THE EFFECTS OF TRUST ON THE EFFECTIVENESS OF PROJECT RISK MANAGEMENT FOR ENGINEERING AND CONSTRUCTION PROJECTS

Measuring the dimensions of trust between project managers and clients and their effects on the effectiveness of project risk management at Tebodin

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Preface

This thesis project is the last phase of my studies on Management of Technology at TU Delft. I conducted the research at Tebodin, an Engineering & Consultancy company that provided me with all the necessary resources to formulate valuable and sound conclusions.

Working at Tebodin gave me the opportunity to explore the Dutch culture in a professional basis as well as the possibility to use my research and analytic skills for the development of what was a motivating and attention-grabbing project. The company’s culture allowed me to be close to experienced project managers from which I acquired valuable knowledge that helped me analyze different aspects of project management as a complex profession. During the execution of this project I was able to perceive the importance of trust and its effects on project risk management and I believe that the conclusions and recommendations found at the end of this report will help Tebodin’s PM department professionalize their practices.

I want to thank the project management department for giving me the chance to execute my thesis project as a member of the team and for collaborating with my research. Special thanks to Sidney Bakker and Hushang Ulfati for being actively involved in my project. I also want to thank my graduation committee at the TU Delft especially my first supervisor Jos Vrancken for guiding me in this process but also for letting me experience this phase of my studies in a very autonomous and autodidactic way.

Finally, I want to thank my family and friends for showing interest during the whole process.

David Robert Assis
Rotterdam, September 2015
Executive summary

The main objective of this research project is to explore the potential correlation between the level of trust between project managers and clients and the effectiveness of their Project Risk Management. The research project is executed in collaboration with Tebodin, a Dutch company that offers engineering and consultancy services worldwide; therefore, one of the project’s main targets is to professionalize Tebodin’s PM practices through the implementation of managerial recommendations for the PM department.

Trust is a complex psychological state (Rosseau, Sitkin Burt & Camerer1998) that has plethora of different definitions that are often derived from discipline-driven studies subsequently causing ambiguity and controversy (Brewer & Strahorn 2012). Nevertheless, the definitions presented in this documented highlight the importance of vulnerability as a key component of trust between two co-existing individuals; subsequently, vulnerability brings up the concept of uncertainty which is an important concept when dealing with Project Risk Management. The idea behind the conceptual model that is tested in this research project is that trust serves as a driver for projects managers and clients to engage in productive communication when using Project Risk Management techniques that include human interaction; “If trust is present, people can spontaneously engage in constructive interaction without pondering what hidden motives exchange partners might have, who is formally responsible for problems, or the risks of disclosing information” (Kadefors 2004, pg. 176).

The scope of the research follows a 6-phase process starting by performing a literature review on types and dynamics of trust as well as models and techniques of project risk management. The objective of the literature review is to be able to find a method to measure the level of trust and the performance of the Project Risk Management executed in the ten selected projects for analysis. For this study, the dimensions described by Hartman (1999) serve as building blocks to define the basis of trust between project managers and clients’ project managers. Competence trust, Integrity trust and Intuitive trust are the notions that better match the scope of the project as being focused on a project manager-client relationship. Project Risk Management is operationalized according to present practices at Tebodin which are based on existing literature (PMBOK, Gray & Larson 2008, Hillson & Simon 2012) Among such practices certain tools are used in which trust is likely to influence performance (Raz & Michael 2001). Then, two surveys are formulated to measure the variables of the conceptual model: the level of trust (LOT) and the Effectiveness of Project Risk Management (EPRM). The analysis consists of comparing these two in order to verify the existence of a correlation.

Moreover, the approach of the research project is to analyze how trust develops in two different scenarios: on the one hand there are projects that were conducted on a partnering basis and on the other hand there are projects that were performed in an operational environment. Therefore, projects were selected with certain criteria including the type of working environment.
After analyzing quantitatively and qualitatively the data obtained from ten different construction and engineering projects at Tebodin, there is evidence to claim that there is a significant correlation between the level of trust from clients towards project managers and the effectiveness of the risk management techniques that involve human interaction. Hartman’s three trust dimensions were tested separately against the variable EPRM to verify their individual correlation and the only dimension that showed a significant level of correlation was integrity trust. The data showed that projects belonging to the type-partnering environment ranked in average higher on both variables, LOT and EPRM, than the projects under the type-operational environment conditions.

Furthermore, the qualitative analysis performed supports the correlations explained before. Interviews with project managers and Customer satisfaction reports filled by the clients describe specific incidents that support the correlations between studied variables. Important aspects such as cultural differences, client proximity, technical affinity, technological complexity and project manager-client professional history were identified and supported with existing literature on Project Management. These aspects gave insight into the data provided by project managers and their clients which created the correlation lines between the studied variables.

The last section of the document includes as part of the conclusions of the research a list of recommendations for future research that include: 1. analyze the importance of Meyerson’s concept “swift trust” in projects executed in operational environments or as she defines it: temporary organizational structures (Meyerson, Weick & Kramer 1996); 2. Characterization of the trust between members of the project organization in terms of its resiliency and fragility and how could project managers deal with the two different types; 3. Further develop the effects of the level of trust in the control mechanisms used in Project Risk Management procedures. Under the same section a list of managerial recommendations for Tebodin project managers is given including: 1. Start a program on trust management among all project managers to emphasize the importance of trust on the EPRM techniques used at Tebodin; 2. Emphasize the importance of partnering environments for the execution of projects; 3. Include the concept of integrity trust in future Customer Satisfaction reports; 4. Continue the research on trust dimensions and their effects on EPRM by enlarging the data sample.

Finally, the most important limitation of this research project was the reduced data sample of projects; this had undesirable repercussions on the quantitative analysis because the quantitative methods to analyze that type of data were limited to non-parametric techniques. The statistical analysis that was performed was non-parametric because the assumption of normality due to the small sample size could not be made. The consequences this had on the results is that the conclusions about the hypotheses are rather signaling a certain behavior but do not entirely confirm the conceptual model.
# Table of contents

1. Introduction ............................................................................................................. 13
2. Origin of the research project .................................................................................. 15
3. Research approach .................................................................................................. 16
   3.1. Research focus: LOT between project manager and the client’s project manager .................................................................................................................. 16
   3.2. Scientific research objective .............................................................................. 17
   3.3. Practical research objective ................................................................................ 18
   3.4. Research approach ............................................................................................. 18
   3.5. Research question .............................................................................................. 19
   3.6. Methodology ...................................................................................................... 19
4. Phase I: Literature Review ...................................................................................... 21
   4.1. Definition of trust ............................................................................................... 21
   4.2. Trust theories ..................................................................................................... 22
   4.3. Dynamic aspects of trust development ............................................................. 23
   4.4. PRM definition ................................................................................................... 24
   4.5. Risk management models .................................................................................. 24
5. Phase II: Conceptual framework ............................................................................. 27
   5.1. Evaluating trust: Hartman’s trust dimensions .................................................... 27
   5.2. Evaluating PRM .................................................................................................. 28
   5.3. Conceptual model ............................................................................................... 30
   5.4. Survey formulation ............................................................................................. 32
6. Phase III: Project selection ...................................................................................... 34
   6.1. Type of working environment ............................................................................ 34
   6.2. Engineering and construction ........................................................................... 35
   6.3. Project life cycle: include basic engineering ..................................................... 35
7. Phase IV. Quantitative Analysis ............................................................................. 37
   7.1. Measurements and data collection .................................................................... 37
   7.2. Results ................................................................................................................ 37
   7.3. Statistical non-parametric analysis ................................................................... 41
8. Phase V. Qualitative Analysis ................................................................................. 47
   8.1. Quantitative results ............................................................................................ 47
   8.2. Cultural differences ........................................................................................... 48
   8.3. Client proximity .................................................................................................. 50
   8.4. Technical affinity between project manager and client ..................................... 53
   8.5. Technological complexity .................................................................................. 55
   8.6. Project manager & client professional history .................................................. 58
List of abbreviations

TOE_A- Average value the variable under a type-operational environment
TPE_A- Average value the variable under a type-partnering environment
ATOM-Active Threat & Opportunity Management
CT-Competence Trust
CRM-Customer Relationship Management
CSR- Customer Satisfaction Report
EPRM- Effectiveness of Project Risk Management
EPRM3-effectiveness of project risk management first 3 phases.
IGT- Integrity Trust
ITT-Intuitive Trust
LOT- Level Of Trust
PLC- Project Life Cycle
PMBOK- Project Management Body of Knowledge
PM- Project Management
PMI- Project Management Institute
PMP-Project Management Performance
PRM- Project Risk Management
RMC-Risk Management Contribution
SCM- Scope Change Management
SMART- Specific Measurable Assignable Realistic Time-related
TOE-Type-Operational environment
TPE-Type-Partnering environment
List of tables

Table 1, PRM techniques effects on RMC, PMP and RMC+PMP (Raz & Michael 2001) . 29
Table 2, PRM techniques used at Tebodin that improve PRM ..........................30
Table 3, Regression analysis and significance for LOT vs EPRM (H1)..............42
Table 4, Regression analysis and significance for IGT vs. EPRM (H1b).............43
Table 5, Summary of PRM Techniques used in the first three phases of the PRM....44
Table 6, Descriptive statistics according to the control variable (H2)................46
Table 7, Quantitative results from section 7...................................................48
Table 8, Quantitative results regarding the type of environment (TPE vs. TOE) ....48
List of figures

Figure 1, Project organization scheme (Tebodin PM Department, 2015) ...................... 17
Figure 2, Research methodology .............................................................................. 20
Figure 3, Hartman's trust dimensions (1999) ............................................................ 22
Figure 4, Rousseau's trust dimensions (1998) ......................................................... 23
Figure 5, Lewicki & Bunker's trust dimension (1996) ................................................. 23
Figure 6, Dynamics aspects of trust development (Smyth 2010) .............................. 23
Figure 7, PMBOK's PRM structure ............................................................................ 25
Figure 8, Gray & Larson's risk management process (2008) ...................................... 25
Figure 9, ATOM (Hilson & Simon 2012) .................................................................. 26
Figure 10, Conceptual model .................................................................................... 31
Figure 11, Project portfolio division according to type of project environment ....... 35
Figure 12, Project life cycle (Tebodin) ...................................................................... 36
Figure 13, LOT vs. EPRM for all projects ................................................................. 38
Figure 14, Integrity trust effects on EPRM ................................................................. 38
Figure 15, Competence trust effects on EPRM .......................................................... 39
Figure 16, Intuitive trust effects on EPRM ................................................................. 39
Figure 17, LOT effects on EPRM3 ............................................................................ 40
Figure 18, Control variable regarding the type of environment ............................... 40
Figure 19, LOT vs. EPRM linear and quadratic correlation ........................................ 42
Figure 20, IGT vs. EPRM linear and quadratic correlation ......................................... 43
Figure 21, LOT vs. EPRM3 linear and quadratic correlation ...................................... 44
Figure 22, Control variable (type of environment) .................................................... 45
Figure 23, LOT vs. EPRM (cultural differences effects on LOT and EPRM) ............. 49
Figure 24, LOT vs. EPRM3 (cultural differences effects on LOT and EPRM3) ........... 50
Figure 25, LOT vs. EPRM (Client proximity effects) ................................................. 52
Figure 26, LOT vs. EPRM (Client proximity effects on LOT and EPRM 2nd example) .... 52
Figure 27, IGT vs. EPRM (Effects of technical affinity) ............................................ 54
Figure 28, IGT vs. EPRM (professionalism and dedication) ....................................... 54
Figure 29, LOT vs. EPRM (Effects of low technological complexity) ....................... 55
Figure 30, High technological complexity influence on LOT and EPRM ................. 57
Figure 31, LOT vs. EPRM (High technologically complex projects) ....................... 58
The effects of trust on the effectiveness of project risk management for engineering projects

Measuring the dimensions of trust among project managers and clients and their effects on the effectiveness of project risk management

Abstract

The following document evaluates the relationship between the level of trust in business-to-business relationships and the effectiveness of risk management practices in project management. The basis of the research is that many project risk management techniques require the sharing of uncertainties from one party to the other in order to identify, assess and evaluate risks. This document analyses how the level of trust between project managers and clients improves the effectiveness of such techniques by allowing the members of the project organization to engage into constructive interaction during the different sessions of the PRM process. The research focuses on two different project environments (long-term partnering environments and short-term operational environment) in engineering and construction projects held by a Dutch engineering and consultancy firm. Recommendations to the senior PM department of the company are provided resulting from a quantitative and qualitative analysis on the correlation between the studied variables.

Key words and concepts: Trust, Dynamic aspects of trust, Project risk management, Project Management, Project organization.

1. Introduction

The understanding of project management as a recently new profession has been a task that has kept many researchers interested since the late 1960s in an attempt to find out which are the factors that actually lead to project success (Cooke-Davies 2002). Regardless of many factors such as: decades of individual and collective experience on PM, the rapid evolution in membership of PM professional bodies such as the PMI (Project Management Institute) and the increase in demand for project management practices in the industry; the outcomes of projects continue to disappoint stakeholders (Cooke-Davies 2002). This is why research on project success factors has become a priority especially for firms offering PM as a service. Nevertheless, the definition of success in projects is a complex task since “project success is a topic that is frequently discussed and yet rarely agreed upon...It is a concept which can mean so much to so many different people because of varying perceptions, and leads to disagreements about whether a project is successful or not” (Liu & Walker 1998, pg. 213). Therefore, focusing on such a broad concept such as project success might be extremely ambitious considering that the results must be scientifically valid and generalizable to a certain point. Previous PM consortia have identified more specific areas that improve the overall project success and serve as guide for project managers to professionalize their practices. However, each of them can be treated as a separate profession: project controller, project planner, procurement manager or even project risk manager; it is not always the case that a project manager has a project team that includes all of the above
and therefore it is expected that he/she is up to the task of fulfilling all the requirements that PM demands.

The PMI has pointed out several areas into which project managers should focus in order to substantially increase their possibility of achieving project success. This research project focuses mainly on the area of PRM (Project Risk Management). Due to the fact that projects are becoming more complex and the areas of uncertainty and attendant risk are proportionately increasing (Smyth, Gutafsson & Ganskau 2010), the attention to PRM has increased in order to better identify, assess and mitigate risks during the execution of projects. Nevertheless, the nature of risks implies the existence of uncertainty for all parties involved in the project. Actors in construction and engineering projects include project teams, project managers, clients, contractors, suppliers etc. These actors have to cooperate during the execution of the project which gives rise to the concept of trust in inter and intra-organizational systems. Trust is an important precondition for greater openness between parties (Smyth, Gutafsson & Ganskau 2010) ultimately improving the assessment and identification of risks. The concept of trust is widely seen as unconscious and intangible; however, it is the roll of management to facilitate the development of trust in-between the PO and increase the awareness of its value in project business (Smyth 2010). This research demonstrates that the value of trust is such that it has repercussions on PRM as a practice that involves human interaction.

PRM is an area of PM that deals with the uncertainties that might affect the PO in their attempt to match a certain scope, quality, budget and time schedule. Uncertainties between project managers and clients make many of them experience vulnerability during important decision making activities; such feeling shifts their focus towards defending their position instead of establishing a more co-operative environment within the project organization (Kadefors 2004). Being unable to share uncertainties due to the lack of trust towards the project manager harms the potential identification or risks and therefore decreases effectiveness of PRM. “If trust is present, people can spontaneously engage in constructive interaction without pondering what hidden motives exchange partners might have, who is formally responsible for problems, or the risks of disclosing information” (Kadefors 2004, pg. 176). Such information which would otherwise be kept to one’s self could prevent unidentified risks from developing further to a point that mitigating them becomes problematic.

Uncertainties on the outcomes of projects are inherent to the profession of project management and thus are risks; the logic is that trust is compulsory when there are uncertainties (Smyth, Gutafsson & Ganskau 2010). Therefore this research.
2. Origin of the research project

The project originates from a variety of reasons including an overall analysis of the projects that were selected from a project success perspective. The analysis was on critical success factors involving both clients and project managers as an intention to target integrally the concept of project success. From the clients’ side CSR (customer satisfaction reports) were collected and confronted with interviews on critical success factors conducted with the project managers. Posterior to that, a qualitative analysis was performed to understand the level of success of the projects in terms of client satisfaction and achievement of goals (time, cost and scope). The outcome of this analysis raised several hypotheses that explained the level of success or non-success of the projects; one of these was selected to be validated among the other 10 projects through a more detailed analysis. Even though the hypotheses imply different concepts, the model that is tested on this research might use important insight obtained from the rest of the units that were analyzed. In other words, the selected hypothesis for this research was obtained through the analysis of the most successful project among the ten. Nevertheless, the other nine projects reported facts that could be used to understand the mechanisms that explain the potential correlation between the independent and dependent variable subjected to study.

Among other reasons, since the research project is done along with a consultancy company, during early phases of the research and after the personal interviews with both the project managers and the senior PM department, a necessity for improving PRM arose. Even though the first idea that comes to mind is to educate project managers on PRM matters or create a separate PRM department with a unique objective of controlling/assessing/designing the risk management procedures followed during projects; the motivation for this research project is to find a way to target PRM from a different angle rather than just improving the already existing practices described by the literature on the topic. This is possible due to the nature of project management as a profession dependent on interpersonal skills. Section 4.3 explains how trust is dependent not only on evidence of good performance (as one might think when dealing with these sort of relationships) but also on the propensity of a person to build trust, its ability to communicate uncertainties and its explicit desire to satisfy others’ expectations when such are vulnerably exposed.
3. Research approach

Project management is a profession in which human interaction is present repetitively during the execution of projects. Project managers must interact with a variety of actors such as members of the project team, clients, members of the senior PM department, contractors and suppliers among other stakeholders that form the PO. Therefore, it is often discussed that project managers should develop competencies such as self-awareness, conscientiousness and intuitiveness as a way to engage into human interaction (Müller & Turner 2010). Nevertheless, trust is an essential requirement that initially enables human interaction making it an intrinsic component of the project organization (Brewer & Strahorn 2012).

Trust becomes then an important factor to consider when building up relationships between critical project stakeholders (Brewer & Strahorn 2012). Many PRM tools such as generating checklists, brainstorming, risk documentation forms, periodic risk reporting, risk classification and ranking, risk impact assessment among others (Raz & Michael 2001), require human interactions to take place between members of the PM Service provider and the client. This research focuses on the positive effects that higher levels of trust might have on the usage of such tools consequently improving the overall PRM. Analyzing all possible interaction between members of both sides in order to verify the existence and LOT (level of trust) and its effects on PRM would create a conceptual model almost impossible to operationalize. Therefore the problem analysis focuses on the two main stakeholders inside the PO: the project manager and the client’s project manager.

3.1. Research focus: LOT between project manager and the client’s project manager

As mentioned before trust is an important factor among the members of the project organization; therefore, the level of trust could be assessed to any of the relationships present inside the project environment. These include relationships between members of the task forces, project managers and third-party contractors, project managers and their teams etc. Figure 1 describes the project organization scheme that Tebodin follows when executing their projects. There might be some variations from project to project considering the project size due to the fact that some projects might require a different amount of disciplines. Nevertheless, for matters of this research project, as highlighted on figure 1, the research focus concerns the relationship between Tebodin’s project managers and the client’s project manager.
3.2. Scientific research objective

The main objective of this research project is to explore the effect of trust on PRM as a key success factor for project success when projects are performed by consultancy firms. “The complexity of the problems faced by the PM, taken together with the rapid growth in the number of project-oriented organizations has contributed to the professionalization of project management” (Meredith & Mantel 2011. Pg. 5). High levels of complexity and the increasing incidence of market-driven projects have incremented the degree of professionalization in PM through practice itself. Day to day projects require more complex and intangible solutions that are difficult to operationalize and expose to clients without cooperative dialogue (Smyth 2010). Nevertheless, companies are forced to remain competitive and thus strive to improve their PM “soft” skills to target those intangible client necessities in order to deliver superior results and satisfy their clients.

As established by the PMI, PRM is considered to be a key factor for project success which makes it attractive for firms willing to excel in the PM consultancy market. The intention of this research is to verify the possible relationship between the LOT and the
level of effectiveness of PRM; meaning that a higher LOT in client-to-consultant relationships improves the likelihood of having an effective PRM. Furthermore, a parallel intention of this research is to support Gustafsson’s idea that trusting counterparties in project organizations reduces the probability of risk to fire, instead of the misguided “rational” approach that considers trust as inherently hazardous and therefore risky (Gustafsson 2009).

The outcome of the thesis should add to the existing literature on PRM as a key area for project success (PMI 2004). If a correlation exists between the LOT and the effectiveness of risk management practices in projects, further research on trust management could be done to better identify the intrinsic mechanisms that help project managers build up a solid LOT with their clients.

3.3. Practical research objective

The research project is executed in collaboration with Tebodin, a Dutch company that offers engineering and consultancy services worldwide; therefore, one of the project’s main targets is to professionalize Tebodin’s PM practices. Professionalizing PM practices adds value to Tebodin’s services by increasing the success rate in their projects which has a direct positive effect in client’s fidelity, market competitiveness, business sustainability, undesired personnel turnover, among other professional benefits. It is expected, after the culmination of the project, to have a set of recommendations for Tebodin’s project managers that would help them achieve higher success rates in their future assignments.

3.4. Research approach

The analysis consists of comparing the LOT between project managers and their counterparty (the client’s project manager) with the effectiveness of the risk management techniques performed by Tebodin’s project managers. Moreover, the approach of the research project is to analyze how trust develops in two different scenarios: on the one hand there are projects that were conducted under a partnering basis and on the other hand there are projects that were performed under an operational environment. The importance for this specific approach to the understanding of the relationship between the LOT and the effectiveness of PRM is brought up by Hartman in 2002 when he refers to the importance of the limited time that is available to build trust under operational circumstances:

“A particular challenge in a project environment lies in the temporary nature of the organization. The time available to build trust is severely limited by the window in which the project must be completed. It is further hampered by the fact that there is a high degree of randomness in the assembly of the organization, especially if we include all suppliers and contractors involved. Not only do we face the challenges of inter-company language and cultural differences, but also we probably have teams and

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1 Operational environment is defined in this document as an environment for the PO in which the project manager has a short-time relationship with the client’s project manager limited by the time of execution of the project. Projects executed in an operational environment do not necessarily share location, a certain company’s culture nor language, engineering tools or PM tools; whereas, projects executed in a partnering environment have the opportunity to share all of the above as well as a history of projects due to an existing portfolio of projects with Tebodin.
groups of people who are involved for one reason only. They are available and have some or all of the necessary skills to complete the project. This and other specific challenges of project delivery put special pressures on trust building that an operational environment does not necessarily have” (Pinto, Slevin & English 2009, pg. 640)

The secondary objective of the research is to understand how the environment in which the project is executed affects the relationship between the measured variables (trust and PRM). Theories to analyze how trust develops itself inside the project organization such as Smyth’s (2010) dynamics of trust development serve to understand the possible difference between the values of trust that correspond to each environment (be partnering or operational). It is important to clarify that the intention of the project is not to verify the validity of the different trust theories available in the literature; instead, theories are used to understand the results obtained after the quantitative analysis in order to better characterize the relationship between project managers and clients.

The control variable regarding the environment in which the projects were conducted is introduced into the conceptual model because 50% of Tebodin’s (Bakker, 2015) portfolio of projects are being performed on a long term relationship basis meaning that the project managers must work repetitively with the same client under the same circumstances, for example: the sharing of an inter-company language and a certain company’s culture (Hartman 2002). Moreover, the notion that both teams (Tebodin’s and the client’s team) must work towards the same objectives is more evident in partnering environments than in operational environments due to the fact that they share basically every engineering tool, technological procedure, working-space and even knowledge with each other (Tebodin’s PM). These factors might affect the dynamics of trust development inside the PO and for matters of this project between the project manager and the client’s project manager. The outcome of this research, regarding the control variable that was just explained, aims to find the level of influence that trust has on PRM when varying the environment of the project.

3.5. Research question

What is the effect of the level of trust between project managers and their clients on the effectiveness of PRM in construction and engineering projects?

3.5.1. Sub-research questions

i. What is trust and how can it be measured in a project manager-client business relationship?

ii. What is PRM and how can it be evaluated in already executed projects at Tebodin?

iii. How does the influence of the LOT on the effectiveness of PRM varies according to the environment of the project (partnering or operational environment)?

3.6. Methodology

The scope of the research follows a 6-phase process starting by performing a literature review on the topics of interest and finishing with conclusions and recommendations
for Tebodin’s project managers based on the results of the project as well as for further research for related topics.

Figure 2, Research methodology
4. Phase I: Literature Review

This phase is focused on informing the reader on the existing theories on the measured variables and of which the tested concept consists. The phase is divided in two parts concerning the two main variables which are the LOT and the effectiveness of the PRM found during the project. Three different theories to approach the concept of trust are portrayed along with a model of trust development used to differentiate the two ambiances in which the variable is measured (refer to section 3 on research approach). Afterwards, the concept of PRM is introduced through the definition of risk and its use in management and subsequently in project management. Finally, three theories to evaluate risk are examined to back-up the practices performed by the project managers at Tebodin. These theories are presented to introduce the reader in the concept of PRM and to help understand the mechanisms that explain the results of the project.

4.1. Definition of trust

The first important concept that must be defined is the concept of trust. In order to be able to understand the effects of trust on the effectiveness of PRM one must first comprehend the mechanisms that condition the development of trust between two parties. Rousseau (1998) defines trust as being:

“A psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another” (Rosseau, Sitkin, Burt & Camerer1998, pg. 395)

Furthermore, another definition but closely related to the one just stated above is presented by Edkin and Smyth (2006) in which they define trust as being:

“A disposition and attitude concerning the willingness to rely upon the actions of or be vulnerable towards another party, under circumstances of contractual and social obligations, with potential for collaboration” (Edkins & Smyth 2006, pg. 84)

Lastly, a third definition of trust presented by Baier (1986):

“Accepted vulnerability to another’s possible but not expected ill will (or lack of good will) toward one” (Meyerson, Weick & Kramer 1996, pg. 170)

All definitions clearly highlight the existence of vulnerability as a key component of trust between two co-existing parties. Vulnerability brings up the concept of uncertainty which is an important concept when dealing with PRM. Moreover, Rousseau points out that such acceptance of portraying oneself as vulnerable under a certain situation comes from the existence of positive expectations on the behavior of the counterparty. In other words, being disposed to rely on the actions of others comes from the feeling that expectations are to be fulfilled by the potential positive intentions of the trusted party.

The concepts of vulnerability and expectation are important for this research since they are key to understand the LOT that existed between project managers and clients during the execution of the projects selected for the study. This LOT is compared to the level of effectiveness of their PRM in order to verify the principal objective of the research.
4.2. Trust theories

After understanding what trust means, the next step is to be able to measure it. There are several theories that describe the concept of trust which give an idea of how it could be measured in project management relationships.

The different ways in which trust can be operationalize varies from author to author (refer to figures 3, 4 & 5). Nevertheless, among the models described by Hartman (1999), Rousseau (1998) and Lewicki and Bunker (1996), the definitions used to understand the concept of trust overlap from one model to another. For instance Lewicki and Bunker’s (1996) concept of deterrence trust is similar to Rousseau’s (1998) institution-based trust. Both concepts address the fact that trust is built up upon norms and rules that parties must follow allowing the one to trust the other. These concepts imply the existence of cultural, institutional and societal norms (Rousseau 1998) that parties comply in order to avoid sanctions for violation (Lewicki & Bunker 1996) and thus promoting trust between the organizations. Furthermore, Lewicki and Bunker’s concept of knowledge-based trust (1996) overlaps with Hartman’s (1999) dimensions of competence and integrity trust as the first one implies that one party can predict the other’s behavior which could be divided into how the other performs (competence trust) and the ethics upon which his decisions are based (integrity trust).

The conclusion is that trust is a complex psychological state (Rosseau, Sitkin Burt & Camerer1998) that has a plethora of different definitions that are often derived from discipline-driven studies, causing ambiguity and controversy (Brewer & Strahorn 2012). This provides the researcher with freedom of choice on which model to use in order to judge the LOT between two specific parties according to the area of study. Figures 3, 4 & 5 summarize the three models that were analyzed in this literature review with the objective of selecting one to operationalize the level of trust between project managers and their clients.

<table>
<thead>
<tr>
<th>Hartman 1999</th>
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<tr>
<td><strong>Integrity trust</strong></td>
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<td><strong>Competence trust</strong></td>
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<td><strong>Intuitive trust</strong></td>
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*Figure 3, Hartman’s trust dimensions (1999)*
Rousseau 1998

**Calculus-based trust**
Trust is motivated by self-interest or economic incentives

**Relational trust**
Trust emerging through repeated, direct interactions that spark a comfort level between parties

**Institution-based trust**
The role played by legal institutions, cultural and societal norms in promoting trust within a culture or country

*Figure 4, Rousseau's trust dimensions (1998)*

Lewicki & Bunker 1996

**Deterrence-based trust**
Parties can be trusted to keep their word in order to avoid sanctions for violation

**Knowledge-based trust**
Parties know each other well enough that their behavior towards each other is predictable

**Identification-based trust**
Mutual understanding is developed to the point where parties can act on each other’s behalf

*Figure 5, Lewicki & Bunker's trust dimension (1996)*

4.3. **Dynamic aspects of trust development**
The construction of trust between two parties follows a particular process in which it develops to a certain level. Such process places the above concepts in different stages; this helps organize the existing theories in order to come up with a way to assess the LOT in the selected projects between project managers and clients.

*Stage 1*
- Propensity to trust and organisational norms and conditions for trusting

*Stage 2*
- Trust without existing evidence of behavior

*Stage 3*
- Zone of interpretation

*Stage 4*
- Tangible and behavioral evidence to build confidence

*Stage 5*
- Increased expectations due to repeated business

*Figure 6, Dynamics aspects of trust development (Smyth 2010)*
The process of trust development clearly shows that there must be a difference between the way one assesses trust in long-term partnering relationships and in short-term operational environments. Another important remark from this model is the propensity to trust intending that different new relationships might have a different starting point for trust to start developing. Important aspects to focus on according to stage 1 (refer to figure 6) of the process are for instance cultural differences and technical affinities between project managers and their clients, aspects that will be later useful to understand the causes of the outcome of the research.

4.4. PRM definition

The second target of this literature review corresponds to the concept of project risk management as an essential for project success. The absence of an effective PRM has a series of negative consequences for the project’s stakeholders due to the lack of a preemptive measure against the risks and uncertainties found in the development of every project (Serpella 2014). Two important concepts are brought up by Serpella (2014) which are: risk and uncertainty. Hillson (2003) gives an insightful definition for the difference between these two by saying that “the risk is the uncertainty measured, and uncertainty is a risk that cannot be measured” (Serpella 2014, pg. 655). This semantic definition of the concept of risk is useful for this research because it indicates that in order to assess or evaluate risk, an uncertainty must be present; it is only then that risk management takes place. The research question that this project intends to answer has to do with awareness of those uncertainties by the project’s stakeholders as an essential step towards an effective PRM.

Continuing with the definition of PRM, the PMBOK (project management body of knowledge), states that PRM is actively managing risks on a project; moreover, the ISO 31000 (2009) definition of risk is the “effect of uncertainty on objectives” (Purdy 2010, pg. 882). These two notions of risk management and risk respectively are joint together by the PMI’s definition that describes PRM as:

“An uncertain event or condition that, if occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, or quality” (PMBOK 2004)

4.5. Risk management models

This section describes four similar risk management processes which are useful to understand in which phases of the process this research has more validity. Furthermore, it also important to understand the theoretical process of risk management in order to be able to measure how effective it was during the selected projects for the validation or negation of the hypotheses.

4.5.1. PMBOK

The risk management process consist of several steps according to the PMI’s PMBOK (2004):
4.5.2. The risk management process (Gray & Larson 2008)

Gray and Larson (2008) more or less coincide with the PMI’s PRM process but add an extra feature which is its iterative nature. The 5 phases named on figure 8 are redistributed into 4 phases that repeat themselves along with the project’s execution. After each phase is finished new risks arise starting the risk management process all over again from identification to mitigation through the execution of a risk management plan.
4.5.3. **ATOM (Hillson & Simon 2012)**

The ATOM model describes the process in eight phases. The intention and thus the way it is portrayed, is for project managers (or any other practitioner) to be able to manage opportunities and threats (shadowed on figure 9) that show up after the risk assessment is performed and a quantitative risk analysis is derived from it.
5. Phase II: Conceptual framework

5.1. Evaluating trust: Hartman’s trust dimensions

For this study, the dimensions described by Hartman (1999) serve as building blocks to define the basis of trust between project managers and clients’ project managers. Competence trust, Integrity trust and Intuitive trust are the notions that better match the scope of the project as being focused on a project manager-client relationship. The definitions of the three trust models presented above were analyzed along with Tebodin’s PM senior department in order to jointly select the model that better fits the sort of relationships that Tebodin wants its project managers to build with their clients. Tebodin’s slogan is “always close”, meaning always close to the client. As such, project managers are expected to remain close to the client to assure a high degree of satisfaction according to their expectations. All project managers commented during the interviews that their only objective is to fulfill the client’s expectations. Hartman’s integrity trust (1999) especially states that trust is built upon the belief that one other party is always willing to look after the other’s needs.

Another important reason for having selected these dimensions is the importance of the personal relationship between project manager and client as basis for this research. In one side, Rousseau (1998) and Lewicki & Buncker (1996) give substantial importance to factors surrounding the relationship between the project manager and the client. These factors are addressed by the dimensions institution-based trust and deterrence-based trust respectively. The first one refers to the existence of norms that surround the PO which influence the parties’ ability to build up trust; these norms or rules might belong to a certain culture or country and are aimed to promote trust. The second one, conditions the construction of trust by saying that parties are willing to trust each other in order to avoid external sanctions for their misbehaviors. These two concepts do not match with the research approach of this project as being to analyze trust as a willingness to be vulnerable to another under the belief that he/she will act accordingly to one’s needs. Acting according to societal and cultural norms or fearing punishment for misconducted actions does not represent trust as a state of vulnerability.

In the other side, Hartman’s dimensions focus merely on the characteristics of the project manager as a source of trust or miss-trust; characteristics that could be managed through coaching or further professional education due to the fact that concern mostly the individual and not his/her surroundings. This does not mean that other models of trust apart from Hartman’s do not have the ability to operationalize the construction of trust between project managers and clients, what it says is that according to the approach of this research such models do not focus on the personal relationship between project manager and client.

Moreover, the concepts brought up by Hartman focus on two very important areas of project management which are performance and integrity. In order to satisfy clients, performance is a key component that project managers must fulfill (Patterson, Johnson & Spreng 1997). Integrity is a concept that must be present in every professional relationship and in many situations parties trust on each other’s ethical values. The last dimension concerning intuition is the hardest one to operationalize because it deals with our ability to be intuitive towards certain actions or decisions in a rather irrational way. Trust is a socially constructed state and it develops itself through iteration in largely
intuitive ways that are often unconscious and intangible (Smyth 2010). Therefore, the inclusion of the third dimension described by Hartman is required in order to understand the irrational side that helps parties trust or distrust each other. According to the previous analysis, the hypotheses that are tested in this research project are the following:

- $H_1$, Greater levels of trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- $H_{1a}$, Greater levels of competence trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- $H_{1b}$, Greater levels of integrity trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- $H_{1c}$, Greater levels of intuitive trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- $H_{1d}$, Greater levels of trust between a project manager and the client improve the effectiveness in identifying, assessing and evaluating risks (first three phases of the PRM process).

5.2. Evaluating PRM

Previously, theories on PRM were presented that portray the ideal process through which risks should be identified, assessed, evaluated and mitigated. Consultancy companies such as Tebodin follow PRM processes with similar structures as those found in literature. Many companies that perform project management rule their PRM practices by the PMBOK; the reason is that risk management is a broad concept that can be applied to a variety of fields causing different modifications according to specific needs. The PMBOK has developed a framework to guide project managers on different areas of PM in which PRM plays an important role. Therefore, the different steps found in the process are specifically thought to please PM needs. Nevertheless, among these steps a large number of tools can be used to perform PRM (Raz & Michael 2001). Raz and Michael (2001) studied the impact of these tools on project management performance and ranked them among the population of projects that demonstrated high performance in terms of: overall project success, meeting project schedule, meeting project budget, meeting planned objectives, achieving customer satisfaction and success of project portfolio. The study showed that the following tools had significant effect on PMP (project management performance), RMC (risk management contribution) and both PMP and RMC.
The usage of these tools is correlated to high rankings of project management performance and PRM practices performed in projects. These results were compared to Tebodin’s PRM procedures in order to formulate a questionnaire that would measure the level of effectiveness of PRM in the selected projects. In order to understand the present PRM procedures found at Tebodin, an interview with project risk manager Hans van Noordende was performed. During the interview these tools were shown to the interviewee to assess until what extend such tools include social interaction (between project manager and client) and if they were present during formal risks identification sessions performed by Tebodin’s project managers.

The interviewee was to judge these tools under two specific criteria:

I. How often are these tools used by Tebodin’s project managers?
   - Always
   - Sometimes
   - Never

II. How often are these tools performed together with the client during PRM sessions? The possible answers were:
   - Always
   - Sometimes
   - Never

<table>
<thead>
<tr>
<th>RMC</th>
<th>PMP</th>
<th>RMC + PMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk time frame assessment</td>
<td>Risk probability assessment</td>
<td>Risk impact assessment</td>
</tr>
<tr>
<td>Cost-benefit analysis during risk planning</td>
<td>Responsibility assignment</td>
<td>Risk classification</td>
</tr>
<tr>
<td>Cause and effect analysis during risk planning</td>
<td>Simulation</td>
<td>Ranking of risks</td>
</tr>
<tr>
<td>Project re-planning for risk mitigation</td>
<td></td>
<td>Periodic document reviews</td>
</tr>
<tr>
<td>Revision of risk assessments</td>
<td>Periodic trend reporting</td>
<td></td>
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<tr>
<td>Periodic reporting of risk mitigation plans</td>
<td>Analysis of trends, deviations and exceptions</td>
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<tr>
<td>Critical risk reporting to senior management</td>
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<td>Subcontractor management</td>
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<td>Project re-planning</td>
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<td>Quality management</td>
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<td>Procedure for closing risks</td>
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<td>Training programs</td>
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<td>Contingency plans for risk mitigation failure</td>
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<td>Customer satisfaction surveys</td>
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<tr>
<td>Cost-benefit analysis during risk control</td>
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<tr>
<td>Cause and effect analysis during risk control</td>
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<tr>
<td>Configuration control</td>
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<tr>
<td>Quality control</td>
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</tbody>
</table>
Table 2. PRM techniques used at Tebodin that improve PRM (Criterion 1: frequency of usage; Criterion 2: Frequency of client involvement)

<table>
<thead>
<tr>
<th>Tool</th>
<th>Response Criterion 1</th>
<th>Response Criterion 2</th>
</tr>
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<tbody>
<tr>
<td>Risk time frame assessment</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Cost-benefit analysis during risk planning</td>
<td>Always</td>
<td>Always</td>
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<tr>
<td>Cause and effect analysis during risk planning</td>
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<tr>
<td>Project re-planning for risk mitigation</td>
<td>Always</td>
<td>Sometimes</td>
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<td>Never</td>
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<tr>
<td>Subcontractor management</td>
<td>Sometimes</td>
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<tr>
<td>Quality management</td>
<td>Always</td>
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</tr>
<tr>
<td>Training programs</td>
<td>Never</td>
<td>Never</td>
</tr>
<tr>
<td>Customer satisfaction surveys</td>
<td>Always</td>
<td>Always</td>
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</table>

5.3. Conceptual model

The objective of the study is to investigate the correlation between the LOT and the effectiveness of PRM in project manager-client relationships. In one side, the concept of trust has been defined and operationalized through Hartman’s 3-dimensional model (1999) in which it is considered that trust depends on three aspects: Competence trust, Integrity trust and intuitive trust. In the other side, PRM has been operationalized according to present practices at Tebodin which are based on existing literature.
Among such practices certain tools are used in which trust is likely to influence performance (Raz & Michael 2001). Nevertheless, for the scope of the thesis project it is important to focus on the practices that are currently being used by Tebodin’s project managers in order to be able to judge the difference in effectiveness of PRM among the projects.

As mentioned above (refer section 3.3 on the research approach) a control variable is added regarding the operational environment according to the type of contract of the project. The variable represents two different environments for the PO: an operational environment and a partnering environment. According to Hartman (2002) and Smyth (2010) the concept of trust is a construct that builds up more easily through iterative business; therefore the inclusion of a control variable to separate projects belonging to short-term operational environments from long-term partnering environments. The following and last hypothesis of this research represents the importance of the project environment as control variable between the independent and dependent variable.

- H2, The environment in which the project has been conducted affects the relationship between the LOT and the effectiveness of PRM.

Figure 10, Conceptual model

<table>
<thead>
<tr>
<th>Level of Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Competence trust</td>
</tr>
<tr>
<td>- Integrity trust</td>
</tr>
<tr>
<td>- Intuitive trust</td>
</tr>
</tbody>
</table>

| Effectiveness of PRM |

| Control variable |
5.4. Survey formulation

This section focuses on explaining how the two surveys used to operationalize the variables LOT and EPRM were created.

5.4.1. Level of trust

The survey used to operationalize trust as dependent variable of this research project is based on elements described by Hartman (1999, 2002) and Pinto and Slevin (1986) and it was previously used by Pinto (2009) to judge the effect of trust on project success in project management. The survey is divided into 3 parts regarding each of the dimensions explained by Hartman (1999).

Competence trust

*Competence trust* is measured with a 4-item scale including statements such as: “*I am certain that the other party has the ability to perform productively*” and “*I believe the project engineers and other technical people are competent*”.

Integrity trust

*Integrity trust* is measured with a 14-item scale including statements such as: “*I feel comfortable about being dependent on the other party throughout the life of the project*” and “*I believe the other party will keep their word throughout the life of the project*”.

Intuitive trust

*Intuitive trust* is measured with a 2-item scale including the following two statements: “*I am willing to be vulnerable to the other party*” “*My “gut feeling” tells me to be cautious when dealing with the other party on the project*”.

The full questionnaire for operationalizing the level of trust is found in appendix A.

5.4.2. Effectiveness of project risk management

According the results found on table 2, and the input given by the interviewee on Tebodin’s PRM procedures, a questionnaire was formulated including the following five phases of PRM at Tebodin. All

Phase 1: Identification

A 4-item scale was used to measure how effective the identification sessions were along the execution of the PRM process. Project managers at Tebodin follow risk identification sessions at the beginning of projects as well as the start of the phases found in the project life cycle (refer to section 6.3 on the PLC); statements to measure this phase included: “*The number of risks identified was sufficient*” and “*the client’s level of participation during risk identification sessions was excellent*”.
Phase 2: Assessment

A 3-item scale was used to measure how effectively assessed were the risks identified in phase 1. The items aimed to measure how accurate the probability and impact of risks was assessed. Also, a statement brought up during the interview with Tebodin’s project risk manager (v. Noordende, 2015) was included in this scale concerning the openness and transparency of the client about its business case. Hans words:

“Getting to know the client’s business case helps me determine the possible impact of risks in a better way because it helps me understand which are the priorities of the project; if it is for instance budget-driven or cost-driven...if project managers know their clients’ business cases, it is most likely that they excel in their PRM practices when assessing and evaluating risks” (v. Noordende, 2015).

Statements to measure this scale included: “the level of impact assessed to the risks was accurate” and “the client was transparent and open about its business case”.

Phase 3: Evaluation

A 2-item scale was used to measure the importance of risk and the control of risks over the whole cycle of the project. Statements included: “the risks prioritization was according to the client’s perspective” and “the client was committed to evaluate/control risks over the time of the project”.

Phase 4: Development of a strategy

A 5-item scale was used to measure the effectiveness of the strategy according to a SMART criteria. The strategy developed to mitigate risks should be specific, measurable, assignable, realistic and time-bounded. This scale was measured with the following statements:

➢ The strategy was specific
➢ The strategy was measurable
➢ The strategy was assignable
➢ The strategy was realistic
➢ The strategy was time-bounded.

Phase 5: Implementation

A 1-item scale was used to measure the reliability of the strategy that was implemented according to the previous phases of the PRM of the project. The statement was: “The implementation of the strategy was according to the previous agreement with the client”.

The full questionnaire for the PRM evaluation is presented in Appendix B.
6. Phase III: Project selection

During phase III of the research the projects were selected under the criteria described below. Besides that, the ten projects were based in the Netherlands and were closed and reviewed no longer than three years ago; this to facilitate the availability of the clients’ project managers for the interviews to collect the data. It is important to highlight that having selected projects that happened too long ago would have compromised the clients’ project managers ability to remember the relationship with Tebodin’s project managers during the execution of the project. The criteria is as follows:

6.1. Type of working environment

As discussed before in section 3, the environment in which projects are executed affects directly the amount of time available to build trust between the project manager and the client. On the one hand, as a consultancy company, Tebodin has created tighter strings with clients similar to contractual partnerships meaning that both parties share the working environments, task forces, locations, and other characteristics. On the other hand, projects are also executed under an operational environment as described by Hartman (2002). Half of the selected projects belong to each of the types of working environments described above. The intention of this criterion is to be able to introduce the control variable regarding the type of environment of the project. This variable, as explained before in section 3.4 on the research approach, enables the analysis of trust development inside the project organization for a great portion of Tebodin’s project portfolio. The first question that comes to mind is:

i. Is the LOT between Tebodin’s project managers and clients higher in partnering environments than operational environments?

After understanding the difference between the levels of trust between partnering to operational environments, the objective is to analyze the effect that this has on PRM. More specifically the question that is to be answered is:

ii. How is the relationship between the LOT vs. the effectiveness of PRM in both environments?

Answering these questions will give insight into the type of recommendations that later will be proposed to Tebodin’s project manager depending on their most common type of environment. At the moment Tebodin’s project portfolio is divided as showed in figure 2 according to the type of working environment.
Project management is a profession that is present in every type of project. Tebodin is an engineering and consultancy company that deals with projects worldwide in the engineering industry and to which all procedures such as PRM are tailored; therefore, the analysis on trust vs PRM and the conclusions reported should only considered to be valid for engineering and construction projects. Furthermore, the background of all Tebodin’s project managers that were asked to respond to the survey on PRM effectiveness is either mechanical engineering, civil engineering or process engineering. Likewise, the clients (clients’ project managers) that answered the surveys on the LOT had a technical background as well.

6.3. Project life cycle: include basic engineering

The importance of selecting projects in which Tebodin had influence on the basic engineering design is because there must be opportunity for project managers to use start the PRM process in conjunction with the client. After the end of the FEL 3 (Front-end Loading 3), the first four phases of Tebodin’s PRM process have been executed given opportunity for project managers to involve their clients in the process; that means that after the FEL 3, risks should be identified, assessed, evaluated as well as included in a mitigation strategy. The core of this research project is that risk awareness depends on each other’s trust to communicate uncertainties (refer to section 4.1 on the definition of trust) and thus improve the management of risks. Therefore, for the model to be feasible both parties must interact from the moment in which risks are identified to the moment that the EPCM ends.
The recommendations to project managers that arise from this research target projects that involve at least the last four phases (FEL 3 + EPCM). This criterion has been selected because Tebodin offers every type of service package ranging from the whole PLC to a specific phase such as basic design, detailed engineering or EPCM.
7. Phase IV. Quantitative Analysis

7.1. Measurements and data collection

The measurements were performed with ten projects matching the criteria described on section 6. In order to test the control variable, five of the projects belonged to the TPE (type-partnering environment) and five to the TOE (type-operational environment). Even though for TPE projects just two different companies were selected meaning that three projects belonged to one company and the remaining two to the other, the observations were done with a different combination of Tebodin’s project managers and the clients’ project managers. It is important to recall that the variable LOT depends on the relationship between project managers and clients; therefore, in order to avoid repeated values when using the trust scales, the sample of couples were always different even though the projects belonged to the same company.

The data was collected by using the surveys described in section 5.4. All scales for both questionnaires were measured with a Likert scale (1: strongly disagree; 7: agree). A total of 10 different client’s project managers were interrogated following the statements on the trust survey. 2 surveys were completed via e-mail and 8 of them were performed via telephone for a total of 10 entries. The clients that were reached by telephone the procedure was the following: The 20 statements were read to them one at the time. The client answered the statement with a number from 1 to 7 according to how much he/she agreed with it. If the client did not understand the question correctly, the question was read one more time until full communication was achieved.

Regarding the EPRM surveys, the procedure was similar. 7 different project managers (3 were interviewed for 2 different projects for a total of 6 projects) were asked to answer the questionnaire on EPRM. 7 of the questionnaires were answered in presence of the interviewer, 2 were performed via telephone and 1 was sent by e-mail. The 15 statements (refer to appendix B) were read to the project managers and they were to judge them from 1 to 7 according to the Likert scale described above.

7.2. Results

The scales were measured and the results were analyzed through the additive indices technique. The reason behind this decision has to do with the fact that the sample was too small to execute a factor loading analysis to verify the loadings of the scales that define the variables LOT and EPRM. In this section of the article the reader is presented with the results according to the effects that the level of trust has on the effectiveness of PRM. As mentioned before, the data is treated with the additive indices technique in all cases described below in this section. After the graphical representations of all variables that are highlighted from this study, a statistical analysis is presented regarding the data obtained considering the correlation between the variables, the validity of the data and its significance.
7.2.1. LOT effects on EPRM

![LOT vs. EPRM for all projects](image)

*Figure 13, LOT vs. EPRM for all projects*

7.2.2. Integrity trust effects on EPRM

![Integrity trust effects on EPRM](image)

*Figure 14, Integrity trust effects on EPRM*

7.2.3. Competence trust effects on EPRM
7.2.4. Intuitive trust effects on EPRM

**Figure 15. Competence trust effects on EPRM**

**Figure 16. Intuitive trust effects on EPRM**
7.2.5. LOT effects on identification, assessment and evaluation of risks (EPRM3)

![LOT EFFECTS ON EPRM3](image)

*Figure 17, LOT effects on EPRM3*

7.2.6. Control variable test

![CONTROL VARIABLE (CONTRACT TYPE)](image)

*Figure 18, Control variable regarding the type of environment (partnering vs. operational)*
7.3. **Statistical non-parametric analysis**

A polynomial regression or order 2 was performed to verify the correlation between the analyzed variables to which a chi-squared is assigned to judge the fit of the regression. The following hypotheses were tested:

- **H1**: Greater levels of trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- **H1a**: Greater levels of competence trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- **H1b**: Greater levels of integrity trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- **H1c**: Greater levels of intuitive trust between a project manager and the client improve the effectiveness of PRM in engineering projects
- **H1d**: Greater levels of trust between a project manager and the client improve the effectiveness in identifying, assessing and evaluating risks.

- **H2**: The environment in which the project has been conducted affects the relationship between the LOT and the effectiveness of PRM.

7.3.1. **H1 LOT vs. EPRM**

The results indicate that H1 is accepted with a non-parametric linear correlation of $R^2=0.77$ which means that there is a signal that higher levels of trust are correlated with higher levels of EPRM. The significance of the correlation is supported by a $p$-value=0.001.

Even though the regression in table 3. is linear, a quadratic regression is also performed to fit the data and the results show that the relationship between LOT and EPRM is more likely to be quadratic ($R^2=0.8$) meaning that after a certain point the variable LOT no longer significantly affects the variable EPRM. This is also logic since trust is a concept that explains the willingness to accept vulnerability and as a mental stage or attitude (Rosseau, Sitkin, Burt & Camerer1998; Edkins & Smyth 2006) it reaches maximum stage. The dynamics of trust state that it can be further developed after repeated business (Smyth 2010) based on the fact that expectations increase with time and thus the notion of trust as a concept that is based on the expectations that the other party will act accordingly to one’s needs. Yet, one cannot say that failing to manage the others expectations is caused by the lack of trust assuming that the level of trust is already relatively high and there is an evident improvement in the levels of trust since the relationship started. More specifically when it comes to PRM, there are always risks that are impossible to foreseen such as those regarding natural incidents, higher political changes which cannot be identified nor assessed or evaluated and certainly not included in certain strategy. These risks might harm the overall EPRM of a certain project even though some authors argue that there are many ways of understanding, assessing and managing the unforeseen or potential surprises (Aven & Krohn 2014).
<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
</tr>
<tr>
<td><strong>R Square</strong></td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Variable</td>
<td>0.944789</td>
<td>0.180203</td>
<td>5.242913</td>
</tr>
</tbody>
</table>

Figure 19, LOT vs. EPRM linear and quadratic correlation

### 7.3.2. **H1b IGT vs. EPRM**

Furthermore, the results indicate that H1b is also accepted with a non-parametric linear correlation of $R^2=0.80$ which means that there is a signal that higher levels of integrity trust between project managers and clients improve the effectiveness of PRM in engineering projects. The significance of the relationship between ITT and EPRM is supported by a $p$-value=0.0004. The same quadratic regression has been performed to this set of data and also represents a higher correlation with the quadratic behavior ($R^2=0.84$).
Table 4. Regression analysis and significance for IGT vs. EPRM (H1b)

<table>
<thead>
<tr>
<th>Regression Statistics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>0.897027</td>
</tr>
<tr>
<td>$R^2$</td>
<td><strong>0.804657</strong></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.780239</td>
</tr>
<tr>
<td>Standard Error</td>
<td>9.409016</td>
</tr>
<tr>
<td>Observations</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Variable 1</td>
<td>1.144782355</td>
<td>0.199421</td>
<td>5.740518</td>
<td><strong>0.000434</strong></td>
</tr>
</tbody>
</table>

7.3.3. **H1a and H1c (ITT vs. EPRM; CT vs. EPRM)**

H1a and H1c did not show any substantial correlation among the data coming from the sample. Nevertheless, a bigger sample could give better insight to rule out completely both of the hypotheses; until now there is no signal of the variables ITT and CT affecting EPRM in engineering projects.

7.3.4. **H1d LOT vs. EPRM3**

Nevertheless, LOT and EPRM3 showed a significant correlation which signs that H1d is accepted meaning higher levels of trust between project manager and client leads to a better identification, assessment and evaluation of risks in engineering projects. The reason behind this correlation is due to the techniques used in the first three phases of

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**Figure 20, IGT vs. EPRM linear and quadratic correlation**
the PRM process at Tebodin; such techniques enable Tebodin’s project managers to involve the client significantly during the first three phases of the PRM process. A list of the techniques that are always used in the process and that are always performed in conjunction with the client is summarized from table 5 and presented below.

Table 5. Summary of PRM Techniques used in the first three phases of the PRM process at Tebodin that are proven to improve PRM (Raz & Michael 2001)

<table>
<thead>
<tr>
<th>Technique</th>
<th>Frequency of usage</th>
<th>Frequency of client involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk time frame assessment*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Cost-benefit analysis during risk planning*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Cause and effect analysis during risk planning*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Project re-planning</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Contingency plans for risk mitigation failure</td>
<td>always</td>
<td>Always</td>
</tr>
<tr>
<td>Cause and effect analysis during risk control*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Risk probability assessment*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Responsibility assignment*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Risk impact assessment*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Risk classification*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Ranking of risks*</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Periodic document reviews</td>
<td>Always</td>
<td>Always</td>
</tr>
<tr>
<td>Customer satisfaction surveys</td>
<td>Always</td>
<td>Always</td>
</tr>
</tbody>
</table>

The results show that there is a high correlation ($R^2=0.84$) between the level of trust and the added three initial phases of the PRM procedures at Tebodin.

Figure 21, LOT vs. EPRM3 linear and quadratic correlation
Lastly, H2 is not rejected because there is indeed a difference between the behaviors of the regression curves according to the type of environment in which the projects were conducted. First of all, the TPE projects indicate higher levels of trust with a higher average $LOT_{TPE_A}=108.8$ compared to $LOT_{TOE_A}=100.6$. This means that project managers working under a partnering environment are able to achieve higher levels of trust which allows them to improve the effectiveness of PRM using the same PRM techniques as those under operational environment-conditions. This is reflected as well in higher levels of EPRM in cases of partnering environment than operational environment: $EPRM_{TPE_A}=78 > EPRM_{TOE_A}=67.6$.

![CONTROL VARIABLE (CONTRACT TYPE)](image)

*Figure 22, Control variable (type of environment) quadratic correlation for partnering vs. operational projects*
Table 6, Descriptive statistics according to the control variable (H2)

<table>
<thead>
<tr>
<th>TPE</th>
<th>LOT</th>
<th>EPRM</th>
<th>TOE</th>
<th>LOT</th>
<th>EPRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>108.8</td>
<td>78</td>
<td>Mean</td>
<td>100.6</td>
<td>67.6</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>13.1</td>
<td>16.6</td>
<td>Standard Deviation</td>
<td>23.9</td>
<td>23.7</td>
</tr>
<tr>
<td>Minimum</td>
<td>97</td>
<td>59</td>
<td>Minimum</td>
<td>73</td>
<td>35</td>
</tr>
<tr>
<td>Maximum</td>
<td>127</td>
<td>94</td>
<td>Maximum</td>
<td>127</td>
<td>97</td>
</tr>
</tbody>
</table>

However, the limited size of the sample permits just to signal a tendency in the behavior of the variables LOT and EPRM and their potential correlation under the control variable effect.
8. Phase V. Qualitative Analysis

Due to the small sample size of projects that were quantitatively analyzed previously, a qualitative analysis was performed in order to support the results shown in phase IV of the research. There is evidence coming from the quantitative analysis to further investigate the correlation between the level of trust between project managers and client project managers among the project organization and the effectiveness of PRM techniques used during the phases of the PRM process at Tebodin. Therefore, the objective of this qualitative analysis is to further develop on the specific factors that conditioned the behavior of the variables under study as shown in the previous section of this document.

In order to understand what happened during the execution of the projects that led to a certain level of trust and EPRM, interviews with the project managers were performed in a more extensive way. The interviews were based on a broad analysis of project management techniques, success factors, personal attitudes and KPI’s for project success found in the literature (refer to Appendix C for the guideline). The intention was to engage into a fluent conversation with the project managers about the projects without specifically questioning them about the objectives of this project; instead, the purpose of this interview was to understand the overall development of the project including positive and negative issues. This way of conducting the interviews enabled the project managers to talk with freedom about the events, obstacles, highlights they found intriguing in that specific project. Evidently, questions related to their effectiveness of PRM were also addressed as well as questions related to the willingness of their clients to be open about their uncertainties and doubt of the project as evidence of trust.

The project managers were as well asked to provide customer satisfaction reports filled in by the clients as a way to have a double-angle perspective of the events that occurred all the way from the basic design phase to the handing over of the project. In some cases, satisfaction reports after the culmination of each phase were also provided which gave more specific insight into the events that took place. All this served to have a helicopter view of the project organization in order to understand the causes and certainty of the results shown in section 7.2.

8.1. Quantitative results

The results found after the quantitative analysis serve as a starting point for the qualitative analysis described in this section. The intention is to investigate which were the events, obstacles or incidents that describe the potential correlation between the level of trust and the EPRM. This way the overall analysis of the conceptual model presented in section 5.3 gains validity in order to reduce the limitations of the small data sample that was available. The results found in the previous section are listed in table 7 describing both correlations, liner and polynomial, between the studied variables.
Table 7. Quantitative results from section 7.

<table>
<thead>
<tr>
<th>Studied variables</th>
<th>Linear correlation (R²)</th>
<th>Quadratic correlation (R²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOT vs. EPRM</td>
<td>0.77</td>
<td>0.80</td>
</tr>
<tr>
<td>IGT vs. EPRM</td>
<td>0.80</td>
<td>0.84</td>
</tr>
<tr>
<td>IIT vs. EPRM &amp; CT vs.</td>
<td>No correlation</td>
<td>No correlation</td>
</tr>
<tr>
<td>EPRM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOT vs. EPRM3</td>
<td>0.81</td>
<td>0.84</td>
</tr>
</tbody>
</table>

The control variable regarding the variation in the project environment (TPE & TOE) was studied by analyzing the average value of the values of LOT and EPRM between the two sets of groups. The results on table 8 show that on average, projects that are conducted in a partnering environment tend to have greater levels of trust and subsequently EPRM than those executed in an operational environment.

Table 8. Quantitative results regarding the type of environment (TPE vs. TOE)

<table>
<thead>
<tr>
<th>Studied variable</th>
<th>Average value TPE</th>
<th>Average value TOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOT</td>
<td>108.8</td>
<td>100.6</td>
</tr>
<tr>
<td>EPRM</td>
<td>78</td>
<td>67.6</td>
</tr>
</tbody>
</table>

The objective of the qualitative analysis presented below is to support with qualitative data the results portrayed on tables 7 and 8. The analysis is divided into different sections according to the phenomena that might have conditioned clients to trust or distrust their project managers, consequently lowering the effectiveness of their PRM techniques. There are five facts that were highlighted from the interviews with project managers and the customer satisfaction reports that could have affected positively or negatively the level of trust between the project manager and the client.

8.2. Cultural differences

Even though all projects belong to the region north-west of the Netherlands, one of the clients’ project managers had a different cultural background. During the interview with the project manager from Tebodin that was responsible for this project, he insisted that the difference in cultural backgrounds played an important role in the execution of the project during several decision-making activities including the identification, assessment and evaluation of the risks involved.

The most significant factor that was highlighted from the interview with Tebodin’s project manager regards the importance of addressing, understanding and dealing with cultural differences which can be related to Smyth’s (2010) dynamics of trust development. Different cultures have different norms which influence the individual’s propensity to trust as first step towards the development of trust. This is as well corroborated by Rousseau’s (1998) institution-based trust which says that individuals build up trust based on norms and rules belonging to a certain culture or organization. The project manager repeatedly addressed the considerable cultural differences with this particular client (Italian nationality) and how these affected negatively the course of the project which in the end resulted in major scope, time and cost changes.
Moreover, Geert Hofstede ² suggests that managers from different cultural environments might perceive and evaluate project risk in a different way (Camprieu, Desbiens & Feixue 2007); therefore, having discrepancies in risk assessment and evaluation sessions might affect the EPRM when using techniques such as cost-benefit analysis, cause and effect analysis during risk planning, risk probability assessment or ranking of risks. All these techniques belong to the PRM that Tebodin’s project managers follow during their projects and as being said before are always performed in conjunction with the client; consequently, due to the difference in risk perception between members of the project organization, risks might be unwisely ranked, miss-assessed in their probability and impact or in the worst of cases unidentified. The results in the previous section showed that this project ranked the lowest in both variables (refer to figure 23); what this analysis suggests is that the big cultural difference between the project manager and the client was key in the construction of trust and the effectiveness of the techniques used by the project manager especially during the first three phases of the PRM.

² Professor Geert Hofstede (1928) conducted one of the most comprehensive studies of how values in the workplace are influenced by culture. Through the publication of his scholarly book Culture's Consequences (1980, new edition 2001), He became the founder of comparative intercultural research. His most popular book, Cultures and Organizations: Software of the Mind (1991, newest edition 2010, co-authored with Gert Jan Hofstede and Michael Minkov), has so far been translated into approximately 20 languages. Geert Hofstede's articles have been published in social science and management journals around the world. He is recognized internationally for having developed the first empirical model of “dimensions” of national culture, thus establishing a new paradigm for taking account of cultural elements in international economics, communication and cooperation. Later, he also developed a model for organizational cultures. (Geert Hofstede website)
The next key aspect that is highlighted from the interviews was the importance of client proximity. Project managers that were able to be close to their clients were rated higher on the level of trust by their respective clients. This aspect also supports the control variable regarding the working environment in which the projects were executed due to the fact that proximity in partnering environments is often easier to achieve. Nevertheless, from the group of TOE (type-operational environment) there is an important example in which the project manager emphasized during the interview that risk management was a matter of trust and was enabled by a high degree of proximity to the client.

The basis of this project is that human interaction between project managers and clients give place for trust to arise; additionally, the higher the levels of trust between these two members of the project organization is, the higher is the effectiveness of the PRM techniques that involve human interaction. Frequent interactions among the members of the project organization tend to produce interpersonal attraction (Koskinen, Pihnlanto & Vanharanta 2002) which is a key component for trust to be constructed. Trust becomes then an important factor to consider when building up relationships between critical stakeholders of the project organization (Graham & Strahorn 2012) such as the project manager and the client. This document argues that client proximity
enables human interaction which subsequently improves the likability of trust to arise.

The interviews with Tebodin’s project managers provided valuable insight to understand how client proximity causes higher levels of trust. To start, as mentioned before, one of the project managers stated (refer to figure 25 to visualize the project in discussion) that trust was an important factor that allowed risk to be managed. When the project manager was asked on how strong was his risk management in addressing/assessing/managing risks, he answered that “risk management came naturally”. He backed up his answer by explaining that it was through daily conversations with the client (informal and formal) that he managed to understand the client’s uncertainties that could have brought risks to the project during the EPCM phase. Communication was such that both the client and the project manager could inform to each other their problems, doubts and wishes. Therefore, PRM went naturally meaning that risks were assessed and mitigated constantly by maintaining a close relationship with the client. The project manager said: “I personally picked him (client) up every day at the airport when he came to visit us even though it took me 2 hours to get there; this time I spent with Stuart helped me get to know all his uncertainties about the project”.

The results in phase IV of the research show that indeed the level of trust between Tebodin’s project manager and his counterpart was high, ranking 2nd among all projects. Yet, the EPRM was not as high as it should have been. The project manager answered the EPRM questionnaire saying that the overall strategy to mitigate the risks was rather mediocre as well as the implementation of such strategy which caused the overall ranking of EPRM to decrease substantially. This could have been caused by the fact that the strategy was not needed as the risks were naturally mitigated through the high levels of trust as mentioned before by the project manager: “risk management came naturally”. In other words there was a strategy and it was implemented but due to its lack of importance, there was not much effort put into it. On the other side, the grading for the first 3 phases (Identification, Assessment and Evaluation) were higher in comparison with the rest of the projects.
In the quantitative analysis, the average for both LOT and EPRM variables was higher in projects belonging to TPE. The environment defined in this document as partnering environment enables project managers to be close to their clients since the working space is shared between Tebodin’s task force and the client’s project manager. Two out of the three projects (refer to figure 26) that belong to this group support the notion that client proximity enables human interaction and thus the possibility to construct trust.

Figure 25, LOT vs. EPRM (client proximity effects on LOT and EPRM 1st example)

Figure 26, LOT vs. EPRM (client proximity effects on LOT and EPRM 2nd example)
Another important aspect that was mentioned during the interviews was the technical affinity that project managers had with their clients. Tebodin is a consultancy and engineering company that offers services to a broad range of clients. Clients vary in needs, priorities or expectations. This causes projects to be either cost-driven, time-driven or quality-driven. Quality-driven clients often demand project managers with an extensive technical background in both experience and education; one could say that competence trust becomes then of great importance when building up trust with such clients. Nevertheless, since competence trust and intuitive trust did not show any particular tendency that signals a correlation with EPRM, one can propose that the technical affinity between a project manager and a client is a matter of integrity trust. Hartman 1999 defined integrity trust as the ethical dimension of trust that makes one party believe in the other’s intentions to routinely look after his/her interests; whereas, competence trust is the belief that the other party has the ability to perform the work that was assigned. Yet, one can argue and it has also been discussed in the literature that the boundaries between the different trust dimensions treated in this document are not clearly established (Kadefors 2004) and therefore the scales used to measure present a degree of overlapping. Hence, what this analysis attempts to claim is that technical affinity, a factor that was observed during the interviews that conditioned the relationship between some project managers and their clients, could be attributed to the dimension regarding integrity trust and not necessarily to competence trust. The objective of this analysis is to explain how lower and higher levels of integrity trust among the studied couples (project manager-client) have repercussions on the effectiveness of project risk management.

On the one hand, there were two projects (highlighted red in figure 27) in which the interviewee stated that the client demanded a project manager with a profound technical background in a particular engineering area. He argued that the lack of such specific knowledge caused many difficulties during decision making activities because he sensed a lack of trust in the client. On the other hand, projects that rated high in both LOT/IGT and EPRM had project managers with specific engineering backgrounds (highlighted blue in figure 27) that matched the technical challenges of the projects; two of these projects belong to the type-partnering environment meaning that their selection by the PM department was also based on their technical affinity towards that specific client (Ulfati, Tebodin). The remaining project was the construction of a building; this project was led by a project manager with an architectural background which supports the notion that technical affinity improves the variables LOT/IGT and EPRM. One could then argue that assigning project managers according to their technical background improves the levels of integrity trust between manager and client and the effectiveness of project risk management in engineering & construction projects.
Moreover, one of the scales of integrity trust measured how professional and dedicated the clients thought were their assigned project managers. The clients of projects that rated low (highlighted red in figure 28) on IGT/EPRM answered on average 4/7 whereas clients of project with higher values of IGT/EPRM answered on average 6/7. As discussed before, overlapping is an issue that must be revised if future research is to be performed on the subject of trust and its dimensions; one can argue that being professional is an integral characteristic that involves many aspects such as technical knowledge, project management capabilities, responsibility etc. Nonetheless, clients that demanded highly qualified and specific technical backgrounds judged their project managers as less professional and dedicated.
8.5. Technological complexity

As defined by Tebodin’s project managers, technological complexity depends on two major aspects: the project’s degree of innovativeness and the project’s size. The first aspect concerns the technological processes involved in the project and how these are new to the project manager. The second aspect covers a variety of characteristics such as: number of disciplines involved, size in men hours and number of different sub-activities performed simultaneously. Three out of the ten project managers that were interviewed mentioned that the technological complexity of their projects affected the presence of uncertainties and expectations in their clients.

There are two different approaches to the aspect of technological complexity present in this analysis. The first one argues that lower levels of technological complexity in projects enhances the variables LOT and EPRM. The second one debates that higher levels of technological complexity in projects also allow trust and EPRM to be on top of the line.

8.5.1. Low technological complexity

During the interview with the project manager responsible for the highest rated project on EPRM he mentioned that it was an “easy project to manage”. He supported his statement by saying that the project was relatively small in man hours (3720 MH), it was not technologically innovative and that the history with the client was rather impeccable (this argument is treated in the next section of this analysis). He remarked that PRM was performed along with the client and that all risks were identified successfully due to the small size of the project and its low level of novelty. Likewise, the strategy to mitigate risks was specific, assignable, realistic and time-related and was implemented exactly as it was agreed with the client. The client opinion on the project manager was: “Persistent and consequent”; subsequently, the client commented on their relationship as having a “very positive and open communication”.

![LOT vs. EPRM for all projects](image-url)
8.5.2. High technological complexity

On the other hand, there are two examples that show that a higher degree of technological complexity might as well be correlated with the variables LOT and EPRM as dependent variable. A consequence of high levels of technological complexity is that uncertainties inside the project organization increase and thus the level of risk. In order to deal with complexity in project management as a consultancy service, Patterson, Johnson & Spreng 1997 stated that educating clients on the complexity of projects increases the perception of fairness and consequently their satisfaction with the outcome of the project; yet, to be able to share uncertainties a certain level of trust must be present.

According to Smyth 2010, trust develops in five stages:

One can argue that in order for expectation in clients to increase due to repeated business (stage 5), the level of technological complexity must increase as well. This on the assumption that there has been a process in which trust has been built up following stage 1, 2, 3 and 4. Hartman’s dimensions mainly belong to stage 1 in which there has not been any particular behavior to judge upon by the client that gives evidence to trust his/her project manager. This is why the control variable (different environments: TOE and TPE) is important for the research project’s approach. Both of the projects explained below that were highly complex in their technological processes belong to the type-partnering environment in which repeated business has been conducted. In order to explain why these two projects rated high on LOT and EPRM one can claim that due to the high technological complexity a high level of trust should have been present to deal with the high level of uncertainty and thus risk. This last statement is supported by using Smyth’s dynamics of trust development in which stages 1-4 demonstrate that through behavioral evidence, clients can increase the level of trust towards their project managers. Furthermore, such level of trust is sensitive to higher expectations (stage 5) that can only be present through the existence of more complex projects.
The first example is a project that was characterized as large in both men hours and scope activities (regarding the number of sub-activities). The project manager expressed during the interview that the number of sub-activities in the WBS (work break-down structure) in the project increased substantially the level of complexity which required an extremely specific, assignable and time-related mitigation strategy. He mentioned that openness in communication was essential to specifically identify, assess and evaluate all the risks that were present. He has been working for this client for over ten years sharing work space and task forces, which enable him to interact frequently with the client. Nevertheless the strategy was not implemented as planned during the 4th phase of the PRM process due to the complexity of the project but not to a lack of trust in his professional relationship with the client; he repeatedly argued that it was an exhausting project due to the large quantity of simultaneous activities that had to coincide at some point in schedule in order to accomplish time and scope. This caused a change in the strategy to mitigate the risks which was as well claimed through formal communication.

The second example deals with a project in which a relatively new technological process was present. The main challenge in this project had to do with the piping of the infrastructure. The reason is that the plant was to be constructed by assembling individually constructed blocks. However, the piping had to coincide from one block to the other which created a notorious challenge for the piping discipline involved since it was the first time they had to perform under such instructions. The project manager during the interview commented that the communication with the client was such that it allowed him to inform the client on the complexity of the task. The risks concerning the technological process were consensually identified, assessed and evaluated and the strategy to mitigate them was openly known. The only downside of the project’s PRM was that the project manager from Tebodin believed that he should have been informed on the lack of budget that delayed the project and which was not identified as a risk from the beginning.
8.6. Project manager & client professional history

The last aspect highlighted during the interviews that gives insight into the results of this research is the professional history between the project manager and the client. At Tebodin 25% of the projects are performed with former clients which gives the opportunity to establish long lasting relationships between project managers and clients. Many perspectives of how trust matures stress that trust is a history-dependent and therefore, as well, a situation related process meaning that trust builds incrementally and it accumulates over time (Koskinen, Pihnlanto & Vanharanta 2002). This aspect is closely related to the environment in which projects are executed. However, not only projects executed in partnering environments enable project managers to establish close relationships with clients. The last example refers again to the project with highest EPRM and second best in LOT. The project manager, as mentioned before, said that he knew the client (client’s project manager) for a long time; a time in which trust was sufficiently constructed.
9. Phase VI. Conclusions & Recommendations

9.1. Conclusions

This section portrays, based on the quantitative and qualitative analysis in section 7 and 8 respectively, which are the hypotheses that are accepted from those proposed in section 5. The conclusions are based on the correlations between the dependent and independent variables according to each of the hypotheses.

_H1, Greater levels of trust between a project manager and the client improve the effectiveness of PRM in engineering projects_

And,

_H1b, Greater levels of integrity trust between a project manager and the client improve the effectiveness of PRM in engineering projects_

After analyzing quantitatively and qualitatively the data obtained from 10 different construction and engineering projects at Tebodin, there is evidence to claim that there is a significant correlation between the level of trust from clients towards project managers and the effectiveness of the risk management techniques that involve human interaction. Hartman’s three trust dimensions were tested separately against the variable EPRM to verify their individual correlation and the only dimension that showed a significant level of correlation was integrity trust. This dimension is defined by Hartman as: “Ethical trust or belief that one party will routinely look after the interests of another party” (Hartman 1999); clients that believed that their project managers were to routinely look after their interests facilitated the use of PRM techniques that involved human interaction such as: Risk time frame assessment, cost-benefit analysis during risk planning, cause and effect analysis during risk planning, risk probability assessment among other techniques listed in section 5.2. The use of these techniques at Tebodin forces human interaction to be present and the level of trust that clients have towards their managers is correlated with how effective these techniques are.

_H1d, Greater levels of trust between a project manager and the client improve the effectiveness in identifying, assessing and evaluating risks._

Moreover, since the conceptual model that is tested in this project requires human interaction to be present when executing PRM, a different dependent variable was created to verify the validity of the results. The variable EPRM3 (effectiveness of project risk management-first 3 phases) concerned the phases of identifying, assessing and evaluating risk leaving aside the subsequent phases regarding the strategy and its implementation. There is a higher correlation between the variables LOT and EPRM3 than with EPRM meaning that the effect of trust on EPRM is greater during the first three phases of the PRM due to more intense human interaction during the execution of the PRM techniques.

_H2, The environment in which the project has been conducted affects the relationship between the LOT and the effectiveness of PRM._
The approach of the project included a division of the sample data into two different groups in order to test the control variable regarding the environment in which projects were executed. One environment was called TOE (type-operational environment) meaning that the relationship between project managers and clients was limited by the time of the PLC. The other environment was defined as TPE (type-partnering environment) meaning that project managers have worked with their clients inside the same working space for a period longer than the PLC. The data showed that projects belonging to the type-partnering environment ranked in average higher on both variables, LOT and EPRM, than the projects under the type-operational environment conditions. This hypothesis is supported by Smyth’s 2010 dynamics of trust development in which the author proposes a model that argues that trust builds up through the interpretation of tangible behavior. Such behavior is more likely to occur during projects belonging to TPE because project managers and clients have a longer professional relationship with their clients than the duration of the PLC. In other words, clients have the opportunity to base their trust on their interpretation of previous behavior. The effect of such a process is that client expectations rise, giving space for trust to be built up through the execution of future projects.

Qualitative analysis

Finally, a qualitative analysis was performed to support the correlations explained before. Through interviews with project managers and CSRs filled by the clients, there are specific incidents that support the correlations between LOT & EPRM, IGT & EPRM, LOT & EPRM3 and the difference in averages between projects TOE and TPE. Important aspects such as cultural differences, client proximity, technical affinity, technological complexity and project manager-client professional history were identified and supported with existing literature on PM. These aspects gave insight into the data provided by project managers and their clients which created the correlation lines between the studied variables. As a conclusion, there is a strong recommendation, if future research is to be done regarding this topic, to include these aspects during the formulation of new conceptual models.

Furthermore, due to the limited time for the execution of this project, the data obtained was limited to ten projects; nevertheless, a recommendation for future research is to enlarge the sample in order to implement more specific and informative statistical methods. For instance, a factor analysis would be useful to understand the overlapping between the scales to measure the different trust dimensions. Additionally, a larger sample would as well be useful to definitely verify the importance of the dimensions competence trust and intuitive trust on EPRM. Until now, the data did not show any correlation regarding these two variables but there is not enough evidence to rule them out of the equation. A factor analysis would as well guide the managerial recommendations presented in the next section of this document because it would help the researcher understand which scales have greater effect on EPRM or EPRM3. The additive indices technique, as being non-parametric, shows a tendency of correlational (or non-correlational) behavior between the studied variables but it does not have the power to scrutinize the factors that explain such correlation between the dependent and independent variables.
9.2. Recommendations for future research

“Swift trust” between project managers and clients in operational environments

This research project analyses how the different dimensions of trust described by Hartman 1999 affect the effectiveness of PRM in engineering and construction projects. However, models such as the ones described in section 4.2 are a conceptualization of the construct of trust that assume different reasons why trust should emerge and the forms it will consequently take (Pinto, Slevin & English 2009). The research’s approach highlighted the importance of two different project environments (TOE and TPE) as a driver for trust to arise between project managers and clients; one of the conclusions is that projects executed in TPE tend to rate higher in LOT than those executed in TOE conditions. A recommendation for future research in the area of trust between members of the project organization is to analyze the importance of Meyerson’s concept “swift trust” in projects executed in TOE or as she defines it: temporary organizational structures (Meyerson, Weick & Kramer 1996). The concept refers to the notion that individuals might start trusting their counterparts instead of distrusting them when working in temporary situations such as those in TOE projects. This research focuses on the level of trust that clients have towards their project managers after projects have ended. It might be also interesting to analyze how trust varies from the starting phase of a project to its end; this might give insight into the factors that caused trust to vanish and how project managers could prevent this from happening in future temporary situations.

Trust characterization: Resilient or fragile? How does it affect EPRM?

Characterization of trust being either fragile or resilient (Meyerson, Weick & Kramer 1996) might also play a role in future research. “Researchers have generally argued that different forms of trust vary considerably in their fragility and resilience” (Meyerson, Weick & Kramer 1996, pg. 184). It could be interesting to understand how project managers should deal with the different types of trust according to this perspective. The questions of whether trust is “thick” or “thin” raises several questions on how individuals initially calibrate and update their expectations about other’s trustworthiness (Meyerson, Weick & Kramer 1996). A recommendation would be to understand the effects that these two different types of trust have on EPRM or any other key-success factor of the project management. For instance, the notion of swift trust explained above is considered to be fragile and temporal; a recommendation for future research is to analyze which are the mechanisms that can “thicken” it in order to achieve greater levels of resilience for future projects.

Higher effectiveness of control mechanisms due to higher levels of trust (Das & Teng 1998)

In the previous section of this document managerial recommendations were presented to improve the practices of PM at Tebodin. One of the recommendations is to start a program of trust for the project managers that would help them increase their ability to create trust with their clients and thus improve their effectiveness of PRM. Das and Teng (1998) mentioned several ways in which trust can be generated among strategic alliances which are described in appendix D. They conclude that the level of trust has a direct effect in determining the control level needed in organizational partnering.
relationships. As a recommendation for future research in the area of trust and PRM, and following the idea of control mechanisms being affected by the level of trust, this research proposes to further develop the effect of the level of trust in the control mechanisms used in PRM procedures.

9.3. Managerial recommendations for Tebodin

Aside from the scientific input that this project has, there was also a practical incentive to execute the project. The project was conducted with a Dutch engineering and consultancy company named Tebodin responsible for engineering and construction projects in the west-region of the Netherlands. The formulation of the conceptual model was done under the supervision of Tebodin’s senior PM department with the objective of improving PM practices at the company. After conducting this research, we have found the following recommendations for Tebodin’s project managers and senior PM department:

Start a program on trust management among all project managers to emphasize the importance of trust on the EPRM techniques used at Tebodin.

Many of the PRM techniques used at the company especially during the first 3 phases of the PRM process involve human interaction which gives the possibility for building high levels of trust with the client. There is evidence in this document to claim that higher levels of trust from clients towards project managers are correlated with better effectiveness in project risk management. Therefore a way to tackle weaknesses in PRM at Tebodin is through the implementation of a trust management program. As a starting point, Das & Teng (1998) present four different techniques to enhance the building of trust in strategic alliances (that could be applied to project organizations in TPE) in order to improve the effectiveness of control mechanisms.

Emphasize the importance of partnering environments for the execution of projects.

On average, projects conducted under TPE conditions rated higher on both LOT and EPRM meaning that the project managers had the opportunity to build up higher levels of trust which led to higher levels of effectiveness in project risk management. TPE enables closer client proximity which allows human interaction, longer professional history and the possibility to engage in repeated business as an igniter of client expectations. At the moment 50% of Tebodin projects are executed with previous clients; raising this number would increase the overall levels of trust among project managers and clients consequently incrementing the effectiveness of PRM at Tebodin.

Include the concept of integrity trust in future CSRs.

There is evidence to claim that the scales that explain the dimension of integrity trust are correlated to the effectiveness of PRM at Tebodin; therefore, in order to gain

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3 Das and Teng (1998) propose four different ways to develop trust in strategic alliances. Their approach is more focused on an organizational level rather than on the individuals as this research project does. Nevertheless, these four methods could be a basis for the development of a trust program that would improve the level of trust present in partnering environments: 1. Trust from risk taking, 2. Trust from equity preservation, 3. Trust from communication, 4. Trust from inter-firm adaptation. Further explanation of these methods is presented in appendix D.
feedback from clients on matters regarding this dimension, it would be wise to include questions that measure the level of integrity trust from clients towards project managers. This feedback would help project managers understand their weaknesses in future projects.

*Continue the research on trust dimensions and their effects on EPRM by enlarging the data sample.*

As mentioned before, the data sample was limited to ten projects. Conclusions on the results are as well limited to the point that one can just argue that there are certain tendencies to claim the correlational behaviors among the studied variables. Moreover, it is stated in the literature (Kadefors 2004) that the dimensions that explain trust are not clearly delimited one from the other; this causes overlapping in the scales to measure the level of trust which might affect the results. With a larger sample, a factor loading analysis could be executed to understand which are indeed the scales and factors that explain the correlation with EPRM.

### 9.4. Limitations and personal reflection

The most important limitation of this research project was the reduced data sample of projects; this had undesirable repercussions on the quantitative analysis because the quantitative methods to analyze that type of data were limited to non-parametric techniques. The statistical analysis that was performed was non-parametric because the assumption of normality due to the small sample size could not be made. The consequences this had on the results is that the conclusions about the hypotheses are rather signaling a certain behavior but do not entirely confirm the conceptual model.

As a personal reflection I believe that this research project has contributed to the professionalization of PM practices at Tebodin by targeting an important area, such as PRM, through the notion of trust. It is a topic that has not been explicitly discussed nor assessed during PM coaching sessions and that shows to have a significant correlation with one of the common concerns that project managers have at Tebodin: project risk management (PM day Tebodin, 2015). Moreover, it is a starting point for future research in the area of trust management as a concept that affects several aspects of PM. The notion of trust has been investigated by a diversity of disciplines and there is scientific evidence to claim that it is primordial in project organizations. Nevertheless, project organizations are nowadays highly complex due to the existence of different interpersonal relationships and their multi-cultural and multi-disciplinary nature. This raises a variety of topics ranging from the importance of trust in diverse areas of PM to the techniques or competences that allow trust to arise between individuals of the project organization.
10. References


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11. Appendix

Appendix A
Trust scales based on Pinto (2009)

<table>
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<tr>
<th>Dimension: Integrity trust</th>
<th>1</th>
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Dimension: Integrity trust
1. I feel comfortable about being dependent on the other party throughout the life of the project.
2. I believe the other party will keep their word throughout the life of the project.
3. I feel confident that the other party has high levels of integrity.
4. I believe the other party will adhere to high ethical principles throughout the life of the project.
5. I am certain the other party will be fair throughout the life of the project.
6. I am confident that the other party will look out for my interests throughout the life of the project.
7. I feel I can trust the other party throughout the life of the project.
8. I believe the other party would like to see me do well.
9. I can rely on the other party to not take advantage of me.
10. I believe the other party has ulterior motives or hidden agendas.
11. The other party would not knowingly hurt me in order to benefit themselves during the life of the project.
12. The other party is professional and dedicated.
13. Most people, even those who are not close friends of the other party, would trust and respect them if they were to execute a project with them.
14. Other associates who must interact with these individuals would consider them to be trustworthy if they had to execute a project with them.

Dimension: Competence trust
15. I am certain that the other party has the ability to perform productively.
16. I believe the project engineers and other technical people are competent.
17. Given the other parties’ track record, I see no reason to doubt their competence and preparation for future projects.
18. I can rely on the other party not to make the project more difficult by careless work.

Dimension: Intuitive trust
19. I am willing to be vulnerable to the other party.
20. My “gut feeling” tells me to be cautious when dealing with the other party on the project.
Appendix B

Scales based on PRM practices performed at Tebodin and tools proven to improve PRM and PMP (van Noordende, 2015; Raz & Michael 2001)

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**Step 1. Identification**
1. The number of risks that were identified was sufficient
2. The client informed us about all the possible risks that they could foresee
3. The client was committed during the risk identification sessions
4. The client’s level of participation during the risk identification sessions was excellent

**Step 2. Assessment**
5. The probability assessed to the risks was accurate
6. The level of impact assessed to the risks was accurate
7. The client was transparent and open about its business case

**Step 3. Evaluation**
8. The risks prioritization was according to the client’s perspective
9. The client was committed to evaluate/control risks over the time of the project

**Step 4. Development of a strategy**
A SMART strategy was developed meaning that:
10. The strategy to mitigate the risks was Specific (targeted a specific area of risks)
11. The strategy to mitigate the risks was Measurable (there was clarity during step 2 and 3)
12. The strategy to mitigate the risks was Assignable (there was clarity of rolls between yourself and the client to implement the strategy)
13. The strategy to mitigate the risks was Realistic
14. The strategy to mitigate the risks was Time-bounded

**Step 5. Implementation**
15. The implementation of the strategy was according to the previous agreement with the client (Step 4)
Appendix C

This questionnaire is based on various aspects of PM and was executed with Tebodin’s project managers in order to assess qualitatively the relationship with the clients’ project managers. The answers helped understand the events that took place during each project which led to a certain outcome in the project and conditioned the relationship with the client. The questionnaire served mainly to start the discussion with project managers on various topics in order to find out which were the key aspects and priorities of each project.

Section 1: General

- Rather than seeing projects as tasks that meet cost, time and scope, one should perceive projects in a broader sense. (Shenhar, Levy & Dvir 1997)
  1. What is your perception of a project as a project manager?
- Notice the possible disparity between PMS and customer satisfaction (Shenhar, Levy & Dvir 1997)
  2. Do you believe in the difference between achieving PMS (achieving the constraints of cost, time and scope) and satisfying a client?
  3. What do you consider failure? (Sage, Dainty & Brookes 2014)
- An effective means of “learning from experience” on projects, that combines explicit knowledge with tacit knowledge in a way that encourages people to learn and to embed that learning into continuous improvement of project management processes and practices (Terry Cooke-Davies 2002)
  4. Do you have access to previous projects’ results/reviews/lessons learned? Did you use that information before you started the project as a possible source of “learning from experience”-documentation?
  5. Name 5 (or more) leadership traits that a Project Manager as yourself should have in order to successfully guide his/her project team?

Section 2: Team performance

- (Belassi & Tukel 1996)
  - Ability to delegate authority
  - Ability to trade-off
  - Ability to coordinate
  - Perception of his role & responsibilities
  - Competence
  - Commitment
- Success factors of Project Manager Vs Project team
  - 4 Cs (Davis 2014)
    - Communication
    - Collaboration
    - Cooperation
    - Consultation
  - Identifying/agreeing objectives/mission
- Project manager leadership traits (Fortune & white 2006) (15 citations)
Judge from 1-7, how well do you think you performed on the following traits when conducting the project:

6. Were you successful on delegating authority to your project team members? (7 being that you fully trusted your project team members when authority was delegated to them)
7. Did you fully trust your project team’s expertise and knowledge during decision-making activities especially when you did not agree with them? (7 being that you always trusted them and you were willing to change your mind)
8. Were you able to successfully coordinate your project team (7 being that coordination among the project team was excellent)
9. Your perception of your role and responsibilities as a project manager (7 being that you were totally aware of your role and responsibilities)
10. Were you able to fully communicate with your project team (7 being that communication was excellent)
11. Were you able to give your collaboration to the project team (7 being always when they needed it)
12. Were you available for consultation by your project team (7 being that you were always available)

Section 3: Client satisfaction

- Decision uncertainty
  - Finding key-decision maker’s uncertainties on the promised service
  - Reassure the client by keeping them informed on a regular basis
  - (Engineering & Construction) Educate the client on technical processes and methods
  - Newsletter the client to inform about previous successful assignments to reassure performance and lower uncertainty
  - Having a well-conceived marketing communication program to inform, educate and reassure the client and attract new ones.
13. Were you fully aware of the client’s uncertainties about the project?
14. Were you successful on resolving these uncertainties?
15. Were you able to educate the client on technical processes and methods that were going to be used during the project?

- Decision novelty
  - Clients are unable to judge the true worth of completed assignments because of their lack of experience on the topic.
  - High level of professionalism during client contact
  - Reliability on meeting deadlines
16. Were you aware of the client’s previous experience/knowledge on similar projects?

- Importance of the project to the client
- Balance expectations with perception of performance. Managing client expectations to realistic levels once the project is won.

17. Were you able to realistically manage your client’s expectations on the outcome of the project?
   - **Fairness (Balance input with the output)**
     - Strategies to increase the perception of fairness in the client
     - Highlighting emerging problems or issues for the client firm
     - Informing the client about the complexity of the project
     - Informing the client about the technical expertise and the resources involved in completing successfully the project

18. Were you able to inform your client on the complexity of the project?
19. Were you able to inform your client on the expertise/knowledge of your team, including yourself?
   - **Disconfirmation/Client satisfaction**
     - Reviewing the client’s previous CSR to understand the client’s expectations and perceptions of the firm’s performance

20. Were you able to review the client’s previous CSR if available?

### Section 4: PMS

- **Project planning (Dvir, Raz & Shenhar 2003)**
  - Involve the client during the planning phase (cost, time, scope)
  - Usage of planning tools and procedures (time)
  - Meeting functional requirements (Scope)
  - Meeting technical specifications (Scope)
  - Effort on planning (cost, time, scope)

21. Were you able to involve the client during the planning phase of the project?
22. Did you use any planning tool or procedure to assist the planning of the project? Which?
23. How much effort did you put into the planning of the project?

- **Critical success factors identified across 63 publications (Fortune & white 2006)**
  - SCM (scope change management)
  - Support from senior management
    - Availability of resources
    - Meeting on a regular basis with the senior PM
  - Clear realistic objectives
  - Strong detailed plan kept up to date
    - A clear plan was formulated and an efficient planning and control system was operated to keep them up to date.
  - Good communication feedback
  - User/client involvement
o Skilled/suitably qualified/sufficient staff/team
o Competent project manager
o Proven/familiar technology
o Realistic schedule
o Risk management→Risks addressed/assessed/managed

24. How mature/robust/effective was your scope change management?
25. How supportive would you consider was your senior PM department? (time, resources, consultation)
26. How realistic was the project’s plan after the FEL 3 was handed over to the client?

• CSF (Terry Cooke-Davies 2002)

Time performance
  ▪ Adequacy of company-wide education on the concepts of risk management.
  ▪ Maturity of an organisation’s processes for assigning ownership of risks.
  ▪ Adequacy with which a visible risk register is maintained.
  ▪ Adequacy of an up-to-date risk management plan.
  ▪ Adequacy of documentation of organisational responsibilities on the project.
  ▪ Keep project (or project stage duration) as far below 3 years as possible (1 year is better).

Cost estimation
  ▪ Allow changes to scope only through a mature scope change process
  ▪ Maintain the integrity of the performance measurement baseline.

27. How effective was the control system/procedure to keep the plan up to date?
28. How strong was your risk management in addressing/assessing/managing risks?
29. How familiar to you were the technological processes implicated in the project?

Section 5: project results

30. In which percentage was the scope of the project complete?
31. Was the project handed over on the date established on the FEL 3?
   If not, what was the reason and time of the delay?
32. Was the client’s budget stated on the FEL 3 sufficient? If not, what was the reason and amount for the overdue?
Appendix D

Dan & Teng’s (1998) methods to build trust in strategic alliances:

1. Trust from risk taking

“Most theorists would agree that trust is intimately associated with risk and risk taking (Coleman, 1990) and that trust and risk can be considered "mirror images" of each other (Das & Teng, 1998). Trust and risk taking are believed to form a reciprocal relationship: trust leads to risk taking, and risk taking, in turn, buttresses a sense of trust, given that the expected behavior materializes (Boon & Holmes, 1991; Madhok, 1995; Rempel, Holmes, & Zanna, 1985). When a trustee realizes that a trustor has taken considerable risk in trusting her, she tends to be motivated to behave in a trustworthy manner” (Dan & Teng 1998, pg. 503).

2. Trust from equity preservation

“Besides risk taking, a second way to build trust among partners is to ensure that equity and fairness are mostly preserved (Korsgaard, Schweiger, & Sapienza, 1995; Sheppard & Tuchinsky, 1996). In essence, equity means that the firm contributing the most resources (both tangible and intangible) to the alliance should get the most from it. According to the equity theory of motivation, people have a strong need to maintain their sense of equity in exchange relationships (Adams, 1963)... That said, the relationship between trust and equity appears to go both ways—that is, a high level of trust tends to encourage partners to tolerate short-term inequity or mutual forbearance. Given a certain trust level among partners, it is also apparent that extended periods or growing instances of inequity will create tension and strain existing trust. Therefore, for the sake of trust building, profit distribution needs to be kept on an equitable basis” (Dan & Teng 1998, pg. 504).

3. Trust from communication

“Communication and proactive information exchange form yet another tactic to boost trust among partners (Macneil, 1980; Thomas & Trevino, 1993). There may be several reasons why communication and information processing play important roles in trust building. First of all, open and prompt communication among partners is believed to be an indispensable characteristic of trusting relationships (Kanter, 1994; Larson, 1992)... Second, firms need to collect evidence about their partners' credibility and trustworthiness, and communication facilitates this process. Creed and Miles (1996) have stressed the importance of being open to the evidence of others' trustworthiness, but without proactive information exchange, this process would take a long time... Third, communication helps build trust because it provides the basis for continued interaction, from which partners further develop common values and norms (Leifer & Mills, 1996)” (Dan & Teng 1998, pg. 505).

4. Trust from inter-firm adaptation

“Trust is earned from partners if one adapts to the needs of cooperation in partnerships (Heide & John, 1992). Interfirm adaptation refers to the adjustment of one's own behavioral pattern in order to bring about a fit between the partners or between the alliance and the environment (Hallen, Johanson, & Seyed-Mohamed, 1991). Flexibility
and the willingness to accommodate deviations from the contract when necessary are key to inter-firm adaptation. Macneil (1980) has recognized that a willingness to carry out such adaptations is essential for trust building, and Madhok (1995) has proposed that bilateral adaptation in JVs provides incentive for acting for mutual interests rather than self-interests. Being flexible enough to respond positively to the changing needs of a partnership demonstrates that the firm not only values the alliance but is also willing to make considerable efforts toward desirable accommodations” (Dan & Teng 1998, pg. 505).