooperation.

7.1.4. Task

Company1 develops a business application for its customer. To support implementation of system graphical menu-system is needed. Additionally, upgrading the application to modern technologies is considered: an adequate platform system is needed -because of growing expectations on Web functionality. Company is interested to have most of the programming logic placed in the code (Object Oriented Programming). The system must allow the realization of the following tasks:

- Activating and shutting down the applications,
- Managing the applications' rights,
- Controlling the use of applications [5].

7.2. Project Initialization and Management

Company 1 (initiator of the project) insisted on Pilot Project conduction by Company 2 (subcontractor) before general project is started. The idea of the dependency matrix could be demonstrated here: within particular case both companies had reasons to conduct a pre-development study.

Finnish side's reasons:

- New partnership: companies had no experience of co-operation before. Both side are considered to be quite reliable and experienced, but in spite of this fact the problem of new partner was indicated,
- Not clear requirements: specific requirements from the technical point of view and additional difficulty of inclusion the system into the already developed product,
- Large project: on the base of functional points determination, which has been done, project was classified as a big one,
- Absence of experience in subcontracting project between companies rises the problem of shared management,
- Project has been classified as an industrial, that suppose large budget and value of errors goes up,
- Due to international character of the project, risk of language problem and cultural aspects in companies is quite high, in spite of a cross-border region,
- Geographical distance, which is peculiar to outsourcing, leads to the problem remote monitoring procedure establishment [18].

Russian side's reason:

- Absence of experience in project management with particular company increases the risk of mutual understanding problem, cultural aspects and language,
- Due to prove stability and possibility of technical realization, Russian side preferred initial prototypes development,
- Pilot project supposed to give clear management structure for long-term and complex project [5].

7.3. Project's scheme

7.3.1. Project Realization Scheme

The whole project could be shared in 2 main parts: Stage 1 and Stage 2, and communication establishing Stage 0.

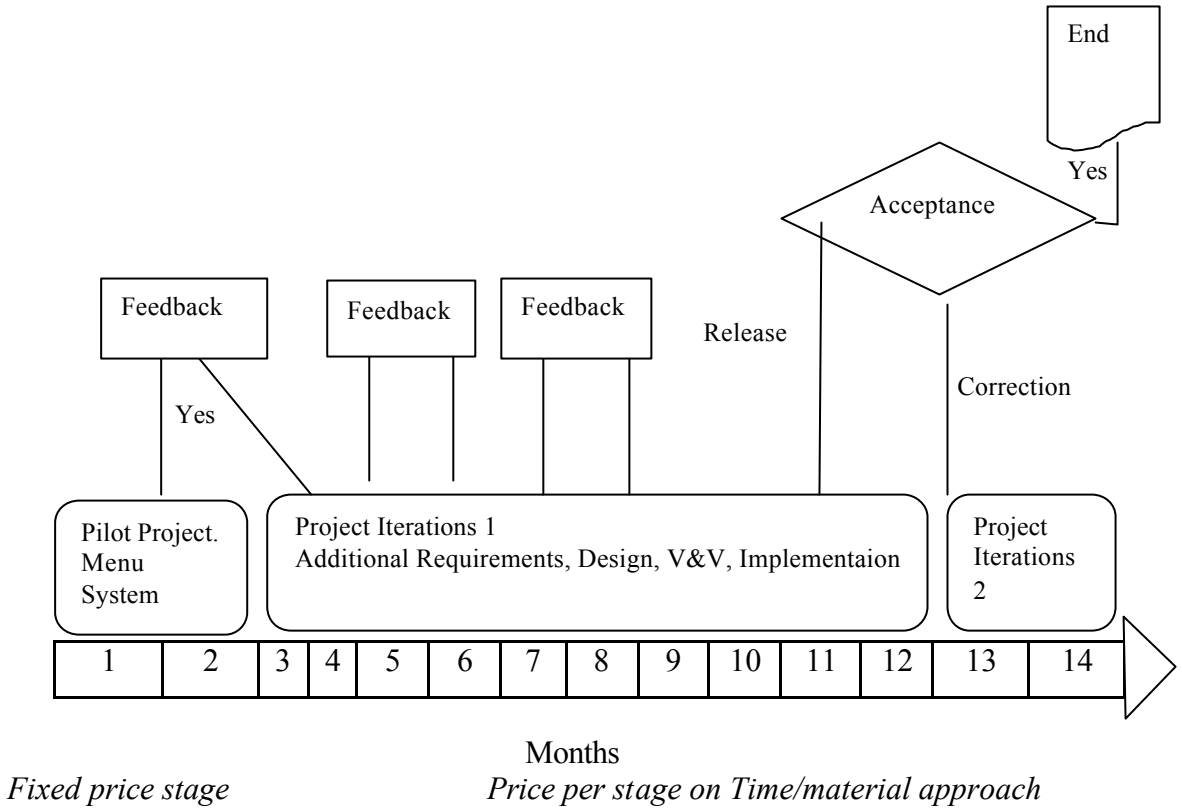

Figure 17. Scheme of project realization

7.3.2 Pilot Project Realization

Stage 0. Search for candidates

Due to successful carrying out the stage, the following activities have been realized:

- Sending a proposal with the initial requirements,
- Considering variants on the base of the experience, trust, reliability, and price list,
- Choice of the partner.

Company 1 sends a request to several software development companies. Few answers have been turned back. Eight companies were considered as potential partners: 2

Finnish companies, 1 Baltic, 2 Sweden, 1 German and 3 Russian companies. One of the solutions has been proposed by Russian Company 2, which has a high experience in DBMS and .NET technology [18].

In the heart of the decision in Company 2 favour were:

- Technical experience,
- Preliminary price estimation in respect to time and remoteness difficulties.

Stage1. Pre-development Pilot Project

The purpose of this stage is examination of possibilities, pilot study, and pilot prototype Companies decided to start the project from the initial stage - Pilot Project - with the next purposes

- To reduce and share risks,
- To make each other familiar with the management approach,
- To check feasibility of the project both from technical and economic points of view.

Step 0. Making each other familiar with the previous samples of this area.

Step 1. Getting request from the partner for solving the problem, preliminary requirements:

Technical part

- Graphical menu system, which allows activating, operation, and shutting down the applications,
- License of the system: menu system transports information about to the application user's right, which are assigned within the administration,
- Managing the applications' rights according to licensing,
- Company-wide Intranet solution for controlling the applications,
- Facility for installation,
- Adequate platform system -because of growing Web functionality,

- Most of the programming logic should be placed in the code behind the files and Web controls.

Recourses:

- Funding of 340 000 euro [1]
- Time limits: 1 year.

Physical:

- No specific hardware is necessary:
- System should have possibility to operate under the personal computer with 200 ? Hz and higher: 32 ? ? .

Step2. Pilot Project Design

1.

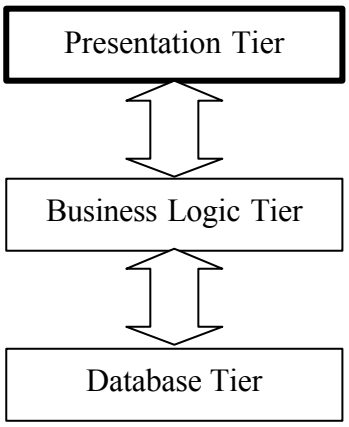

Figure 18. Three-tier architecture

Within the Pilot Project framework, were decided to present initial GUI for Menu system with limited functionality. Additionally, was considered to present transferred independent component of business application in NET technology.

[1] The sum of the contract is not real and is given just for clearness of the cost-estimation

2. Results of Pilot Project were considered to present ones per 2 weeks during 8 weeks (2 months). Evaluation of the Pilot project results is going to be done in 3 main dimensions:

Technical:

- Task understanding correctness,
- Requirements and realization matching,
- Operational correctness,
- Possibility of combination with existing system,
- Final technical feasibility result for all system.

Economic:

- Matching the budget for whole project,
- Time limits requirements reality (on the base of Gant diagram, milestones),
- Final economic feasibility result.

Management

- Suitability of both side management approaches,
- Understanding of co-operation, controlling and reporting system,
- Informal communication.

3. Scheme of Pilot project has been established (Figure 19.).

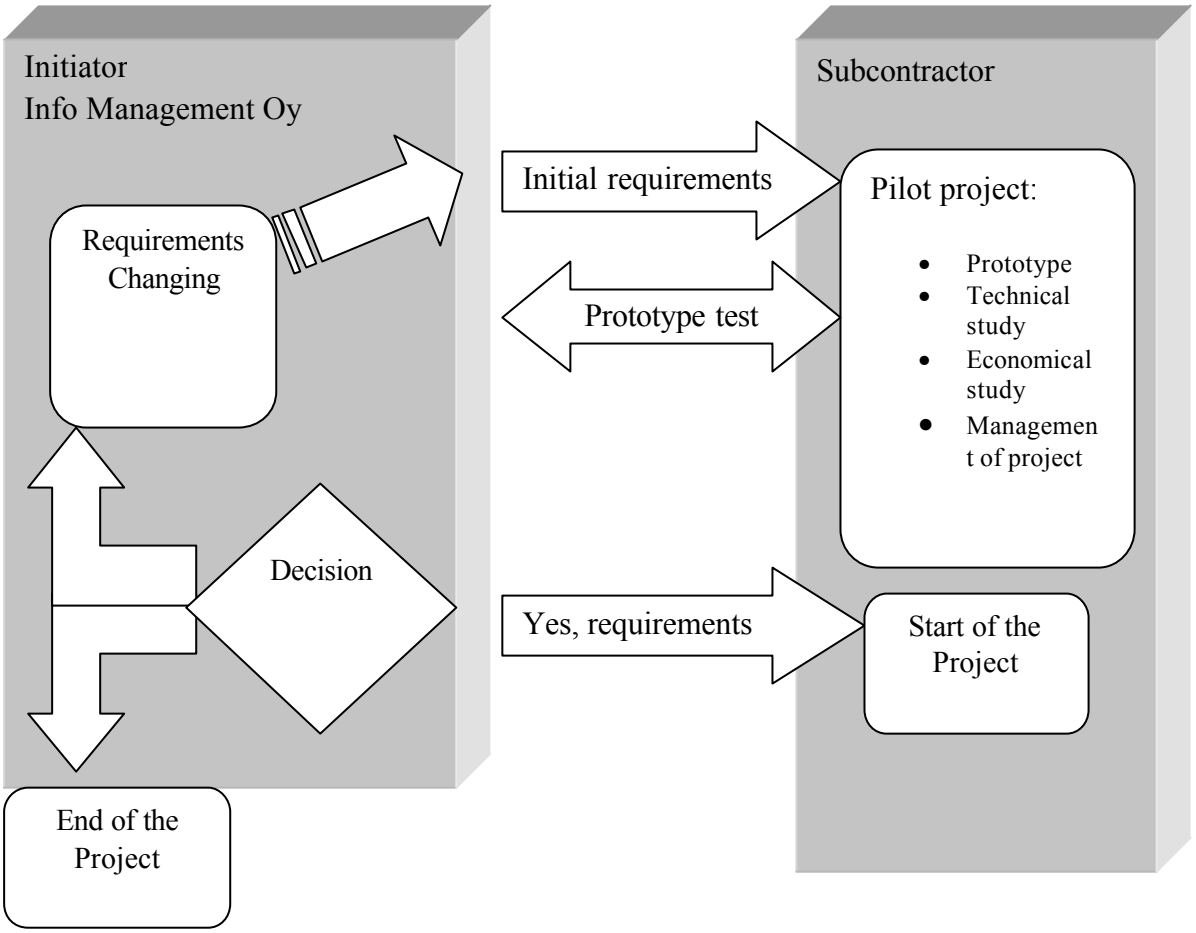

Figure 19. Scheme of Pilot project

Step 3. Pilot Study

1. Project co-operation model has been established to avoid miss understanding

All cooperation in project was handled via main project manager (Finnish side) and team leader (Russian side) (Figure 20.).

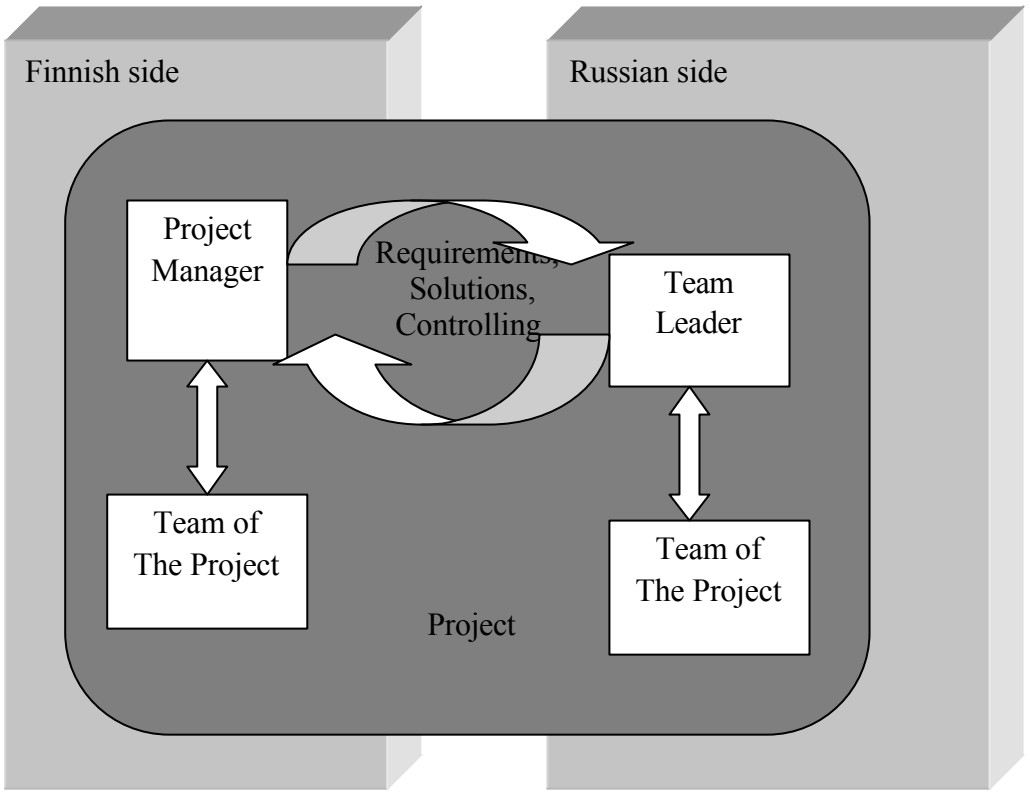

Figure 20. Scheme of Communication within the project

Company1:Dedicated project management,Tractability of requirements and change requests (memorandums),Weekly phone meetings.Company 2:

- Team allocation with dedicated Team Leader,
- Combination of inter-department resources for the project,
- Team management (weekly reports on project progress).Common:
- Structured file exchange scheme,Communication options (mail list) [5].

2. Short Pilot project creation and it's testing according to initial functional requirements.

- The solution is has been done with DBSM technology, using DBMS: Oracle and MS SQL Server,

Programming language: VB .Net, VB6, Java-script,
Development environment: MS VS 6, MS VS. Net,
Other: XML. [41,47]

- Hardware no addition HW – created GUI matches the condition of HW (200 ? Hz and higher: 32 ? ?) [5].

3. Feasibility Study

To support Pilot Prototype development, feasibility study has been done, covering technical and economic aspects. For the Pilot Project cost estimation and time planning schedule of work has been developed On the based of prototype development experience the estimation of the whole project has been done (Gant Diagrams).

- Pilot study - 2 month approximately (44 working days) plan has been done,
- Whole project -14 months, 58 humans/months,
- Material - no specific,
- Budget: Cost calculation is based on internal company price list per humans/months, license costs, and operational costs,
- Approximately 315 000 euro. [5,18]

Step 4. Results evaluation

1. Pilot Prototype has been tested

Table 9. Results of Pilot Prototype testing

	Items	*Test*
1	Correctness of task understanding	Yes
2	Requirements and realization matching	Yes
3	Operational correctness	Yes
4	Possibility of integration with existing system	Yes

2. Pilot Study results:

- Budget limits are going to be matched,
- Time limits requirements are going to be covered,
- Suitable for both sides' management approaches,
- Informal communication is established,
- Cooperation mechanism is established and tested,
- Technical realization is possible,
- Economic realization is possible,
- Partnership relations are proved.

3. Recommendations

- No deflections comparing with planed and designed Pilot Project has been determined
- Finnish side accepted results, and decision about future project has been made.

Step 5. Results Implementation

Created Pilot prototype meets all the technical requirements. The created model can serves as architectural prototype and demonstration model. At the same time it should clarify requirements. Recommendations have been done to transform the Pilot Project into final project and to implement already existing proved variant as a core part of the system. It can be used as Prototype proper or Breadboard prototype later.

7.4. Case Study Results

To conclude the example of the cross border co-operation in Russian Finnish region I need to say, that final result of the project, which has been done in respect to above described model, was successful [5]. The system has been developed in time and according to the given tasks and requirements. There were determined no additional problems in co-operation after the system of collaboration had been established. In spite that, I need to point out few obstacles, which were determined on the stage of Pilot Project development.

- Lack of mutual understanding during first period of communication due to geographical distance and language problem,
- Difficulties in join project management system were determined: different management tools were used of Russian partner and Finnish one. Russian side solved the problem: for particular project it was decided to use technology, proposed by Finnish side.

In the generalized view, the per-development analysis on the base of initial prototype helped:

- To prove that technical realization is possible as a fact,
- To prove that company is able to solve the problem,
- To give initial price,
- To prove that Russian partner is able to meet time, technical, price requirements,
- To reduce the risk of all project.

To conclude, I need to point out that on the example of this case study particular way of implementation Pilot Project method was demonstrated. As it easy can be seen, not all activities according to the scheme of Pilot Project have been covered due to specific characteristics of project. But still, all 5 phases has been passed. The answered for the questions why and how were presented in respect to theoretical funding and empirical study of the thesis. The way of adopted pre-development study technique – Pilot Project- has been illustrated and idea of the dependency matrix demonstrated.

8. CONSLUSIONS

This Master thesis objects was the demonstration of the aspects for the Pilot Project development as a way of pre-development study for software projects. Significant aspects have been considered such as projects requirements engineering, feasibility study methods, and trust model. The task of the work was achieved and the results of the study are presented in this chapter of Master's Thesis: most important theoretical conclusions and findings. Theoretical study results are supported with the practical research, focusing on the particular area of the Pilot Project scheme's implementation– internationally distributed software projects. According to the

described issue, the Russian- Finnish cross-border area has been analyzed. On the basic of the results, several implications were suggested

The improvement of the development process is a crucial issue in software engineering. Literature review has showed that Technology Creation and Application model and standard Business model of the development process both do not present all the characteristics of the pre-development study for software projects. However, only Project Evolution model (PEM) can provide more extensive overview for the preliminary phase. But due to business focus of the model, it is quite poor from the technical point of view. According to my opinion, predevelopment stage has a great influence on the whole duration of the project. The only two issues should be covered: firstly, the scheme of the pre-development study must reflect all specific aspect of software development process; secondly, the group of cases, where the pre-development stage is recommended, must be cleared. On the base of the analyse of the global situation, pre-development stage, as a global phase in any project, is suggested to be included in large-scale joint projects, geographically distributed projects, new partnership projects, new technology projects.

Several important aspects of pre-development stage of software projects were determined. Trust within information technology projects has been proposed as a symptom factor for preliminary feasibility study. According to the three-level trust model, characteristics were pointed out, considering as basic duties for the company to be checked: (1) capacity to keep obligations, (2) competence in the field, (3) wish and readiness to cooperate (4) ability to cooperate within the project. One of the possible mythologies to increase the trust within particular project was determinate as a pilot project development.

Obviously, preliminary study can't be carried out without requirements engineering. According to this, among the requirements types I determined three main, which might fit preliminary study of the software project better: physical requirements, technical functionality, and recourses. That initial requirements fit as incoming information flow for the pre-development stage.

Due to support processing of the initial requirements flow, and, especially, facilitate technical realization of the system, pilot prototype development aspect has been proposed. Prototype modeling technique, which is more common for the

development stage, in this case acts as a method to hold up preliminary study. Supporting this idea, set of advantages could be underlined. Firstly, model of future system allows presenting the perspective of project realization from technical, economic and organizational points of view. It is evident, that this issue is significant for development of large-scale information systems or internationally distributed project, focusing on new technologies implementation. Second, obvious reason is finance support. Thirdly, pilot system, which was developed for pre-development stage, can be used to decrease efforts of the whole system creation and avoid repeating processing of the customers requirements. This scheme is common for "open-end" prototyping.

In respect to considered aspect of predevelopment study of the software projects, and on the base of the results of the work, the scheme of Pilot Project was presented. The whole software project might be shared in two logical parts: pre-development study stage (or Pilot Project) and development stage. Pilot study, is realized on the pre-development stage, according to presented scheme includes Feasibility Study and, in addition, Pilot Prototype. The purpose of Pilot Prototype is to check technical and economic viability of realization. Besides typical advantages, has been argued that Pilot Prototype, as a part Pilot Project on the pre-development, allows to establish and check co-operation relations within the project and to solve problem of trust, reliability and management, which are crucial for internationally distributed projects. Nevertheless, three main obstacles has been discovered for the presented model of pre-development study: lack of experimental part, lack of study and research part, and no use of Pilot Study's of results for the final project.

In the context of this study, I present my findings concerning the dependency between project type and particular project realization technique by creating matrix of dependency. This matrix illustrates the particular scenarios, which suits better for pre-development study with prototyping technique – Pilot Project. The outcome of this research has showed, that pre-development study is not ideal solution and can't be implemented for each and every one case. But investigation concludes that this model of software project management is perspective for industrial large-scale projects, which are carried out by geographically distribute partners and are focused on long term relationship.

The specific characteristic, aspects, obstacles, advantages and disadvantages have been considered on the example of the cross-border area of Russia and Finland. Just a first view on the area has demonstrated, this cross-border region is quite perspective from the information technology transfer point of view. According to the study, which has been done in the context of this thesis work, the largest part of IT projects are medium or large-scale projects (up to 70%) which are managed by companies as subcontracting or joint projects (up to 80%)[20]. In respect to these facts it is possible to conclude, that this region can be considered as a potential target area for implementation of the method of pre-development study by Pilot Projects could give positive results. Presented case study illustrates one of the considered above scenarios. It demonstrates the way of proposed technique of Pilot Project development implementation.

To conclude, I would like to notice, that there is no ideal scenario for software project management proposed. The given Pilot Project methodology presents just one way, which might be used to improve the information technology development project. I suppose that realization of this project management method, is not limited by ICT sector, but could be used for other projects as well.

REFERENCES

[1] A survey of the IT industry, The Economist, 10, May, 2003

[2] Analysis Stages Overview: Feasibility Study (URL:http://www.umsl.edu/~sauter/analysis/deliverables.htm).

[2] Andrews, P., A feasibility study: Can you manage it? 2002. (URL:http://www.zdnet.com.au/builder/manage/project/story/0,2000035082,20269565,00.htm).

[4] ANSme Dictionary, (URL:http://define.ansme.com).

[5] Arcadia , corporate website (URL: http://www.arcadia.spb.ru/news.html)

[6] Budde, R., Kuhlenkamp, K., Mathiasssen, L., Zullighoven, Approach to Prototyping, Sprnger-Verlag, Heidelberg, ,Hardgrave, 1995

[7] Burakov, P., Software development: methodic book for students, SPb, 1998.

[8] Carr, M., Vermer, J., , Prototyping and Software Development Approaches (URL:http://www.is.cityu.edu.hk/Research/WorkingPapers/paper/9704.pdf)

[9] Chapman, M., Clegg, J., Mattos, H., Close neighborhoods and distant friends: Managerial perceptions in cross-border mergers and acquisitions, 2002 (URL:http://www.aueb.gr/deos/EIBA2002.files/PAPERS/W32.pdf).

[10] CSR Corporate web page, Feasibility study structure (URL:http://www.csrt.ru/consulting/k042.shtml).

[11] Davis, A., Principles of Software Development. Englewood Cliffs, NJ: Prentice-hall, 1993.

[12] Digital Design, Fort Ross comsortium, information material, 2003.

[13] Feasibility study guideline, 1998 (URL:http://spr.das.state.or.us/guidelin/feas.htm).

[14] Feasibility study guidelines for Information Technology Investments, Washington State Department of Information Services, 2000 (URL:http://www.wa.gov/dis/portfolio).

[15] Gomaa, H., Scott. D., Prototyping as a Tool in the Specification Users Requirements, IEEE Press Piscataway, NJ, USA, 1991 (URL:http://delivery.acm.org/10.1145/810000/802546/p333-

gomaa.pdf?key1=802546&key2=0195149601&coll=GUIDE&dl=ACM&CFID=14330058&CFTOKEN=35842273).

[16] Grass R, Pilot Studies: What. Why, and How, Journal of Systems and Software New, January 1997, York, NY, USA.

[17] Handbook of Statistics: Russian Regions 2000-2001, Russian Goskomstat, Moscow.

[18] Info Manager, corporate website (URL:http://www.infomanager.fi/Web/Infomanager/europe/index.html).

[19] Investments project Life Cycle (URL: http://www.stk.ru/invest_metod.html).

[20] IT Services and Outsourcing in Russia, Market-Visio, 2002 (URL:http://www.marketvisio.fi/eng/index.cfm).

[21] IT solutions (URL: http://www.poweran.com/services_sysconsult.htm).

[22] Jumpponen, J., Mobile Duel - Preliminary Findings of the Russian Operators' Rush for the Regions, Athens, Greece, December 8-10, 2002.

[23] Kassi, T., Management of Technology, course material part1, LUT, 2003.

[24] Kaufmann, F., Internationalization via Co-operation: Strategies of SMEs, International Small Business Journal, N13 (2), 1995.

[25] Kotler, P., Marketing Management, Millennium Edition, 2000.

[26] Kovalev, A., Kudrumov, I., Software projects management, Alpina, Moscow, 2001 (URL: http://www.citforum.ru/book/uprsite/uprsite_vv.shtml).

[27] Lachkine, S., Empirical study: Outsourcing of Information systems in Finnish Companies, HSE, 2003.

[28] Lichter, H., Schneider-Hufschmidt, M., Züllighoven, H., Prototyping in industrial software projects—bridging the gap between theory and practice, 1997 (URL: http://delivery.acm.org/10.1145/260000/257623/p221-lichter.pdf?key1=257623&key2=7678049601&coll=portal&dl=ACM&CFID=14326958&CFTOKEN=60007852)

[29] Lifengvel D., Program solutions. Requirements engineering, Zara, Kiev, 1999.

[30] Makareny, D., IT tools in trust distributed development, 2003. (URL:http://www.lut.fi/~makareny/IT_final.doc)

[31] Mannio, M.,Nikula,U., Requirements elicitation using combination of prototypes and scenarios, TBRS, 2001
(URL:http://www.lut.fi/~unikula/Publications/TBRCRR5.pdf).
[32] Mekson M., Albert M, Hedoury F., Management Basic, Moscow, Delo ,1992
[33] Offshore Development, Marty McCaffrey, Salinas, CA
(URL:http://www.intsoft.spb.ru/faq.html).
[34] On-line dictionary FOLDOC (URL:http://foldos.doc.ic.ac.uk).
[35] Pfleefeger, S., Software Engineering: Theory and Practice. Prentice-Hall, NJ, 1998.
[36] Pomberger, R., The role of Prototyping in Software Development, JKUL, Australia
(URL: http://www.swe.uni-linz.ac.at/publications/pdf/TR-SE-94.02.pdf).
[37] Pressman, R. Software Engineering, a Practitioner's Approach, 5-th edition, McGraw Hill, 1997.
[38] Requirements Engineering, 5-th IEEE Symposium (URL: http://www.re01.org/).
[39] Sabherwal, R., The role of Trust in outsourced IS development projects, 1999
(URL: http://delivery.acm.org/10.1145/300000/293485/p80-sabherwal.pdf?key1=293485&key2=3274149601&coll=GUIDE&dl=ACM&CFID=14329601&CFTOKEN=62471449).
[40] Savchenko, N., Technical and economic analysis for projects, Exam, SPb, 2002.
[41] Snir., E., Hitt, H., Vendors screening on IT contracting with a pilot project, 2001(URL: http://grace.wharton.upenn.edu/~lhitt/pilot.pdf).
[42] Sommerville I., Software Engineering, 3-rd ed AWPC, 1989.
[43] Star-Soft, Fort Ross consortium, information material, 2003.
[44] Trofimov, S., What is Project? Project Management Institute materials, 2001
(URL:http://progcpp.narod.ru/doc/articles/whatproj.htm).
[45] Vasuxin, ? ., Golubev, ? ., Pavlova ?., Economic investments' estimation, SPb, 1998.