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An Agile Procurement Model that Facilitates Agile Execution of Projects
A Case Study at Telia Company

Fredrik Sivander
MID SWEDEN UNIVERSITY
Department of Information and Communication System

Examiner: Aron Larsson, aron.larsson@miun.se
Supervisor: Håkan Sundberg, hakan.sundberg@miun.se
Author: Fredrik Sivander, frsi1202@student.miun.se
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Abstract

Since agile execution of projects has become more frequently used the discovery that the surroundings of the projects are not always compatible has been made. The problematic issue within the area is traditional accounting restrictions and cost estimation. The purpose with this research is to develop a procurement method that facilitates for agile execution of projects. Previous research focus on facilitating the procurement itself and not the agile execution which proves that the agile principles can be used in a procurement process successfully, but does not include how well it will perform. This research includes theories about the agile estimation models and requirement prioritizing methods. The method used to complete this research is design science, which includes six steps to ensure reproducibility and validity. This research resulted in a procurement method that includes three methods within two phases with focus on minimizing the pre-study, focusing on the most important requirements only. The procurer will then attend the agile execution and both procurer and executer enter the project with the mindset that the initial budget- and time estimation will increase. Both procurer and executor works together towards the same goal, maximum customer value for minimal cost. The method is tested on two projects conducted by Telia Company and the test result is that the generated solution reduces the total cost of the project and time to generate project result and facilitates for an agile execution. This research concludes that an agile procurement can facilitate agile execution of project but before this agile procurement model can be a recommendation more tests are needed.
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1. Introduction

In this section an introduction to the area that this thesis addresses will be presented. Chapter 1.1 will present the background to the area of field. Chapter 1.2 will present a problem formulation where the problematic within the addressed area is presented. Chapter 1.3 will present the purpose and goal with this thesis and chapter 1.4 will present delimitations. Chapter 1.5 will present the generated research questions and chapter 1.6 will present the outline of this study which will guide the reader through the report.

1.1 Background

The last decades haven been overwhelmed by the rapid change in implementation technologies, system requirements and market demands and an agile development style has shown advantages compared to traditional development styles. The agile development style stands out with its focus on minimization of the cost of transferring information between individuals and reduction of time between decision and realization of the decision. The development style is called agile because one of the main principles is to accept and welcome change at any time within the project. The agile development style has been proven to solve many types of problems and develop attractive work environments within many organizations. (Cockburn, Highsmith, 2002)

An important factor for an organization to stay competitive in the rapidly changing environment, with diversification in customer needs and complexity within products or services, is to properly manage the supply chain (Park, et al. 2009). If the supply change management is applied successfully the uncertainty and risk within the organization will diminish and process cycle will be optimized to enable the organization to satisfy the customer and generate profit (Park, et al. 2009). The traditional boundaries an organization identifies itself with has been extended by the agile development style, the effectiveness of response to a rapidly changing environment depends on the organizations trading partners (Power, et al. 2006). To develop an agile strategy for project execution becomes in this context strategies for managing the entire supply chain in an agile way, boundaries between trading partners needs to be eliminated so that the partners works towards the same goal (Power, et al. 2006).
Since agile execution of projects has become more frequently used, especially within the field of software development, the discovery that the surroundings of the projects are not always compatible has been made. Sirkiä and Laanti (2015) states that agile software development does not cooperate with traditional cost accounting, because they valuate differently within time planning and accounting. The nature of an agile project is with fixed resources and time-schedule and the project scope flexible, which can lead to a non-desirable outcome of the project (Lang, et al. 2001). There is an increase of awareness of the impact of financial control on projects executed according to the agile manifesto but this has not reached to the financial sector yet because the need of cost control in the accounting department is to strict. Therefore traditional cost estimation and control methods should not be used because they contradict with the agile manifesto, se the quote below. (Sirkiä, Laanti, 2015)

“Enterprises that approaches uncertainty and risk in software development based on lean and agile methods often experience financial planning of projects as a restriction. Traditional budgeting and cost reporting is a system based on rigid frames, and it –along with the process of project cost accounting- burdens the lean and agile enterprise with unnecessary and counterproductive overhead and friction. The traditional system provides at best a false sense of cost control to any enterprise”. (Sirkiä, Laanti, 2015)

According to Jungchun, et al. (2006) between 50 % and 80 % of the combined cost of procurement and execution of the project addresses the procurement. This information combined with the quote above provides the conclusion that too much cost and effort goes to a process that does not provide enough relevant information, and the problem is cost estimation and accounting. Mansor et al. (2011) reviews agile and traditional cost estimation process and draws the conclusion that an agile cost estimation process result in more precise information and reduces time, effort and cost. Jamieson, et al. (2006) proposes another way to overcome the problematic with traditional cost estimation for agile projects and that is with a new procurement process, se the quote below.

“There are still significant problems with software cost estimation, it have not improved in twenty years despite extensive development in formal estimation methodologies. It seems as though methodologies cannot adapt as quickly as new issues arise. Thus a new procurement process that reduces the impact of inaccuracies on software cost estimation is one way of approaching this challenge. This will have the added benefit and cost estimation processes”.
(Jamieson, et al. 2006)
Within a procurement process different activities are included, these activities can vary depending on which organization or individual who are defining the process. In this research the procurement process is defined as the needed activities within an organization to undertake an idea, decide if it should be executed and start the execution. The idea may have the need for external consults or internal development only, and even if external consults are involved the idea still needs to be processed by internal activities. This research is addressing the path from idea to result, executed in an agile way, with focus on the time and effort spend on the activities before the execution of the project starts. Within this research the execution of projects are defined as the needed activities to complete the project result, which starts after the procurement are finalized and stops when the project result is delivered.

1.2 Problem Statement

As stated by Sirikiä and Laanti (2015) the main problem with agile execution of projects within a traditional organization is cost estimation and accounting, see the first quote in chapter 1.1. Other factors may be relevant but this is the core of the problematic issue. When it comes to cost estimation of projects that are executed in an agile way a new procurement method that enables an agile execution of projects is one way to address the problematic issue, since years of development for a new cost estimation method has not resulted in anything sustainable (Jamieson, et al. 2006).

1.3 Purpose and Goal

The purpose with this research is to develop a solution that addresses the problematic issue with agile execution of projects within a traditional organization and facilitates for both procurer and executor. The goal with this research is to develop a solution that reduces the cost and the time spent on procurement of agile projects at the same time as it facilitates for an agile execution of projects.

1.4 Delimitations

This research is delimitated to address the scenario where a traditional waterfall organization executes projects according to the agile manifesto. This research will address the internal procurement process that focuses on deciding if an idea should be executed or not. The execution should be done according to the agile manifesto and the procurement according to the traditional waterfall model.
1.5 Research Questions

1. How can the agile principles be applied within a procurement process to reduce time and cost related to the procurement of agile projects?

2. How can a procurement process facilitate for projects executed according to the agile manifesto?

1.6 Outline

The report is outlined as following; Chapter 2 present extended background which contains relevant theories and previous research. Chapter 3 presents the method that this study has used along with choice and motivation of theories and ethical considerations. The result of this study will be presented in chapter 4 which will contain the design of the proposed method and the evaluation in form of a case study. Chapter 5 will present an analyze of the method and case study and chapter 6 will present the conclusions that this research has resulted in. An appendix displaying content relevant to this study will be presented in the end of the report.
2. Extended Background

This section aims to present relevant extended information about principles, methods and general knowledge within the area of this research. Chapter 2.1 will present the fundamental extended background which this study uses as foundation. Chapter 2.2 will present different estimation methods for both time-estimation and cost-estimation along with requirement prioritization methods. Chapter 2.3 will present the previous researches that are relevant for this research.

2.1 Fundamental Extended Background

In chapter 2.1.1 the agile principles will be presented. Chapter 2.1.2 will present the theory about supplier relationship management. Traditional procurement methods will be presented in chapter 2.1.3. In chapter 2.1.4 fundamental information about project execution, including both traditional and agile project execution, will be presented.

2.1.1 Agile Principles

The agile principles as described by Beck, et al. (2001) is proven to be effective in project execution (Williams, 2014). There are twelve principles developed as guidelines to guide the executor to follow the agile manifesto. The principles are:

1. Continues presentations of parts of the result.
2. Be open and welcome change in the requirements, early as well as late in the project.
3. Deliver usable result frequent and in short time-spans.
4. Business department and executor must work together daily.
5. Trust the executor and generate an environment which motivates the executor and build the project around the motivated individuals.
6. Promote face-to-face communication.
7. Usable result is the primary measurement of progress.
8. Promote sustainable development.
9. Pay attention to individuals with relevant skill which enhances agility.
10. Maximize the work done, keep it simple.
11. Apply self-organizing teams, they tend to produce better result.
12. Let the team frequently reflect over how they can be more efficient, make adjustment. (Beck, et al. 2001)
The agile principles are efficient and helps the executor to maintain the agility within the execution of projects, despite the fact that it was more than ten years ago they were developed. (Williams, 2014)

2.1.2 Supplier Relationship Management

The supplier relationship management is the interaction between internal function within an organization and external suppliers of products or services that will cooperate towards creating and deliver value for an end user or customer (Moeller, et al. 2006). Park et al. (2009) states that a properly managed supplier relationship management will result in lower risk and uncertainty. Supplier relationship management includes purchasing strategy, supplier selection, collaboration and supplier management. (Park, et al. 2009)

Purchasing strategies – There are two types of purchasing strategies, competitive approach and cooperative approach. A competitive approach assumes that the competition between suppliers are based on price and therefor the best selection would be the cheapest supplier. Within cooperative approach the buyer and supplier form a relationship with common long term goal. (Park, et al, 2009)

Supplier selection – There are two reasons why supplier selection is complicated; there are many criterion that decides if a supplier is relevant or not, different suppliers have different specialties. In the case where the project goal is to maximize customer value the best supplier needs to be selected, with proper decision making methods. If the agile manifesto is applied to the execution of projects the highest priority should be on quality. (Park, et al. 2009)

Collaboration – There are different supplier relationship management system which aims to generate a strong relationship between buyer and supplier. For example just in time purchasing which enables the supplier to work according to the just in time method and vendor managed inventory where the supplier takes responsibility of relevant contracts and manage the buyer’s relevant inventory. (Park, et al. 2009)

Supplier management – This step aims to evaluate the supplier’s involvement within a project so that the supplier buyer relationship can strengthens and lead to more successful projects in the future. (Park, et al. 2009)
2.1.3 Traditional procurement

The traditional procurement method as first presented by Royce was aimed towards software development and contained seven steps that should be executed in a specific order. The seven steps are, in order, System Requirements, Software Requirements, Analysis, Program Design, Coding, Testing and Operations. The first four steps of these are aimed to the procurement process and the latter three to the execution. (Royce, 1987)

The positive aspects with a waterfall model is that the requirements are clear before the execution begins, it is easy to implement and each step provides proper documentation to ensure quality (Balaji, Murugaiyan, 2012). The negative aspects with a waterfall model is that problem connected to one step arises after that step is completed and therefore never gets solved and that change in the requirements is not possible to implement during the development (Balaji, Murugaiyan, 2012). Petersen, et al. (2009) states that the waterfall model is strongly identified with high cost and high effort, that the model requires approval of documents, iterations within the development creates redundancy and that the customers’ current needs does not get addressed with the developed solution.

2.1.4 Execution of Projects

The Project Management Institute defines a project as a temporary set of activities to create a unique service, product or result, a project should have a defined beginning, end and scope and it should be unique, not a routine set of activities (Project Management Institute Inc, 2016). The two dominant project execution methods are the traditional execution of projects and the agile execution of projects. Traditional execution of projects results in a 16.2% success rate, a project is seen as successful if the result is provided on time and on budget, and a project executed according to the agile manifesto results in a 52.7% success rate (Mansor, et al. 2011).

Traditional Execution of Projects

The traditional project execution methods, as described by Jansson and Ljung (2013), includes three steps, pre-study, planning and execution. Within the pre-study the goal is to develop a foundation to enable a decision making process to decide if the project should be executed or not. In the planning phase the goal is to develop a detailed plan on how the project should be executed, a decision making process is implemented before the project can move on to the execution phase so the stakeholders can approve the detailed plan. The execution phase is divided into three sub-activities, the first one is realization in which the execution of the project and the
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project result is obtained. In the second sub-activity the project result is transferred to
the project owner and in the third sub-activity the obtained experience is under
evaluation and the project team disunites. (Jansson, Ljung, 2013)

The traditional execution of projects have meet an obstacle in today’s organizational
society, the fast and continuously changing business world. According to Wysocki
(2009) the traditional project execution still suits some projects, where the project
scope is similar to previous projects and little changes are expected. Although
changes are not expected they tend to appear anyway and a traditional execution
may not be optimal but suitable. If changes in the project scope appears while the
project execution is ongoing a change request is needed and the following actions
needs to be performed. (Wysocki, 2009)

- Does the change request needs to be analyzed by one of the project members?
- The project manager needs to assign the request to appropriate member of the
  project team.
- The project member who gets the assignment executes an analysis and writes
  a Project Impact Statement.
- The project manager then provides the client with the recommendation of
  change in the project scope.
- The project manager and the client makes the decision if the change should be
  implemented or not.
- If the change request is approved, the scope of the project, budget, time-plan,
  required resources and client acceptance criteria are updated. (Wysocki, 2009)

This entails that much of the project members time are being consumed on different
tasks instead of the execution of the project and too many change requests will make
the initial pre-study non-value added and at worst venture the project result.
(Wysocki, 2009)
Agile Execution of Projects
An agile execution of projects uses the agile principles as a cultural framework with focus on adapt to change to maximize value for the customer. Gustavsson (2013) describes that the same phases that are central within traditional execution of projects are relevant within agile execution of projects as well. The traditional division is relevant thought it is easier to focus on one area at the time and a firm closure of a phase provides a structure within the project, but focus should still be on the agile manifesto, as presented in chapter 2.1.1. There are different types of agile execution and the most frequently used is Scrum, where the focus is on a close, effective team containing mixed competence working for the same goal, maximize customer value. (Gustavsson, 2009)

Wysocki (2009) states that the optimal scenario for using agile execution of projects is when the main goal or scope is known but the path there are unknown. There are a higher risk with agile execution of projects compared to traditional with the planning phase being minimized and changes to the scope is welcomed at any time at the project. The solution if a problem occurs to the project that cannot be solved is, at the worst case scenario, to learn to live with it and make the best of the case. An agile execution of projects therefore suits especially well in a process-improvement environment (Wysocki, 2009).

2.2 Estimation Models
The estimation models that are relevant are the classic agile time estimation methods which are presented in section 2.2.1-2.2.3. Cost-estimation models that applies to project development are presented in 2.2.4-2.2.5. In chapter 2.2.6 a requirement specification prioritization method is presented.

2.2.1 Planning poker
Planning poker is an estimation method which performs estimation on a project level. The estimation is made on user stories, different tasks or activities that the user should be able to do on the finalized product or services, instead of technical errands. The entire development team along with the procurer uses this technique together. All attendant gets a set of cards with discrete values written on them, each user story is examined individually. When a user story is examined all attendant shows the amount of effort, on the discrete scale, that they personally think the task would require. If all the attendant does not agree the attendant who gave the highest and lowest estimation explain their choice. A revote is then conducted and if the attendants has not voted the same again another revote can be performed or the mean value or median can be calculated. Then the team estimates their velocity, how
much of the discrete value they can perform in each iteration of the project. The complete length of the time schedule can then be calculated by multiply the number of iterations with the estimated velocity. Moløkken-Østvold and Haugen (2007) states that planning poker produces the same level of confidence as expert judgement, which will be described in chapter 2.2.5, despite the fact that there is no certainty for an expert involvement in the planning poker phase. (Cohn, 2006)

2.2.2 The Planning Game

The planning game requires that procurer has knowledge about what should be executed and the executor have knowledge about how to perform the execution. The executor estimates how much effort each feature or activity takes and the procurer prioritize the features after their business value. Procurer and executor have an opportunity to solving doubts about prioritization and estimations. Until this point the dependencies between features or activities been overlooked and is now taking to account, the dependencies creates clusters and these clusters constitutes the iterations within the agile execution of the project. (Cockburn, 2004), (Shore, Warden, 2008)

2.2.3 Blitz Planning

Blitz planning is a time and effort estimation method which is based on the planning game described above. The procurer brainstorms all the relevant tasks or activities within the project by writing them on post-it notes. The procurer prioritize the tasks and identifies dependencies. The execution then estimates the time needed to execute each individual task and complement with more dependencies. Both parts then work together to identify the fundamental tasks within the project, the activities required to create a usable result and the activities that are required to create results that brings revenue. Cockburn (2004) states that the blitz planning method works well to plan and estimate project up to a three months basis, if longer periods of time is estimated the detail needed for each activity becomes overwhelming. (Torrecilla-Salinas, et al. 2015)

2.2.4 Algorithmic Estimation Models

The difference between previously mention estimation techniques and algorithm based estimation models is that the latter uses mathematical approaches to calculate the estimations. According to Torrecilla-Salinas, et al. (2015) the three most relevant to estimate agile projects are COCOMO (Constructive Cost Model), function points and use case point technique. The COCOMO model is used most frequent and provides the effort in person months, the execution time in months and the team size in persons, this model is aimed for agile software projects and requires information
as database size and programming language experience (Kaushik, et al. 2012). The function point method is used to measure the size of a data system from an end users point of view with the goal of estimating the development effort (Lavazza, et al. 2013). Use case point technique offers a functional scope of the project where the analysis provides valuable insight in the size of the development project (Monteiro Barbosa da Silva, et al. 2008).

2.2.5 Expert Judgment

In the majority of cost and time estimation expert judgement is applied. The method provides, compared to algorithmic cost estimation models, a fairly accurate result at a lesser cost, which provides a better value for money than algorithmic cost estimation models. Jamieson, et al. (2005) states that an appropriate amount of expert judgment should be applied to all activities within the project. The expert judgment method requires a person with a lot of experience within project cost estimation otherwise the proposed judgment can be misleading and cause the project to exceed estimated budget and time schedule. Jamieson, et al. (2005) proposes several activities that the expert judgment method should include, for example set a realistic time schedule and manage stakeholder expectation. (Jamieson, et al. 2005)

2.2.6 MoSCoW Model

The MoSCoW model is an agile prioritization model which is used for dividing features of the project into different sets and enables selection of the right activity to execute at the time. MoSCoW stands for must have, should have, could have and will not have. Must have features includes the features that makes the minimum scope of a useful result. Should have features includes the features that are not critical for the project result but brings high value to the user and therefore should be implemented. Could have features includes features that can be implemented in the project result if it does not requires too much cost or effort. Will not have features includes the features that are excluded from the project but may be implemented in the latest part of the project or as add-ons after the project is finished. The MoSCoW model can be used to prioritize both requirement specifications or user stories, in the latter the end users thoughts is prioritized to present which features that will bring the most value to the end user. (Waters, 2009)
2.3 Previous Research

Jamieson, et al. (2006) investigates the incompatibility problem between the software project buyers linear or sequential method of procure with the suppliers agile execution. This incompatibility problem often leads to insufficient budget and time-plan compared to the project scope. They conclude that an agile procurement process is necessary to overcome the cost estimation problem. The authors suggest an agile procurement process to support dynamic value for money, where the processes contract management and software development work simultaneously. The dynamic value for money is calculated in every sprint to ensure that the project expenditures is according to budget. The proposed dynamic value for money model enables the scope and time-schedule of the project to be discussed within the project sprints. The dynamic value for money model is successfully tested with a case study at Australian Department of Defense, on a five year long software project which accessional works in an agile way. The conclusions presented by the authors is that an agile procurement process should lead to projects that meets the buyers' expectations more comprehensively. The authors discusses that the agile procurement process will get resistance from those responsible for allocating budgets though increased contract risk that occurs with a smaller pre-study. (Jamieson, et al. 2006)

Jingchun, et al. (2006) analyzes the life cycle of IT projects with two different procurement model, single stage and two stage. The analysis comprises concepts, application conditions, advantages, disadvantages of the procurement models. The authors present that within IT projects the procurement process accounts for 50-80% of the total budget and are also a key factor for success. The single stage procurement process is a traditional approach where the entire scope of the IT project is procure before the development starts. The two stage procurement process is when the project is re-procured after a preliminary design is presented to the stakeholders. The analysis presents that a single stage procurement process is more suitable if the IT project handles an easy task but if the task is complicated a two stage procurement process is the prefer. The authors present conclusions that discusses the risk of the project, and how the risk in a single stage procurement model is only for the stakeholder and in a two stage procurement model the risk is shared between buyer and executor. (Jingchun, et al. 2006)

Jamieson, et al. (2005) investigates the problem that occurs when the development uses agile methodology and the supplier uses a traditional waterfall process for tendering and contracting. The authors present an agile procurement that strictly follows the agile principles. The agile model uses expert judgment for cost estimation and in each iteration of the agile development the value for money is calculated.
along with an update to the project requirements to ensure that the funds is used for the most beneficial task. The author presents that the procurement guidelines and the decision makers involved in purchasing software development projects need radical reconsideration, though taken to an extreme agile procurement would need changing in the existing budgeting protocol. Using an agile procurement and agile development would enable the procurer to revisit their original budget estimations and time planning and highlight if more resources are needed early in the development. The agile principles as a procurement method is tested in a case study at Australian Department of Defense on a ten year long IT project, although this development project does not work agile but iterative. Within the case study the procurement was conducted for every big part of the project, for small easy task a fixed price was used and for bigger more complex task a two stages procurement where used. In the two stage procurement the procurer would be able to revisit the budget and time-plan along with the development team. Using agile principles the procurer would be able to negotiate the tasks that provides the highest value for money at the time. The authors make the conclusions that an agile procurement methodology is likely to lead to more successful projects, and if procurer and executor move towards a collaboration instead of an adversarial contracting the risk and uncertainty with the project would be reduced. (Jamieson, et al. 2005)

Torrecilla-Salinas, et al. (2015) investigates a new way of planning and managing agile web development projects. The proposed model is conducted by theoretical means and tested in a real-life situation in a case study. The proposed model is a set of previously established models such as planning poker for time estimation and expert judgment for cost estimation. The cost estimation process, in more detail, uses expert judgment as a foundation and then an iterative control with a calculation of the return of investment, as an agile way of handling the cost estimation problem. The return of investment is used to answer the question “How much value does this feature bring to the organization”. In the case study the proposed model is successful and as a conclusion the authors discusses that the proposed model can be used in a more general environment and not only in web development projects, but future research is needed before this can be a recommendation. (Torrecilla-Salinas, et al. 2015)
Anderson (2004) investigates how different management techniques and procurement models suit the demands on organizations in the 21st Century, with focus on agile management. The research investigates how throughput accounting can be used to procure agile IT projects. Throughput accounting enables the project to be re-procured within a delivery window which occur in the middle of the project when the uncertainty within project is lower, according to Patterson design model see Figure 1. Where the blue area of the figure is the agile execution of the project and the “investment” part is where the procurement and investment takes place. (Anderson, 2004)

![Figure 1, Patterson design model (Anderson, 2004)](image)

The author draws the conclusion that throughput accounting provides the opportunity to make better management decisions for agile development and to use the stakeholders founds most efficiently. (Anderson, 2004)

Sirkiä and Laanti investigates how to overcome the problem with traditional cost accounting and agile execution of software projects. The authors present a case study at the research department at a global telecommunication company. The article presents an agile approach to financial planning and control where, for example, transparency is promoted within the organizational culture and task fluidity is implemented. Delivery window is introduced as a way to keep the stakeholders up to date with information and keep transparency within the organization. Transparency is ensured with the introduction of the classification “unallocated” for resources, which means that resources that is not in use within projects is classified as unallocated. This to highlight the transparency in the planning and reporting phase and instead align the plans and resources with the reality. Unallocated resources could be a measurement of the risk with delays and exceeding initial financial estimation.
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The authors also introduce the thought of flexible revenue, to not only keep the result of the project flexible, as the agile manifesto suggests, but also the cost, which in this case is referred to as revenue. The authors’ state that this could lead to the scope of the project would be more comprehensive and those lead to more revenue in the future, but to implement this kind of thinking in a company would require radical change in the demands on the business and accounting departments. The conclusions of the article is that the proposed method for agile adaption within the accounting area is proven successful by a case study at one company. (Sirikiä, Laanti, 2015)
3. Method

In this section the method used throughout this research is presented. Chapter 3.1 will present the choice of method and how it will apply to the different activities within this research. Chapter 3.2 will present alternative methods and motivation why the chosen methods were implemented. Chapter 3.3 will present how the methods are applied in each activity of this study.

3.1 Choice of Method

This research follows the method framework Design Science as described by Johanessson and Perjons (2012). Section 3.1.1 will present a description of the method, the selection of methods and theories will be presented in chapter 3.2, and in chapter 3.3 an explanation about how the method has been applied will be presented.

3.1.1 Design Science

Design Science is not a research strategy but a holistic approach to problem solving that undertakes methods for completion of research. Design Science offers a framework of activities that supports structuring and quality insurance for research performance. There are six steps within the Design Science method which are presented in the following section. (Johannesson, Perjons, 2012)

Explicate Problem

The goal with explicate the problem is to investigate and analyze the problem. It is of importance that the problem is not of local practice but of a general interest. In this step the underlying causes of the problem can be highlighted to perform a more thorough problem analysis. To explicate the problem three sub-steps are applied. (Johannesson, Perjons, 2012)

1. Define Precisely – The problem should be precisely defined so different individuals interpreters the problem in the same way.
2. Motivate Problem - There is of importance to motivate the problem so different stakeholder can agree that the problem is worth solving.
3. Find Root Causes – This sub-step is important though the causes of the problem can be solved instead of solving or treat the symptoms of the problem. (Johannesson, Perjons, 2012)
An Agile Procurement Model that Facilitates Agile Execution of Projects – A Case Study at Telia Company
Fredrik Sivander

The research strategies that suits this sub-step of Design Science according to the authors is surveys, case studies, action research, grounded theory and ethnography. (Johannesson, Perjons, 2012)

Outline Artefact and Define Requirements
The goal with this step is to define requirements and outline an artefact that can be a solution to the, now well defined, problem. This can be seen as an extended problem explication using a rather different approach, which is to look at the problem from a solving point of view. In this step requirements functional requirements that addresses the stakeholders’ needs and wants. This sub-step of Design Science requires that the stakeholders’ interest and view of the problem is precisely defined. There are two sub-steps that will guide the researcher through the outline artefact and define requirements step, which will be describe below. (Johannesson, Perjons, 2012)

1. Outline Artefact – In this sub-step the outline of the solution of the problem should be define, which includes defining if the artefact will be a model, construction, method or an instantiation.
2. Define Requirements – The requirements of the solution to the problem depends to a great extent to the problem, the technological opportunities and amount of previous research within the area of field. Therefore this area should be considered in the requirement generation process. (Johannesson, Perjons, 2012)

Johanesson and Perjons (2012) gives the recommendation that case studies, action research and theoretical analysis is research methods that are useful when this section is executed.

Design and Develop Artefact
The goal with this step is to create an artefact that solves the explicated problem at the same time as fulfils requirements resulted from the outline artefact and define requirements step. The artefact design should include a design of both the construction and the functionality of the artefact. This step has also been divided into two sup-steps. (Johannesson, Perjons, 2012)

1. Generate – To generate useful design solution to an explicated problem practice based solution generation approaches can be applied. For example empathetic thinking, where the researcher sees the problem and solution from different stakeholders point of view. Other activities like brainstorming can be helpful.
2. Search and Select – The first design decision is made upon the result of the previous, the research does further design decision, made with the requirements of the solution in mind. Convergent and divergent thinking should here be applied where the former aims to decide between existing alternatives and the latter to create new alternatives. (Johannesson, Perjons, 2012)

Demonstrate Artefact
The goal with this sub-step of Design Science is to demonstrate the use of the artefact. This is performed via a case study where knowledge about why the artefact works will be produced. This will be produced in the same time as proof that the artefact actually can solve the explicated problem will be generated. A demonstration of the artefact and the proof that it works will help to communicate the idea of the artefact in a convincing way. This can be performed in a fictional case developed by the researcher but a real life situation of the problem in its nature is to prefer. It is of importance to justify the choice of case and to describe to what extent the artefact is tested. (Johannesson, Perjons, 2012)

Evaluate Artefact
Evaluate artefact aims to produce knowledge about how well the generated artefact can solve the explicated problem. The result of the evaluation depends of the evaluation strategy that is used. There are mainly two strategies; ex ante and ex post evaluation. The former is a strategy where the artefact is under evaluation without being applied in a case, and the latter is used if there exists an opportunity to test the artefact. An ex ante evaluation is performed by letting experts within the research field share their thoughts about the artefact, in some cases ex ante can provide reliable result but in other, for example if usability is consider, ex ante provides speculative and unreliable result. An ex post evaluation can use the result of a case study as an evaluation, but sometimes if the artefact is deployed within an organization there can arise difficulties about how much the artefact contributed to the result and what was the result of other organizational factors. The research methods that suits this step is experiments, case studies, ethnography and theoretical analysis. (Johannesson, Perjons, 2012)
Communicate Artefact
The result of the research often needs to be communicated to different audience, to researcher, practitioner and sometimes a general public. It is of importance that in all cases describe the knowledge base and its relationship to the generated result along with the choice of method and research strategies and a discussion of validity and reliability. The researcher should focus on different section depending on the audience, if the audience mainly contains of engineers the researcher should focus on the problem and the construction of the artefact. If the audience mainly contains of managers the knowledge base, usability and effects of the artefact should be in focus. (Johannesson, Perjons, 2012)

3.1.2 Literature Review
When a literature review is conducted is there of great importance to follow guidelines from a model or method to ensure the validity of the outcome from the literature review. Therefor different literature review techniques are considered and presented in the following section.

Coopers Taxonomy
The first literature review technique that is considered is Coopers Taxonomy original written by Cooper but in this case presented by Randolph (2009). Coopers Taxonomy divides the review into five parts where information from the literature is examined individually. The five steps are focus, goal, perspective, coverage and audience which will be further described in the following section. (Randolph, 2009)

Focus – The first step is to identify the focus of the research. The result from this step has four different possible outcomes; research outcomes, research methods, theories or practices or applications. The most common is research outcomes, where the need for further investigation easily can be identified. (Randolph, 2009)

Goal – The research can have different goals and it is therefore of importance for the reviewer to be aware of goal with the research. A research often have multiple goals and the literature reviews goal is to identify weakness with the research and thereby propose a solution. (Randolph, 2009)

Perspective – The perspective of the result from the research or literature review often depends on what method is used to generate result. If qualitative study is conducted the author usually presents their preexisting preferences or thoughts of the result. If a quantitative research approach is used the author tend to present their result neutral as facts. (Randolph, 2009)
Coverage – Cooper present four different methods for how to select the coverage of the literature research. Exhaustive review is to include every available piece of research, even unpublished, this tend to take too much effort to execute. Exhaustive review with selective citation is when the reviewer select only one form of publication, for example only journals and not conference articles. Representative sample is when the researcher investigates an entire set of a sample of the research area, this method requires a demonstration of why the sample is of relevance. The last coverage methods is purposive sample where only the central articles within the field is examined, the researcher should convince the audience why the specific articles are of relevance. (Randolph, 2009)

Organization – A common way to organize the literature review is methodologically, that is to follow the structure of the reviewed literature. The result of the literature can be reviewed separately depending on the focus of the research and goal with the review. (Randolph, 2009)

Audience – The audience of the research where the literature is a fragment of should be the focus of the literature review as well. If the research is a dissertation the supervisor and dissertation reviewer are the main target. The review should not be written to general and non-academic. (Randolph, 2009)

Coopers Five Steps
Cooper. H presents a five step model for conducting a literature review to ensure that all relevant information from the reviews literature is collected. These steps are problem formulation, data collection, data evaluation, analysis and interpretation and public presentation. (Cooper, 1982)

Problem formulation – The first step is to formulate a criteria that will guide the researcher through the selection of relative literature. The criteria should be formulated in such way that different individuals interpreters the criteria in the same way. (Cooper, 1982)

Data collection – The second step is to create a strategy for how the data should be collected. The strategy should be transparence described so that the data collection can be performed by a different researcher and the outcome will be the same. The collected date should be divided into relevant and irrelevant literature, it is of importance that this step is thoroughly described so that different individuals interpreters the selection in the same way. (Cooper, 1982)
Data evaluation – The third step is to extract and evaluate data from the relevant literature. The execution of this step should be thoroughly described so that a different research can perform the same evaluation and generate the same result. (Cooper, 1982)

Analysis and interpretation – The aim with the fourth step is to analyze the data according to the guide conducted the problem formulation activity. (Cooper, 1982)

Public presentation – The last step aims to select which data to include in the review, this should be well motivated to ensure the quality of the literature review. (Cooper, 1982)

### 3.1.3 Empirical Review

Researches only have value if it in some way contributes to improve the human condition, and one way to ensure this is by conduct an empirical review (Thiel, 2014). An empirical review can be executed by either conduct quantitative surveys or by qualitative interviews or observations. A quantitative survey is used when a large audience is investigated and the expected outcome of a quantitative survey is numerical (Gunter, 2002). A qualitative empirical review is used when a smaller audience is investigated and the outcome of the review is specific thoughts and opinions on a specified area (Jensen, 2002).

The data generation of a qualitative empirical review can be executed in three ways, structured, semi-structured and unstructured. A structured approach generates opinions from a specific question that the respondent is answering. A semi-structured approach uses subjects with some questions for guidance to generate a broader result. Unstructured interviews uses a topic which the respondent gets to talk freely around. Observations are a complement to interviews where the reviewer observes either when something is executed or the general atmosphere of a situation. Observations can be documented either by recordings or by field notes. The generated data of a qualitative empirical review is often rich, Creswell (2003) proposes a six step method for analyzing data from a qualitative empirical investigation. (Creswell, 2003)

1. Organize and prepare – Sort the generated data into different categories depending on the sources of information.
2. Read through the data – Generate a general overview of the data, note the general impressions from the overall audience.
3. Detailed analysis – Divide data into smaller parts and define the specific purpose or opinions from that part.
4. Connect – Connect the different parts with the type of audience that produced them.
5. Discuss – Describe how the result will be represented and used within the research, this can be done by visualizations or tables or textual.
6. Meaning of data – Generate a conclusion from the result, this can be done by answer the question “What are the lessons learned”. (Creswell, 2003)

3.1.4 Case study

The goal of a case study is to gain information about a specific area in a real life situation. A case study research should be described along with the possible exploration and understandings that might be generated. A researcher that preforms a case study should be concerned about the research ethics, the researches own believes and the different sources. This can be performed by either claim that the case study is postmodern, all the result is generated from interviews, or provide an exhaustive motivation of the case study and its components. (Cousin, 2005)

There are three main categories within a case study, these are intrinsic case study, instrumental case study and collective case study. (Stake, 1995)

1. Intrinsic case study – The focus in an intrinsic case study is aimed at the case itself, this is often used in the purpose of an evaluation of a set of activities or experience.
2. Instrumental case study – The aim with an instrumental case study is to generate understanding about an issue or problem within a specific area. The local effects of the case study needs to be examined to ensure the validity of the research.
3. Collective case study – The goal with a collective case study is for the researcher to perform the research on more than one case. This is executed to broaden research to a more generalized level and overcome some local phenomenon that can alter the validity of the result from the case study. (Stake, 1995)
3.2 Motivations and Alternative Methods

This research followed the research method Design Science as described by Johannesson and Perjons (2012). The first five steps within the Design Science is executed by following research methods, which are summarized in table 1.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Approach</th>
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<tbody>
<tr>
<td>Explicate Problem</td>
<td>Literature review</td>
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<tr>
<td>Outline Artefact and Define Requirements</td>
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Explicate Problem
When the problem was explicated a literature review was applied. A different approach would been to perform a qualitative empirical study to identify the need for change. Johannesson and Perjons (2012) states that previous research needs to be examined to identify how different researcher has approach the problem and what current solutions are available. A qualitative empirical approach requires the researcher to examine the relevant stakeholders to the problem to ensure that the problem is well explicated (Johannesson, Perjons, 2012).

Outline artefact and Define Requirements
A literature review along with an empirical review was used as approach in this stage. The literature study was used to gain information about current approaches to the problem and the empirical investigation to extract information about practical obstacles. Johannesson and Perjons (2012) states that a researcher usually needs to investigate relevant stakeholders to gain better understanding about the problem along with a broader view of the literature research.
Design and Develop Artefact
The approach used in this stage was a literature review along with an empirical review. Johannesson and Perjons (2012) states that if the artefact is of a complex technical sort an empirical investigation usually does not lead to relevant input to the design of the artefact. The relevant methods to conduct is literature review and empirical investigation. This research generates an artefact which are not of a technical sort and therefore are both method implemented to conduct data relevant for design and development of the artefact.

Demonstrate and Evaluate Artefact
The approach conducted to demonstrate and evaluate the artefact is an ex post evaluation. A case study, with an empirical review as foundation for testing, was executed to test how the artefact preformed in a real life situation. Empirical reviews provides rich and relevant data for testing and are considered as a valid approach for measurement of differences between constructs (Schwab, 1980). The other possible evaluation method that could be applied was an ex ante approach. As stated by Johannesson and Perjons (2012), of the two evaluation approaches ex ante is the weaker one and should be consider if there is no possibility of a case study or if the artefact is not ready for a real life situation. Another approach than empirical testing could been used, to fully implement the artefact. This would generate the result that the artefact can or can not operate in a real life situation, but this approach do not support comparison. Previous research has successfully implemented their solutions for agile procurement as a test, this research aims to reduce cost and time spent on procurement, which requires comparison between current construct within the case study and the artefact, and therefore are the empirical test implemented.

3.2.1 Similar Studies
Two relative similar studies has been conducted by Jamieson et al. (2006) and Sirkiä and Laanti (2015). Jamieson et al. (2006) adapted the agile principles in their procurement method for a ten year long software development project. Sirkiä and Laanti (2015) adapted the agile principles into the accounting process and proposed transparency and delivery windows. Both of these studies uses a case study to evaluate how the agile principles can be used in other departments than development, and both studies draws the same conclusion; that the traditional procurement method should not be used on agile projects. The case studies has been generating valid result for both previous researches.
3.3 Application of Method

The design science method provides five activities and the approach taken in this research for the first three steps, explicate problem, outline artefact and define requirements and design and develop artefact, was a literature review. The latter two was combined with an empirical investigation to also cover relevant stakeholders’ opinions. For the literature review Cooper’s taxonomy and Coopers five steps was applied to ensure the quality of the literature review. The last two steps of the design science method, demonstrate artefact and evaluate artefact, was approached with a case study to test how the artefact performs in a real life situation. The demonstrate and evaluate artefact was combined with an empirical review to gain data to the empirical test for comparison between the artefact and the current construct within the company which participates in the case study.

3.3.1 Literature Reviews: Cooper´s Taxonomy

The literature review was applied according to the six characters of Cooper’s taxonomy as described in chapter 3.1.2. The first three steps of the Design science method, Explicate problem, Outline artefact and define requirements and Design and develop artefact, was approached with a literature review where the four last steps of Cooper’s taxonomy, perspective, coverage, organized and audience were general over the entire literature review. The perspective taken was non-neutral. The selection of researches were made to support the reviewer’s research, for example was agile and traditional procurement and execution investigated but not e-procurement because it addresses another research area. This made the coverage of the literature review a representative sample of the existing literature. The literature was organized methodologically, the literature was reviewed according to the outline of the research. The audience of the review was primary the reviewer along with their supervisor and academics focusing on the field of the agile manifesto and project procurement.

In the activity Explicate problem the focus was on previous research that was addressing a resembling problem or solution to the same problem. General researches about procurement and the agile principles and the problematic issue that occurs was gained in this step. The goal with the literature review in the Explicate problem stage was to gain knowledge within the specific field and investigate current methods and how they perform to enable the research question for this study to be generated uniquely and address the right problematic issue.
In the activity Outline artefact and define requirements the focus with the literature review was to identify the procurement methods that were used to address the defined problem within the collected previous research. The goal was to identify the strengths and weaknesses of the existing methods to be able to develop a relevant and unique artefact.

In the activity Design and develop artefact the focus was previous research and their approaches to address the problem. Including the methods and problem statement described by the authors of the previous research. The goal with applying a literature review in this step was to identify the methods and implementations to strengthen the development of the artefact and ensure quality through the development.

3.3.2 Literature Reviews: Cooper’s Five Steps

Cooper’s five steps were applied to the review of the literature, the five steps are problem formulation, data collection, data evaluation, analysis and interpretation and public presentation. A description of the steps and how Cooper suggest to approach the literature review can be found in chapter 3.1.2.

Problem Formulation

This activity resulted in the questions that guided the reviewer through the literature to generate relevant result. The generated questions were formulated as followed.

- What is the problematic issue with traditional project procurement?
- What is the problematic issue with traditional project accounting?
- In which fields do the problematic issue occur?
- How is an agile execution of projects affected by the problematic issue?
- How can the agile principles collaborate within a traditional organization?

To sort the relevant literature from the irrelevant a set of conditions was generated. The literature had to be able to fulfill at least one of these generated conditions;

- The literature had to contain information about project procurement.
- The literature had to contain information about the agile manifesto.
- The literature had to contain information about project accounting.
- The literature had to contain approaches to the procurement problematic issue.
- The literature had to contain a case study where procurement methods where tested on agile projects.
- The literature had to contain a case study where accounting methods where tested on agile projects.
Data Collection
The data was collected with searching in the Google Scholar Search engine and Mid Sweden University’s search function Primo. Phrases was used to gain search result, for example “agile procurement”, “procurement for agile projects”, “traditional procurement”, “agile accounting” and “agile cost estimation”. Other words was added to the phrases to find more relevant answers, for example “… case study” and “… literature review”. The data collection resulted in 25 relevant literatures where further research was made by following the references from the relevant literature.

Data Evaluation
To evaluate the collected data a literature map was conducted to identify relations and similarities between the collected literatures, which are visually presented by the arrows in Figure 2. The literature was divided into three main categories, procurement, the cost estimation problem and agile execution of projects. In Figure 2 the literature map of the procurement category is presented, the literature map of the cost estimation problem and the agile execution, along with the corresponding references, can be found in appendix A.

Figure 2, The literature map of the procurement category
Analysis and Interpretation, and Public Presentation
With the fourth and fifth step of Cooper’s five step model the generated information from the literature was extracted and implemented in the literature review.

3.3.3 Empirical Review
An empirical review as described by Creswell (2003) was conducted to identify practical obstacles, see chapter 3.1.3. This was executed in the outline artefact and define requirements and design and develop activity within the Design science method.

The relevant approach to an empirical review in this research is qualitative interviews and observations because the expected outcome of the empirical review is specific thoughts from experts on a specified area. The qualitative empirical review used observations and unstructured interviews. The respondents were thoroughly selected to gain insight from different point of views, for example economical, technical and from a manager’s point of view. The reason that unstructured interviews were conducted was to get the respondent to deliver complete information that refers to the respondents’ specific area and not delimitate the respondent with specific questions. The qualitative empirical review was started with a presentation of the problematic issue and the artefact to keep the delivered information relevant. The information from the unstructured interviews were obtained by field notes. Observations were also conducted where the reviewer attended everyday meetings as well as occasional meetings to gain information about the overall atmosphere and how different departments acting towards each other. The information from the observations was obtained through field notes. The analysis of the empirical review followed the six step method presented by Creswell (2013). In the first step the data was categorized depending on the source of respondent. In the third step the data was divided into the topics procurement, accounting, agile execution. In step four the dependencies between the topic categories and respondent categories was identified. The analyze of the collected data will be presented in a textual form in which the meaning of the data will be presented.

In the step outline artefact and define requirements of the Design science method the goal with the empirical review was to identify major obstacles which could counteract the result generated from the literature reviews. In the step design and develop artefact of the Design science method the goal was to generate practical solutions to the possible issues with the draft of the artefact.
In the step evaluate artefact an empirical review was conducted within the case study with the goal to collect data from different stakeholders and compare the artefact with the previous used construct. Empirical review as a testing approach provides powerful data about confirming or disconfirming theories or hypothesis (McCutcheon, Meredith, 1993). Flynn et al. (1990) states that an empirical test can be used to demonstrate and evaluate linkage and measure differences between approaches to a problem. The data obtained by the empirical review within the demonstrate and evaluate artefact step was documented by field notes and consisted of unstructured interviews and observations. The respondents within the empirical test was the project managers and the members of the project execution team. The focus within the empirical review for testing was to investigate the linkage and measure differences between the artefact and the previous construct used by the company which the case study takes place. The empirical review will generate data about how and when differences rises and measure the different outcome of the artefact if it would been used instead. McCutcheon and Meredith (1993) states that the validity of the outcome of an empirical test is depending on how well the artefact correspond with the reality and the relevance of the respondents of the empirical test.

3.3.4 Design and Develop the Artefact

The activity design and develop the artefact was executed by a combination of generate and search and select, se chapter 3.1.1. The requirements for this activity was generated from the literature- and empirical reviews. Empathetic thinking was applied in the generate phase where the artefact was restructured to fit every interacting stakeholder as good as possible. Search and select was applied to this draft where divergent thinking was used to generate new solutions. This process was executed iterative to ensure the quality of the artefact.

3.3.5 Demonstrate and Evaluate the Artefact

The approach of the demonstrate artefact and the evaluate artefact stage of the Design science method was an intrinsic case study as described by Stake (1995), se chapter 3.1.4. The foundation of the case study is an empirical test. The focus of this activity is to generate information about how well the artefact preform in a real life situation. This was compared to a traditional way to procure for agile projects and the comparison included budget, the amount of time to produce result and the scope of the result. The test factors was identified in the literature and empirical review conducted in the outline artefact and define requirements step and will be presented in chapter 4.1.1.
3.3.6 Ethical Consideration

In this chapter the ethical consideration, including reproducibility, reliability and validity will be presented. The ethical consideration will be divided into the category which the different research ethics applies. First the ethical consideration within the literature review will be presented, then within the empirical investigation and lastly the ethical consideration within the case study.

Literature Review

To ensure that relevant literature is selected other individuals needs to verify the selection, according to Randolph (2009). The literature in this research did not contain this step and includes instead a description of the selection and selection criteria in such way that another researcher should be able to address the same research area and select the same literature and articles. This research has followed Cooper’s Taxonomy and Cooper’s five steps, as described in chapter 3.3.1 and 3.3.2 to ensure that the literature is executed with focus on reproducibility and validity.

Empirical investigation

The qualitative empirical investigation has been following the research ethics within empirical reviews as described by Patel and Davidsson (2011). The research ethics within empirical reviews are divided into four requirements.

1. The informational requirement – The respondent must be informed about the purpose with the study, survey or interview.
2. The consent requirement – The respondent have the freedom to choose his or her level of participation.
3. The confidentiality requirement – Information about the respondent must be handled with highest possible level of confidentiality.
4. The usage requirement – Information given from the respondent may only be used in scientific purposes. (Patel, Davidsson, 2011)

The respondents within the qualitative empirical investigation has been chosen to be anonymous to keep their integrity and not reveal any personal information about the respondent or the respondents department within the organization.
Case study
According to Cousin (2005) a case study needs ethical consideration when it comes to the researchers own beliefs and the selected organization. In this research the case study is used to test a solution to a problem that exist within the organization. The selection process of organization focused on the fact that the addressed problematic issue within the research existed within the organization. Cousin (2005) mentions that the researches own beliefs should be put aside when the case study is executed. The researcher addressed the selected organization in a neutral way and did not included his own beliefs while the case study was executed. To increase the reliability and validity of the case study more organization should be included, this was not applied in this thesis but given as a suggestion in future development, see chapter 6.1.
4. Result

In this section the generated result from this research will be presented. In chapter 4.1 the requirements and test factors for the artefact will be presented. In chapter 4.2 the context in which the artefact is operational within and the assumptions made will be presented. In chapter 4.3 methods within the activities of the artefact is presented along with a motivation of the selection. Chapter 4.4 presents the design of the artefact and its components. Chapter 4.5 will present the demonstration and evaluation of the artefact, along with what is tested along with the test factors and the result from the tests.

4.1 Requirements

To ensure that the generated artefact address the specified problem and contain all relevant aspects a set of requirements are implemented. The requirements are;

1. The solution should benefit both procurer and executer.
2. The solution should use the agile principles to reduce procurement cost.
3. The solution should reduce the total cost of procurement and execution.
4. The solution should strengthen the cooperation between procurer and executer.
5. The solution should enable a philosophy where changes within budget and time-plan are accepted at any time.

4.1.1 Test Factors

To ensure that the requirements are fulfilled a set of test factors are developed. The test factors are generated under the outline artefact and define requirements step and are based on literature and empirical reviews. The test factors therefore reflect both the parameters previous research values along with what the crowd of the specified area values. The test factors are;

1. Money spent on procurement.
2. Time to execute procurement.
3. Money spent on execution.
4. Time spent on execution.
5. Amount of workload in the end of the project.
4.2 Context and Assumptions

The artefact is addressing the procurement situation that are described in section 1.1, that an internal idea is considered within the decision making process if it should be develop or not. The artefact also addresses the execution of the idea, the assumption is made that the project is executed according to the agile manifesto. The empirical test reviled that the cost within a project can be seen as linear to the time. This means that the cost of a project would reduce or increase at the same phase as the time period would extend or decrease.

The artefact requires the assumption that the departments within an organization is striving towards the same goal. Usually organizations are stating that they striving towards higher customer satisfaction, or something similar, within all departments of the organization. That might not be the complete truth, some departments, for example accounting, might have the goal to decrease cost that contradicts with the rest of the organization. The artefact requires the assumption that the organization is transparent between departments within the organization and that departments are willing to share insight and knowledge with each other.

4.2 Method Selection

In this section a presentation about the methods that are implemented in the core activities within the artefact. The method used for the requirements prioritization, cost estimation and time estimation is presented in that order in chapter 4.2.1-4.2.3.

4.2.1 Requirements Prioritization

The method that will be applied in the area of requirement prioritization is the MoSCoW estimation model. The model will be applied because it is time efficient and provides an easy to use result. Chapter 4.3 Artefact Design will describe how this method will be applied and combined to ensure that the requirements of the model will be fulfilled.
4.2.2 Cost Estimation

According to Jørgensen and Shepperd (2007) who performed a review on 304 academic papers about software cost estimation, the main cost estimation methods for software development is identified regression, function point, expert judgment and theory based. This artefact aims to agile projects overall and not only agile software development which makes the logical selection expert judgment, as described in chapter 2.2. If this models audience would be software development projects only then function points would be considered instead.

4.2.3 Time Estimation

The method that will be used for time estimation is Blitz Planning. This method is suitable because it includes both procurer and executer and therefor will strengthen the cooperation between the included parties. The time required to perform this method depends on the amount of activities that should be considered. According to Cockburn (2004) the appropriate amount of activities, for a full time project, is over a three month period. Since this model will create a philosophy that welcomes changes in the budget and time-plan the activities used in this method will be the must have requirements from the MoSCoW prioritization model and therefor suits Blitz Planning the artefact, further explanation will be presented in chapter 4.3 Artefact Design.

4.3 Artefact Design

The artefact is generated from information obtained from theories and previous research along with an empirical investigation. Sixteen respondents from different departments within a traditional organization were included in the empirical review to obtain information about practical obstacles within procurement of project and project execution.

The generated artefact is divided into two phases. The first phase is conducted before the execution of the project begins and includes both procurement and the pre-study of the project. The second phase is the agile execution of the project. The model is visual presented with Pattersson time uncertainty model described by Anderson (2004), see Figure 3. In Figure 3 the blue section represent the procurement and budgeting and the yellow section represent the agile execution of the project, in the tip of the triangle to the right the project is finalized.
Phase 1
The focus in this step is to minimize time and cost within the procurement and pre-study of the project. The activities in phase one is presented in Figure 4.
As presented in Figure 4 the initial activity is to execute MoSCoW prioritizing on the requirements or user stories. The result from this activity will be divided and prioritized requirements or user stories, from this result the should have, could have and will not have requirements will directly move on to phase 2. The must have requirements or user stories are then treated in the activities Expert judgment and Blitz planning. Within the Expert judgment activity the cost of developing the must have requirements or user stories are roughly estimated by someone who has relevant experience within the field. The Blitz planning activity will undertake the must have requirements or user stories and create a rough time estimation along with dependencies recognition and sprint development, see chapter 2.2.3 for a thorough explanation of Blitz planning. The rough cost and time estimation will be a guideline for what to expect of the time and cost of development the core of the product or service.
Phase 2
In phase 2 the focus is on development of the project result. Figure 5 present the activities within this phase, the abbreviations SH, CH, WH and MH stands for should have, could have, will not have and must have requirements or user stories. The triangular shapes represent an “if” scenario where the rectangular shape is the response if the statement is true, the arrow within the if statement is describing a transformation.

As presented in Figure 5 the requirements or the user stories that are not set as must have are being revisit along with the execution of the project. If some of the should have, could have or will not have or new requirements are considered to implement in the development of the project result this will be meet by an increase in time or budget. This will be under the control of a Project controller which will be a representative from the procurement team. The Project controller will have mandate to increase time or cost, within limits that the project controller negotiate with the procurement team, and will negotiate additional time or budget if changes to the project scope occur. The uncertainty of the cost and time to produce the project result will at this point be lower than if it was procured in the start of the project,
Figure 3. In the case of the arising of information that makes the project result unusable the project should be shut down immediately to save resources and minimize loss. When the execution of the project is based on only the must have requirements the philosophy that changes in the project scope, time and cost is expected from both procurer and executor is created. Both parts knows that more requirements or user stories will arise under the development of the project and that some of the should have requirements or user stories will transformed to must have. One of the agile principles states that changes are always welcomed, if the change is met with changes in time-plan or budget the likelihood that that change are accepted increases. If the project has a launch date, where the project result is delivered to the public, the extension of time to develop the project result if more requirements are needed will be challenged. The budget can be increased to solve this issue but it might not be desirable in all situations. Therefor suggests the artefact to implement a delivery window in this case. A delivery window will be an opportunity for the project to partially deliver the project result, the part of the result that can be used by an end user, to the public and then continue with the development of the project. When the project result is finalized it will be delivered to the public in a second, complete, version.

4.4 Artefact Demonstration and Evaluation – Case Study

In this section the demonstration and evaluation of the artefact is presented. The organization which the case study takes place in is described in chapter 4.4.1. The environment of the test along with the test factors is presented in chapter 4.4.2 and the result from the tests is presented in chapter 4.4.3.

4.4.1 Organization Description

The organization which participated in the case study was Telia Company. Telia Company is a worldwide telecommunication organization which provides numerous services within the field. Telia Company’s goal is to bring people together with easy communication and develop the new generation telecom to generate innovated communication solutions. Telia Company is currently going through a phase where the fundamental characteristics within the company are changing. Telia Company is going from a traditional waterfall organization to an agile organization. This is executed with a project called TGA (Telia goes agile) and the company has started to execute projects according to the agile manifesto, not only within the IT department but within other departments as well. When it comes to the procurement process for projects the company currently still uses traditional waterfall methods which is visually presented in Figure 5, where Dp is an abbreviation for “Decision point”.

The input in this procurement model is an idea which through the step Dp1 and Dp2 is developed to a full requirement specification with specification about every activity, estimated cost, time to execute and expected result. After Dp2 is finalized the result is presented to the management team which considers if the project should be executed or not. If the management team is approving the project the proposed budget is transferred to the project team and the execution of the project can start, which are represented by the steps Dp3-Dp6. Then it is up to the project leader to manage the execution to the project in an agile way. If there are changes in the project scope which will exceed 400,000 SEK the changes needs to be presented and approved by the management team. If the change request is not approved the change is deferred to the end of the project and if there exist an appropriate amount of changes and requirements that did not get executed within the project another project is developed. This means one more procurement phase is executed on the same idea only with extended scope, which happens around 50-70% of the cases. The cost for procurement and the pre-study phase is between 6-46% of the total cost of procurement, pre-study and execution. There is some problems with the procurement method and how the cost estimation process is executed. The yearly budget is divided on different departments and is not that thoroughly calculated. When a project is under consideration if it fits the yearly budget and the project overlaps different department confusion and conflicts arises about which department the cost should apply to.

4.4.2 Test Environment

To be able to fulfill the requirements set in section 4.1.1 a test was conducted at Telia Company on two projects. The first projects aimed to develop or redefine value added services for the organization and was executed by an agile team but without a traditional pre-study. The second project was a traditional project with a traditional waterfall procurement method.
Project 1
The first project was a small project that was, according to Telia Company not defined as a project but instead a task assignment. When a task assignment is executed within Telia Company a small pre-study is conducted that includes a rough budget estimation, time plan and a small proof of concept or prototype. The project had four months as a time plan and aimed to provide a better user experience within customer use of mobile data. The rough cost estimation made in the pre-study was 500 000 SEK and the actual cost was 1 020 000 SEK. Within the project execution a walkout threat raised from the customer service department which threatened the time plan of the project and some implementation was delayed three weeks. In the end phase of the project the agile manifesto was not followed and instead an ad-hoc approach was implemented, this occurred because the workload was overflowing and more resources was need. This made the end phase of the execution stressful and panicky. The project result was delivered to the public on time but some of the result was implemented at a later point because the walkout threat, but the project scope were finalized according to time plan. The project leader of the Project 1 states that the amount of result is fairly small compared to the amount of money invested, and about half of the actual cost would have been more reasonable. The result from the test is presented in chapter 4.4.3.

Project 2
The second test was on a large traditional project that used the waterfall procurement, as described in chapter 4.4.1, and executed the project according to the plan generated in the procurement method. The project was aimed to develop a new technical solution to an existing product to increase the customer value. The pre-study was conducted over a six month period and the executional phase over a two year period. The initial time estimation was that the execution of project would take eleven month but this was prolong mainly because the finding that the current technical platform was not compatible with the developed solution so a new technical platform was developed and also because stricter laws within the area were applied. The project leader of this project states that information about incompatibility between the solution and technical platform should have been discovered within the pre-study. The environment of the project execution was not stressful but frustrating because the stress was within the external development team. The relationship between the external development team and the internal project team was not optimal, the relationship was toxic because previous cooperation. The project leader states that an agile approach to the problematic issue within this project would been to prefer. The test was applied after the project result was finished because the size of the project exceeds the length of this thesis.
Test Factors
Test factor was implemented to enable comparison between the outcomes of different procurement models. The test factors are relevant to be able to ensure that requirement 2 and 3, see chapter 4.1, on the artefact are fulfilled. The other requirements are analyzed in chapter 5.2.

1. Money spent on pre-study, phase 1, pre Dp2.
2. Time to execute pre-study, phase 1, pre Dp2.
4. Time spent on execution, phase 2, Dp2-Dp6.
5. Amount of workload in the end of the project.

4.4.3 Test Result

Project 1
The small agile project that was executed by an agile team which used a pre-study similar to the generated artefacts activities within phase 1 and not the traditional waterfall procurement and the first two test factor was therefore not applied to this test. The estimated cost for the project was 500 000 SEK and the actual cost were 1 020 000 SEK, the increase in cost occurred because the workload rapidly increased in the end of the project and more resources was applied. The empirical test resulted in the use of a delivery window would been implemented. The delivery window would remove the need of extended resources in the end of the project with a prolong release date. The prolonged release date would enable the same project team, without additional resources, to complete the project result in approximately two weeks. The project manager states that a reasonable cost would have been half of the actual cost if not any extended resources would been applied to complete the result on time. The empirical test resulted in that the agile principles was not used in the end of the project and the executional team did what needed to be done to complete the project on time, which entailed a very stressful environment in the end of the project. The empirical test resulted in that a delivery window would have reduced the stress within the end of the project, with the prolonged release date. The generated artefact would extend the time plan with about two weeks, because the use of a delivery window, and therefore the budget as well with about 63 000 SEK. The extended cost is calculated with the time it would take to complete the project result times the cost of having them executed with the current team size. After the extension a second, complete, version of the result would be delivered. In table 2 the test factors result is presented.
Table 2, Test factors result in Project 1.

<table>
<thead>
<tr>
<th>Test factor</th>
<th>Current</th>
<th>Artefact</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 020 000 SEK</td>
<td>563 000 SEK</td>
</tr>
<tr>
<td>4</td>
<td>4 months</td>
<td>4.5 months</td>
</tr>
<tr>
<td>5</td>
<td>Stressful, panicky</td>
<td>High tempo, without stress</td>
</tr>
</tbody>
</table>

The empirical test resulted in that using the generated artefact the environment would be less stressful. The time plan would be extended with about 12% and the project would save about 45% of the total cost.

Project 2

The pre-study within Project 2 was executed under a six month period, the pre-study resulted in a thorough budget and requirement specification that contained 177 requirements. The requirements was divided according to the MoSCoW method. The cost of the pre-study was 1 400 000 SEK. The empirical test resulted in that the time and cost of the pre-study, or phase 1, using the artefact would have been one and a half month and 350 000 SEK. The time to execute is calculated with the time it would take for the same project team to complete the MoSCoW prioritizing and perform a rough time and cost estimation on the must have requirements. In the executional phase a large issue raised that the technical platform which the project result should be implemented on was not compatible. The cost of developing new technical platform was 1 300 000 SEK and prolonged the project with 10 months. The execution of the project took two years but was in the pre-study estimated to take eleven months which makes the initial time estimation almost non value added. The cost of the project execution was 12 100 000 SEK where 8 750 000 SEK was the cost of external development of software. The empirical test resulted in that using the artefact the estimated time to execute project is 14 and a half month, calculated with the time it would take to perform phase 1, external development, development of new technical platform (including decision process) and internal deliver of the project result. The cost for the project execution phase using the artefact would be 10 760 000 SEK. This cost is calculated by removing the external cost for development and divide the remaining cost of internal resources by the initial time it took to execute the project and then multiply with the time it would take to execute the project using the artefact, according to the linear assumption presented in chapter 4.2. The stress and amount of workload within this project was not a problem for the internal execution of the project but to the external development of software and therefore not considered in this test. Table 3 will present the answers to the test factors.
Table 3, Test factor result from Project 2

<table>
<thead>
<tr>
<th>Test factor</th>
<th>Current</th>
<th>Artefact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 400 000 SEK</td>
<td>350 000 SEK</td>
</tr>
<tr>
<td>2</td>
<td>6 months</td>
<td>1,5 months</td>
</tr>
<tr>
<td>3</td>
<td>12 100 000 SEK</td>
<td>10 760 000 SEK</td>
</tr>
<tr>
<td>4</td>
<td>24 months</td>
<td>14,4 months</td>
</tr>
<tr>
<td>5</td>
<td>No stress</td>
<td>No stress</td>
</tr>
</tbody>
</table>

Using the generated artefact would have saved 21% of the total cost of the project and the time it took to generate the project result would have been reduced with 40%.
5. Analysis

An analysis of the result will be presented in this chapter. In chapter 5.1 a comparison between the generated artefact and previous research will be presented. Chapter 5.2 will present an analysis of the test result and chapter 5.3 will present additional analysis of the generated artefact, for example other solution to the problematic issue within the area.

5.1 Comparison with Previous Research

The way to address the problematic issue within the area proposed by Jamieson, et al. (2006) which implements the agile principles in the procurement process, are proven helpful for the procurer but the execution of the project is not under consideration. The generated artefact uses the agile principles to facilitate for an agile execution of project to generate a better result and not only to facilitate for the procurement itself. Jamieson, et al. (2006) test their agile procurement on a ten year long project within the Australian Department of Defense which occasionally executes in an agile way which is a different test environment compared to this research but the agile principles suits the procurement process in both cases.

Jingchun, et al. (2006) proposes a two stage procurement process to enable a renegotiation in the middle of the execution of the project to be able to allocate more resources if needed. This is a way of address the problematic issue within the area but the two stage procurement process is not continues and issues may be presented to late, as presented by the authors this method aims to divide the risk between the procurer and executer (Jingchun, et al. 2006). The generated artefact address the same problem as the two step procurement method but with a continuous collaboration between the procurer and executor which will make the procurer and executor share the risk equally and the need for extended resources will be investigated continuous.

Jamieson, et al. (2005) proposes to strictly implement the agile principles into the procurement process with the aim to facilitate for the procurement process, this is done with expert judgment as cost estimation. The procurement method was tested in a ten year long agile project at the Australian Department of Defense where small parts of the project where procured with fixed price and without the ability to revisit the original cost and time estimation. Larger tasks where procured with a two stage procurement method which could be revisit once in the middle of the execution (Jamison, et al. 2005). The generated artefact uses continuous collaboration between
procure and executor which will overcome the problem that Jamieson, et al. (2005) addresses with combining one stage procurement and two stage procurement to different tasks of different seizes, and takes the collaboration between the procure and executor to a higher level.

Torrecilla-Salinas, et al. (2015) proposes a dynamic value for money approach where the return of investment is calculated along with the execution of the project. The generated artefact will, instead of reporting the progress of the execution, aim to add control for the procure with a collaboration where the procure is attending the execution of the project. This will add the same control but instead of addressing what is already executed the present and future development is under consideration. (Torrecilla-Salinas, et al. 2015)

Anderson (2004) presents throughput accounting as a solution to the address problematic issue within the area. This approach is similar to the two stage procurement method used by Jingchun, et al. (2006) and Jamieson, et al. (2005) but focus on the project accounting. The project budget is revisit under a delivery window in the middle of the project execution when the uncertainty of the project scope, time plan and budget is lower (Anderson, 2004). When a continuous collaboration is executed with the procure attending and negotiates the budget along with the project execution the uncertainty is lower for every negotiation.

Sirikiä and Laanti (2015) presents flexible revenues as a solution to the problematic issue, this is the same principle as not to cost estimate the entire scope of the project. The solution proposed by Sirikiä and Laanti (2015) is reaching the same result as the solution proposed by this research with one big difference, the initial cost estimation. Flexible revenue still requires a complete cost estimation which requires time and effort to perform, and to address this solution with a compromise with the revenue might not attract the stakeholders’ attention in a positive way. Sirikiä and Laanti (2015) present unallocated resources as a solution to keep transparency within the organization. Transparency between departments within an organization is of importance, rivalry between departments is common, for example that departments hide information which gains that department from each other if an opportunity occurs. The generated artefact is addressing this with the assumption that the organization strive towards the same goal and that the departments within the organization overcomes the rivalry between departments. Unallocated resource, as presented by Sirikiä and Laanti (2015), is suggested as an addition to the artefact for further development, se chapter 6.1.
All the previous research are aimed to software development or web development projects, the generated artefact is aimed to all types of agile execution of projects, including software and web development as well. The previous researches does not explain why this constrain was made but it should make an insufficient difference with the relevance to this research.

5.2 Test of the Artefact Analysis

The test of the artefact was a case study with an empirical review as foundation, called an empirical test. This is a valid approach to measure differences between constructs (Flynn, et al. 1990). McCutcheon and Meredith (1993) states that the internal validity within the respondents from the empirical review rarely is a problem but more likely the artefacts initial correspondent with the reality. This was ensured by conducting an empirical review, in the outline artefact and define requirements and design and develop artefact step, to identify practical obstacle and ensure that the artefact correspond to the reality within the specified area of field. The artefact addresses therefore the specified area of field well which makes the outcome of the empirical test valid. The reason that an empirical test was conducted is because the opportunity of comparison arises, the artefact can be compared with the existing constructs to identify how well it operates. Previous research has implemented their approach and can therefore only draw the conclusion that their approach works, not how well or if it is better or worse than the previous used construct at the company that was included in their case study. A reason that a comparison cannot be made if the artefact is implemented is because every project is unique and faces different obstacles. If the same project is executed twice the obstacles would already been identified the second time and therefore would the test not provide a fair result, additionally the company that is included in the case study would be highly unlikely to want to pay for the execution of a project twice. McCutcheon and Meredith (1993) also states that the validity of the empirical test depends on the relevance of the respondents, this was ensured by executing observations to identify which stakeholders are relevant to include in the interviews.
The test of the artefact was an initial test as a proof of concept with a comparison between the artefact and current procurement method at Telia Company. There are hidden costs that are not included that will favor the generated artefact. For example when a change in the project scope occurred the change needed to be analyzed and presented to the management team to accept the change or not, their time dedication and therefore indirect cost is not included within the tests. Telia Company was at the moment fairly new with the agile execution of projects which can be a factor that could alter the test result. The two projects that was used in the test was of different sort, the agile execution was used properly in Project 1 but no real pre-study was applied and Project 2 was using the traditional waterfall procurement to the letter while the execution did not follow the agile manifesto properly.

The test result was different when applied to the different types of Projects. Project 1 resulted in a large difference within the total cost of the project but a longer time-plan, because implementation of delivery window. The delivery window made the project result partially been delivered to the public on the correct lunch date, the work environment less stressful and reduced the cost of implementation, due the need for extended resources disappeared. Project 2 resulted in reduction in both total cost and time to generate project result. The cost of the project would have been even smaller if the software would have been implemented internal or if the relationship with the external developers were better. Here Supplier Relationship Management would been applied to either strengthen the relationship or to generate evidence to use another external developer.

The amount of projects within the test was the maximum amount that was performable due the time restriction of this research. More projects would produce more reliable result but this was not a possibility, the projects that were included within the tests were therefore more carefully selected to complement with testes made in previous researches. The tests within the previous research is mainly at a ten year long cooperation between procurer and executor and therefore are the tests in this research on one small, two month, project and one project of medium size, two years long.
5.3 Additional Analysis

In chapter 2.2.3 a definition of a project is presented and a solution like the generated artefact can contradict with the definition of projects, a project should have a defined beginning and end. The artefact suggests that the time plan, or budget, should be redefined if a change to the scope occurs. The artefact also have a delivery window implemented where a first version of the result can be delivered and the project extend the time plan to later deliver a final version of the project result. This contradicts with the definition of a project, how this impact the usefulness of the artefact is unknown and more testing is needed to enable a conclusion.

When the procurement and pre-study of a project is minimized large amount of money is saved, this could either be seen as a saving or as an opportunity to spend more money on a better project result. A better project result that aligns with the organizations goal, for example better customer satisfaction, will generate more value to the end user and therefore bring more organizational value.

When it comes to large companies as Telia Company the information from the project logs can be quite misleading, the statistics from the project logs are produced from only successful projects with large and small costs, when a percentage is produced from such logs the percentage might not fairly describe the size of the procurement cost. When a large project that has cost that exceeds hundreds of million SEK a 20% procurement cost is huge but for a small project with the cost of a half million SEK 20% is not overwhelming. The project logs of successful project might not be ideal to investigate out of context though many projects completes without the scope completely finished and another project is conducted as a completion, in the latter the total cost of the additional project is not included in the test. According to Jingchun et al. (2006) the procurement cost represented 50-80% of the total cost of the project, in the case Telia Company it was 6-46% when only addressing successful projects. If the failed projects were included the percentage would be more similar to Jingchun, et al. (2006) findings.
The generated artefact is not the only solution to the addressed problematic issue, within Telia Company there are departments that are adapting the agile culture and have agile teams that are working continuously towards a goal, under a six month budget estimation. The main difference with this approach is that the team is not working in projects. This will enhance the agility within the organization or department and remove the need of a procurement process. When larger tasks are under consideration within this approach a project still might need to be conducted. Another possible approach to this problematic issue is to keep the traditional framework and procurement but enable an agile execution, this through acceptance from the management team that it is acceptable to perform a procurement process or pre-study within a short time in an agile way.

If a large number of projects are procured and executed at the same time the issue that small changes in a lot of budgets can create a big impact can arise. The solution lies in the communication the Project controller has with the procurement department and the restriction set from that department. This will entail a different work environment for the procurement department where flexible budgets are matched within yearly cost estimation or budget goals. To fully commit to the an agile way of working within an organization changes in duties will occur, this changes must be handled with proper change management techniques to make an organizational transformation successful.

One area within the solution is not completely developed, how to perform a contracting process with an external consultant. There are several supplier relationship management methods, for instance agile contracting that can be implemented. The traditional way to approach this is to buy the result, but it can be discussed that this prevents the external consults to execute their tasks according to the agile manifesto. Since this research is focusing on the path from idea to execution of the project from the providing organization’s point of view this area is not included in the study but is made as a suggestion for future development in chapter 6.1.

There are different risk aspects that a project entails and the traditional procurement methods are risk averse. The risk is completely within the project execution and with a large pre-study that needs approval before continuing with the execution makes the project owner responsible of all risk. Within the project execution the traditional way of contracting an external consult have been to buy the result, which entails that the external consult is responsible of all the risk.
To apply the generated artefact will make the departments within the organization share the risk, and within the project execution when external consults is contracted the resource is bought and the risk shared. The total risk that the organization is facing when conducting a project may be larger than with a traditional approach, but since agile projects are successful more often, see chapter 2.1.4, this risk is considered worth taking.

To enable a new procurement method the measurement of a department’s performance within a project needs to change. For example within the procurement department at Telia Company their performance is measured in how much monetary value they were able to save during the project compared to the original cost estimation. This needs to change before an agile procurement or an agile execution of project is possible because the different parts within the organization need to work together towards the same goal, which the traditional measurement contradicts.
6. Conclusions

The purpose with this research was to propose a solution to the problematic issue within the area, which the generated artefact does. The generated artefact presents a way of implementing the agile principles in the procurement process. This is implemented in the participation of the procurer in the agile execution, forcing the procurer to adapt their activities according to the agile manifesto. Although the agile principles are not followed to the letter the philosophy of the agile manifesto is implemented. This kind of implementation within the procurement process is highly aimed to facilitate for an agile execution of projects, which answers the second research question. The test result proves that the agile principles in the procurement process will reduce the time and cost of the procurement process, which answers the first research question. All the requirements set on the artefact is met and is demonstrated with the test. Some of these requirements are hard to define if there were successful or not. For example the strengthen of cooperation between procurer and executor, this requirements is fulfilled because the artefact brings the procurer and executor together, with Blitz planning, and forces them to cooperate towards the same goal. The test resulted in different, but positive, result but does not prove that the generated solution will work with every agile project within traditional organization, further development and testing is needed before the artefact can be recommended.

6.1 Future Development

Future development of this research is to perform more tests, both empirical for comparison and practical as in previous research. The solution should be tested within other organizations facing the same problematic issue to ensure credibility. The solution can be extended with more specific instruction within supplier relationship management for external consults, if they occur within the execution of the project. The research could be extended to include the hidden costs within a procurement method, for example the salary of the stakeholders that are dedicating time to examine if the project should be executed or not. The research could also be extended to see if other agile methods that addresses specific areas within the generated solution, for example agile contracting that could facilitate for the process of contracting with external consultants and unallocated resources to ensure transparency within the organization.
References


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Appendix A – Literature maps

The Literature map of the cost estimation problematic within agile execution of projects is presented in Figure 6. The blur arrows represent the dependencies or connection between the areas within cost estimation and the green arrows represent the connection to other relevant areas, the same principles are applied in Figure 7. The numbers within the figure represent the sources, which will be presented in the end of Appendix A.

Software project Cost estimation
[14, 15, 16]

Agile cost estimation
[14, 16]

Identified regression
[15]

Function point
[15]

Expert judgment
[15]

Theory-based
[15]

Agile cost estimation
[14]

Financial flexibility
[16]

Portfolio of agile projects, move resources between projects (internal)
[16]

Dynamic Value for Money
[8, 12]

Throughput accounting
[13]

Agile Principles
[9, 10]

Figur 6, Literature map of cost estimation
The literature map of agile execution of projects is presented in Figure 7, the same principles as in Figure 6 are applied.


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