Does and should control live in Agile Development.

A case study of a gaming company

Pamela Morris Williams
ABSTRACT

In an ever changing and competitive global market, cost estimation and cost control are becoming paramount when companies develop new products and services. Being that the driving force for continuous evolvement in Agile methodologies is reduction in time hence cost, it is quite peculiar that there is so little research made in cost control in Agile. This even though the problem in regards to cost control and handling in system development is a known problem area. Furthermore, most cost estimation in regards to software in an Agile software development environment has several challenges due to the continuous varying levels of customer requirements and different individual personnel capabilities.

The question proposed by this research is: How is cost control affected and managed in Agile driven development projects? In other words how can a company handle cost control in a sufficient and effective manner when using an Agile methodology. The research in this thesis is based on both relevant literature studies as a case study analysis.

Several conclusions can be drawn from the research one being that it is crucial that a company using the Agile Scrum methodology finds a cost estimation technique that gives cost estimation on the on-going projects. A method that will work together with the teams and also give the management the ability to budget and plan for both the short and long term future.

Keywords: project management, cost estimation, cost control, agile methods, software development.
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1. INTRODUCTION

1.1 Background and Goal

Disregarding industries or project types there is one thing that is in common according to Lang(2011) and the numerous of studies that have been conducted over the years, that is that the Information System Development projects often fail or go over budget. He furthermore states that cost estimation has for a long time been an issue and even though there are numerous researches made there are only a few in regards to projects involving system development.

According to Santos(2013) Agile practices, consolidated in the 2000s through the creation of the Agile Manifesto, have been solidified as a viable alternative for improving the cost and scope of projects in the development cycle of software. Mansor(2013) believes that ineffective cost management in software development causes projects to go over budget and therefore contributes to project failure.

The Standish Group(2013) Chaos reports shows an increase in the success rates of projects, but still 18% fail completely and 43% were over budget, late and/or with less than the required features and functions. This thesis will investigate how the Agile methodology is handling the cost control in IT projects that use Agile as the software development method. Is the cost being handled in an efficient and effective way?

In the end of the thesis there will be recommendations on what the company should do to improve their project handling in the future and also which factors contribute to the cost overruns.

Chandan(2012) points out in the written article that value management is not a central to Agile development but as review takes place in iteration, the prospect of better value is more. Chandana(2012) therefore writes that Agile can be considered as an extension of concepts defined in PMBOK minus certain methods that Agile Project Management (APM) has rejected namely the Waterfall model, Formal change and Configuration management and the traditional project manager’s role. Agile focuses on developing project across processes in iterations and through Agile methods.

One of the most important project management activities is project cost control this is needed to ensure that a project is delivered within the cost expectations laid down by the project's definition according to http://www.successful-project-management.com/project-cost-control.html [Accessed 2014-10-20]

The purpose of this thesis is to investigate the issues of project control through a theoretical study of projects and their financial changes during projects life cycle, it will not further investigate individual projects or there specific outcomes. The theoretical findings about projects and methods will then be compared to the framework and project management and handling at a case study company.

1.2 The Research Questions

This study seeks to address the following questions:
“How is cost control affected and managed in Agile driven development projects?”
With the following sub questions:
- What does cost control mean?
- How does an Agile project methodology handle cost control?
- Is cost control a problem in Agile project handling?

1.3 Goals
The primary goal of the study is to produce literature in this area of research that reviews existing methodology/tools used for projects to get an understanding of whether cost control is a problem in the Agile development project environment. Also how cost control is managed in Agile production projects. Also the goal is to conduct a case study at an existing company verify and asses the use of Agile methodology and having sufficient cost control in daily operational projects in a company using Agile as a method for project management.

1.4 Scope
The thesis will foremost cover Betsson’s IT projects and does not include any other non IT project.
The project cost overrun is not only a specific problem to the Case study company but a common problem in the industry and by concentrating on a single case study a common source to the problem can be found.

In Scope
- IT Projects at case company
- Projects that uses Agile methodology for software development
- Case company study using Empirical methodology
- If the conclusion is that the company has issues in regards to cost control, recommendations will be made

Out of Scope
- General non IT projects
- Other projects that has an element of IT in them
- No comparison of other gaming companies and their cost control in projects
- It will not further investigate individual projects or there specific outcomes.

1.5 Limitations
In connection to this master thesis there are some limitations.
This thesis focuses solely on the technical aspects of the development in the company and not the entire chain of events of which the technical development is part of.

This thesis uses a single case study methodology this could possibly be a limitation since usage of multiple case study methodology has a known advantage of establishing more reliable data.

The time limitation for doing an in-depth research
2. METHODOLOGY

This chapter regarding the research methodology used in this thesis is to give an insight to the strategy used so that the validity of the theoretical framework can be verified. Also information in regards to the usage of methods and tools for collecting the data for the thesis will also be explained as well as how the data collected will be analyzed. Furthermore, the quality of the research is evaluated based on validity and reliability.

Initially the thesis will be based on the literature studies about Agile methodology. The literature study will then base on the traditional approach and study the aspects of financial overruns and reasons for these. A case study will be performed at Betsson as the company uses Agile Scrum methodology for their projects. The company’s project framework and methodology will be examined and interviews will be conducted with relevant people in search for Betsson’s way to handle project cost and financial development in operational development projects. Finally these two elements in the thesis will then be analyzed against each other and the conclusion and recommendation based upon the findings of these.

2.1 Research Strategy

The two main strategies used in this thesis are:

- A literature review provides the theoretical foundation to situate the current study within the body of literature to answer the research question
- An empirical study is carried through as a case study. The method in this paper is to have a deductive approach to a descriptive study.

2.2 Case Study

The project cost overrun is not only a specific problem to Betsson but a common problem in the industry and by concentrating on a single case study a common source to the problem can be found. Even though the fieldwork is narrowed the conclusion of this thesis is important and helpful to prevent future project cost overruns and have a general idea of what can be done to prevent them.

This master’s thesis uses the methodology of a single case study, as Yin(2003) points out, it is one of the most common methodologies used among students. He furthermore explains that a thesis can be built on either single or multiple case studies depending on the desired outcome. When using only one case study the author can focus and study the case in detail, thus compared to multiple use less on both time and information according to Yin(2003). Biggam(2011) believes that there are three different types of case studies, those are: explanatory, descriptive and exploratory.

The case studies using the methodology of Explanatory will have an answer to why something is happening; Descriptive methodology will provide a very detailed explanation on a specific event or project. Exploratory methodology is most commonly used when a something is to be researched to get more data and understanding in the matter, this is most common methodology used for setting groundwork for future studies.
Case studies are to be preferred as appropriate methodology for researches according to Yin(2003) when there is a ‘how’ or ‘why’ question involved, especially is the author has no specific control over the outcome of the research.

Combining the wisdom of both Biggam(2011) and Yin(2003) this thesis will explore and investigate the “how” cost control is managed in a daily operational environment. For this paper to be valuable and the results useful and valid, the author will not choose any specific projects included in the case study. The thesis will use a descriptive approach which is most suitable for a more theoretical and in-depth study as identified in research question at hand Biggam(2011). The case study will be conducted through in-depth semi-structured interviews with key people within the company that manages daily operational Agile projects.

2.3 Data Collection

In gathering the information for the case study, interviews will be conducted as stated by Blackstone(2012) “Interviews are useful when the topic being studied is rather complex, and whatever is in the plan to ask requires lengthy explanation, or when the topic or answer to the topic or answer may not be immediately clear to participants who may need some time or a dialogue with others in order to work through their responses to the question at hand”.

As a technique for the interview in-depth interviews will be conducted as they are semi-structured and suits this thesis and purposes best. Using the technique of semi-structured questions in a qualitative interview will help in getting a more open and meaningful dialogue if using open ended questions when conducted according to Patton(1990).

The company chosen for this study is Betsson Technologies situated in Stockholm. Betsson is currently one of the leading online gambling companies and has been operational for over 50 years and has over 1 billion SEK in yearly revenue. The company offers products as betting, casino, scratch cards and poker. The main office is situated in Malta and is owned by Betsson AB that is listed on the Stockholm stock market.

The technical development projects are conducted by using Agile methodology and are therefore an excellent candidate for the thesis. Interviews will be conducted with key personal based on their involvement in the companies Agile Scrum Methodology that is managing and also handling projects that focus on the daily operational development by using the Agile methodology. This is to get a wide and in depth understanding of the project management and handling.

The first step to making the interviews the researcher is to get the interviewee’s agreement to attend a face-to-face interview about the topic. The researcher got the approval of making the thesis from the company’s legal department and the manager of the Development Center in Stockholm. Based on the given recommendations of people most suitable to be considered as key personnel in relation to Agile Scrum at the company, eight interviews were conducted with employees from different management levels. The criteria for the conducted interviews where firstly that the person involved was a part of Agile Scrum at the company. Secondly, interviewing different employees will allow a cross comparison of the given responses. Thirdly, interviewees should provide diverse,
objective perspectives on Betsson. The interview guide used for the interviewees is presented in Appendix A. By using the technique of open ended questions in an interview the interviewer has a much bigger possibility of not only getting the needed information for the ongoing research, but also getting information about other matters that could be of benefit for the research according to Yin (2003).

Dawson (2002) writes that using the semi-structured interview technique the interviewer can sometimes identify other areas of interest during the ongoing interview. By using pre-established questions he writes that interviewer has foundation to work from, but has the flexibility of adding and removing questions along the way. Furthermore Dawson (2002) states that this is one of the reasons why this technique is one of the most popular techniques to use when conducting a qualitative research. Saunders (2003) agrees with Dawson and adds that since there is no requirement for the interviewer to conduct the interview in a specific way he/she can therefore have more freedom in assuring continuous flow in the conversation.

The interviews will have the purpose of making a comparison of the responses depending on what stage and involvement the relevant personnel have. And also in the hopes of getting a different perspective on the issues regarding cost control in the projects of the case study company.

The interviews will be recorded so that the full focus will be on the interview and also to ensure that the data is accurate and truthful.

2.4 Secondary Data
By combining the data found through the academic research (Secondary data) and the data gathered through the interviews conducted, the thesis will deliver a complete description of Agile Scrum cost management and handling at Betsson Technologies.

The secondary data obtained for this thesis is from the KTH library, the universities database and academic websites. Furthermore data will also be collected from several different sources KTH, LIBRIS, PRIMO and reliable internet sources. Searches with keywords such as “Agile development”, “Scrum”, “Cost control” and “cost handling” were conducted. In addition the data regarding the case study company it was collected from the Betsson official website as well as the company’s internal website.

Since the validity and reliability are very important factors to be considered in this thesis the work has taken Biggam (2011) theories into practice. He states that in the selection of literature and secondary sources there are two criteria’s that has to be taken into consideration: 1. The authenticity of the sources 2. The credibility and trustworthy of the resources used.

2.5 Data Analysis
The best way to conduct the interviews for the research was to have them structured to be based on themes. By using this technique the interview were kept to the objectives of the research. The questions for the research were focused on cost control and handling of Agile methodology in the Technical Development.
The data collected for the thesis from the case study through the interviews and other written material is to be compared and aligned with the theoretical framework regarding cost control. The Agile methodology at Betsson will be compared to the theoretical framework existing for cost control and what the major differences are between the two approaches will be mapped.

This will result in an analysis of how the tools and methods for handling cost control, used at Betsson can be improved and by doing so also identify the improvements that can be made to make Agile project methodology more cost effective.

2.6 Realibity and Validity
According to Biggam(2011) the right way of conducting a valid research is to in the correct way implement the empirical work from the selection of an overall research strategy too collecting and analyzing the data by using the correct approach and technique for the ongoing research. For this thesis to achieve validity and reliability the author has conducted in-depth interviews with different employees from different management levels within the company, about how there are involved with the Agile methodology in their work and through these conversations gather their thoughts regarding Agile. Additionally all activities that have been conducted in this thesis e.g. collecting literature information, conducting interviews and so on are all supported with motivations and unbiased explanations.

In order to reduce the bias and ensure the validity of this thesis the author has detailed record of the research plan e.g. interview questions (Appendix A) and recorded transcripts furthermore the techniques and strategies used are all to keep reliability in regards to the objectives of the research Biggam(2011) Yin(2003). The thesis has been conducted as follows first a review of literature and taking published researched views into account, secondly semi-structured interviews for collecting the data from the case company by combining thesis above techniques the thesis guarantee reliability of the evaluation Biggam(2011).

The thesis follows Yin(2003) and his three principles to be able to establish validity and reliability to the research 1. Several different sources is to be used to collect the data such as empirical interviews, official websites and published articles 2. Being systematic and organized when collecting the case study data, 3. Maintaining a chain of evidence so that the data can be traced to the source at all time.

2.7 Limitations of research
There are several known disadvantages in using a single case study one of them being that the thesis, as Flyvbjerg(2006) points out can be biased towards verification and hard to summarize. Another limitation is that this thesis will only conduct a single case study and literature study information regarding other benchmarking companies and their projects solutions are lost. Through including other similar companies into the thesis a wider and more reliable base would have been reached. This is however not possible to carry through since there would be a conflict of interest by the
author being an employee at Betsson. Furthermore it would not be permitted even though the author’s present occupation is not involved in the company’s project framework.

Also the question regarding the thesis being fair and objective could be raised, however this will not be an issue since the material gathered for this paper will be documented properly and no personal interest in this particular subject is in anyway favorable for the author. As Biggam(2011) states it is important for a thesis to remain fair and objective, so that is the goal of this thesis.

Furthermore as according to Biggam(2011) this is also to ensure that the researcher does present an ethical and fair thesis that will present the material collected in the most unbiased and professional way.
3. FRAME OF REFERENCE

A Fact of Project Management:
“It must be remembered that project management is first and foremost a philosophy of management, not an elaborate set of tools and techniques. It will only be as effective as the people who use it”

Bryce’s Law

3.1 Agile methodologies
Dewan(2012) explains that the heavyweight methodologies come under traditional software and are also known as Work Down approach. He further states that is biased on comprehensive planning, detailed documentation and expensive design. Whereas Agile methodology follows the rules of the Agile Manifesto, treating development as the customer of testing. According to Beal(2014) the explanation to Agile development is that it is simply a phrase to express several methodologies for incremental software development. Furthermore he elaborates that Agile is compared to the traditional project management a methodology where the collaboration and empowerment of the people and the teams involved for making decisions, planning and testing etc. is the key for success. He also states that Agile development is simply a concept that includes several different development processes that are in line with the concept of the Agile Manifesto. Beal(2014) states that the Agile Manifesto was developed by leaders in the software industry that had the knowledge of the methods needed for it to work.

According to Waters(2011) Agile methodologies are to be characterized as agile when they exhibit principles that are described in the Agile Manifesto. He explains that some of the methodologies that are considered as Agile are:
- Scrum, has a focus on being Agile and to have better organized and functional development teams
- XP (Extreme Programing), emphasizes on technical practices, has some management elements but is more considered an agile engineering methodology
- DSDM (Dynamic Systems Development Method) a iterative development method
- LSD (Lean Software Development) focuses on eliminating as much overhead as possible

She further explains that the above is seemingly the most widely adopted Agile methodologies. However there are several other methodologies, for instance:
- Crystal
- Feature Driven Development
- Enterprise Agile(previously XBreed)
- Agile Unified Process
The picture below shows that agile methods focus on different aspects of the software development life cycle all according to Abrahamsson(2002)

![Agile life-cycle diagram](image)

**Figure 3.1 Agile life-cycle**  
*Source: Adapted from (Abrahamsson(2002))*

Appelo(2008) considers following methodologies to be the “leaders” in Agile methodology arena.

According to Appelo(2008) Scrum is an Agile project management methodology that is like a skeleton that includes small set of practices and predefined roles. One of the reasons he thinks that Scrum is becoming one of the most popular and a standard for managing software development projects is that it uses practice of common sense that can be used in several situations and industries. Even though he also states that most teams using Scrum will need to complement it with other methodologies to have a completely functional development methodology.

One of the methodologies used to complement Scrum is XP (Extreme Programming), this methodology according to Appelo(2008) covers most of the gaps left open by Scrum. He explains that XP is to be considered an engineering methodology that was created by Kent Beck, the name is based on that the methodology takes some of the practices to an “extreme” level. As with XP and other Agile methodologies, it takes continuous changes to requirements as a natural and necessary feature of software development.

LSD (Lean Software Development) was adapted from Toyota and was then embodied in to the “lean” subculture of Agile according to Appelo(2008). He furthermore explains that he believes that Lean and Agile go perfectly together since Lean is simply a translation of the Lean manufacturing into Agile project management.
DSDM (Dynamic Systems Development Method) is originally according to Appelo(2008) based upon the concepts of Rapid Application Development. It was created and is still maintained by the UK based DSDM Consortium. He writes that DSDM likes to compare itself to Scrum where it also works in iterative and leaves the decisions of the details to be made by the development teams.

According to http://agilemethodology.org/ [Accessed 2014-09-30] Scrum is the most popular methodology of introducing Agile due to it way to be both flexible and simple. Buencamino(2013) writes that he considers Scrum and XP to be most popular among the different Agile methodologies.

3.2 Agile project methodology with Scrum
In the paper written by Chan(2013) it is stated that The Agile methodology was first introduced in 2001 when the “Agile Manifesto” was formalized in Snowbird Ski resort in Utah by 17 people. Furthermore she explains that the Agile Manifesto outlines 12 important principles, which include communication, collaboration, the importance of software and an open mindedness towards change.

3.2.1 Definition of scrum
Scrum is, according to Schwaber(2013), to be considered as a lightweight process using iterative incremental practices controlling and managing software and product development. Zhi-gen(2009) explores this further by stating that the characteristics of Scrum is
- A relatively flexible organization system
- Interactive feedback
- The objective oriented flat management and participation of members solves the difficulties faced in projects
To support the statement of Appelo(2008), Zhi-gen(2009) believes that by combining other methodologies such as XP and RUP to complement Scrum it generates not only the benefits from Agile development but also the advantages of simple implementation.
3.2.2 What is Scrum?
Scrum is, according to its founder Cohn(2012), an agile way to handle and manage a software development project. The founder of Scrum would like it to be considered as a framework for managing a process, more than a methodology for software development. When using Scrum the details of how a problem or a feature should be done is left to the software development team to decide, there are no detailed descriptions in how everything should be solved. He explains this is because in Scrum the knowledge and the know-how are found in the team. The customer will present the problem and a desired outcome in a sprint planning meeting and based on that the team will then develop a satisfying solution. He furthermore explains that the team needs to be cross functional, where everyone is responsible for a part that will take the feature from an idea to a functional implementation.

3.2.3 How does it work?
According to Schwaber(2012) Scrum is a way for teams to collaborate to develop a product or several products. He further states that product development, using Scrum, occurs in smaller pieces, with each piece building upon the previously created piece. By using the system of building smaller pieces at the time he writes that it encourages creativity and enables teams to respond to feedback and continuous changes, to build exactly and only what the customer is requesting.

The most used and also suggested model for keeping projects in progress is using a series of sprints. Cohn(2012) writes that the usage of sprints in Agile methodology is a success being that they are tightly time managed and are most commonly two weeks but no more than a month long.

For the team to be able to commit and plan for how many items they can complete for an upcoming sprint the founder Cohn(2012) writes that a planning meeting is to be held in the very beginning of a sprint. He also promotes that beside the tasks that will be done the team also creates a backlog that includes the tasks that should be completed during the sprint. In an ongoing sprint Cohn(2012) writes that the team develops small sets of features in iterative from the idea and during the process they are then coded, tested and integrated into the developed product or system.
So the team can keep daily track over the status of the sprint, the founder Cohn(2012), writes that the team should conduct daily Scrum meetings where all involved personnel are present. He states that these meetings are to be no longer than 15 minutes and during that time the team members share what they are working on, previous day and today, and also identify any obstacles in their progress.

In the end of the sprint Cohn(2012) encourages that the teams have a sprint review. In this meeting the team should according to Cohn(2012) demonstrate the developed functionality to the customers and other stakeholders that then have the opportunity to provide instant feedback on the product and also the teams work.

According to the founder Cohn(2012) this continuous feedback loop contribute to freshly delivered functionality, but it may also result in revising or adding items to the product backlog.

At the very end of a sprint the whole team should attend a retrospective meeting, this is according to Cohn(2012) an opportunity to reflect on the sprint that has ended and identify opportunities for improvement.

### 3.2.4 The main artifacts

Cohn(2012) the founder of Scrum states that the primary artifact in Scrum development is the actual product itself. In the model of Scrum it is expected that the team brings the product or system to a shippable state at the end of each Scrum sprint. Another artifact in Scrum is the product backlog, according to Schwaber(2013) the should contain a complete list of the remaining functionalities that still needs to be developed for the product or system. According to Cohn(2012) the product owner is responsible for prioritizing the backlog so that the team is always focused on the most important and valuable features in the project. Artifacts defined by Scrum are specifically designed to maximize transparency of key information according to Schwaber(2013) so that everyone has the same understanding regarding the artifacts.

By populating the product backlog with user stories, that are short descriptions of the requested and desired functionality, it has become a very successful way to work in Scrum according to Cohn(2012). This is further explained by Schwaber(2013) that the Product Backlog is dynamic; it is constantly changing to identify what the product needs to be competitive, appropriate and useful. As long as a system or product exists, its Product Backlog also exists.

The founder of Scrum Cohn(2012) explains that in Scrum project management, on the first day of a sprint and during the planning meeting, team members create the backlog. He writes that the Sprint Backlog is to be considered as to-do list for the sprint, whereas a Product Backlog is a list of features that is still to be built. Furthermore he explains that the Sprint Backlog is the list of tasks the team needs to perform in order to deliver the functionality that the team committed to deliver during the sprint.

Other additional artifacts that are effective tools in Scrum software development according to Cohn(2012) is the sprint- and release burndown charts. These charts
can be used to determine if a sprint/release is on schedule and will be finished by the release date.

3.2.5 Roles within Scrum.

The founder of Scrum Cohn(2012) highlights that the most important knowledge to have about Scrum is that it does not have a project manager. He writes that the tasks and responsibilities of a traditional project manager are distributed among the project team, but also to the Scrummaster and Product owner.

It is further stated that the product owner is responsible for the business aspects of the project, including ensuring the right product is being built and in the right order. He further explains that the role represents the business, customers or users and guides the team towards building the correct product.

A good product owner according to Cohn(2012) has the abilities to have an excellent balance in the priorities, have the power to make decisions but foremost be available to the team.

According to the foundation laid down by Cohn(2012) the coach of the team is the Scrummaster, his role is to help the team be as efficient as possible in their cooperation of completing the product or feature. Furthermore, he states that a good Scrummaster should see his role as service provider to the team, removing progress obstacles, facilitating discussions and meetings and also performing typical project management tasks as tracking problems and team progress.

When determining how in the best possible way to achieve a goal, the team itself acts like an agile project management, Cohn(2012) states. Furthermore, he elaborates that the team members are in charge of deciding who in the team works on which task and what needs to be done technically to achieve the goals in the projects etc.

As stated earlier the role of an traditional project manager is distributed among the team and other stakeholders Cohn(20012) explains, consequently the traditional responsibilities such as managing scope, quality, costs, risks, procurement and more are reverted back to team where he thinks they belong. However, the responsibilities for scope and schedule adjustment should be handled by the product owner he further explains. Quality management he states is a responsibility shared among all the stakeholders in the ongoing project.

3.3 Cost Control in Agile

Agile software methodologies are widely used in a variety of industrial projects because of their volatile and flexible nature. Cohn(2012) considered the year 2001 as the year when agility was formally introduced to software development due to the publication of Agile Manifesto and the official formation of the Agile Alliance. Rashmi(2013) writes that the Agile Manifesto presented an industry led vision for a very significant change in software development. In Agile, software is developed in small iterations and the new changes are always welcomed Cohn(202). Due to the dynamic nature of Agile it becomes very difficult to estimate cost and time in an Agile environment. In the study conducted by Popli and Chauhan(2014) it has been observed that current estimation methods which
are used in Agile are not efficient because they do not consider any mathematical formula for accurate calculation of effort and cost.

According to Rashmia and Chauhan(2013) the process of estimation starts from the planning phase and refined throughout the project. One of the benefits of Scrum, according to Cohn(2005), that it works in iterative, incremental manner where changes in the requirements can easily be adopted any time in the process. Stated by Popli and Chauhan(2013) is that the Product owner is responsible for prioritizing the work that shall be performed by the team, the tasks that are to be completed in the upcoming sprint and also the more distant work that are logged in the Product Backlog Items (PBI). They further explain that the PBIs represent the goal of the product and capture feature orientated requirements. They are not describe in detail since in that point of time it is not necessary, but the team do commit to the PBIs in the sprint planning according to Popli and Chauhan(2013).

In Scrum valuable long rage metrics to be used are:
- Velocity: the rate that the team completes PBIs effort on a sprint by sprint basis
- Frequency of change: the frequency at which requirements are changing on the Product Backlog due to new work being introduced or reevaluation of existing items

According to the authors the two metrics above can be used to estimate a release completion date.

Furthermore, Chauhan(2013) writes while the PBIs are logged to describe “what” the desired outcome is, the tasks are for describing “how” the PBIs will be accomplished also the tasks describes the plan how everything will be implemented.

It is recommended in Scrum that a separate estimation scheme is used because Task describes granular work. Popli and Chauhan(2013) writes that “ideal engineering hours” is recommended, also that after PBI and Sprint Backlog is prepared, estimation is done from the historical data from the previous projects or from the expert opinion approach.

Litoriya and Kothari(2013) has in their written paper broken down Software cost estimation techniques to be classified under algorithmic and non-algorithmic models. They write that algorithmic models are based on statistical anlaysis of historical data such as former projects. Furthermore they write that the non-algorithmic techniques are based on new approach such as expert judgment, price to win and machine learning.

Bhalero and Ingle(2009) proposes an algorithm for cost estimation by including several different factors with various intensity level. They are stating that the factors included are project domain, configuration, performance, data transactions, processing, operation ease and security. However, they do highlight that factors that are not taken into calculation are communication, skills and familiarity in the team.
There are according to Jamieson(2005) several problems with the existing estimation models in Scrum. One of them he believes is that the customer must often allocate a budget without a total understanding of the requirements. Decisions like that, he writes, can lead to budget overruns due to vast and costly change management and also delays in the project overall time schedule. Jamieson(2005) also explains that misunderstandings, inaccurate quotes and problems in communication between the stakeholders often are traced back to the fact that in software development there is often when it comes to cost estimation a shortage of data needed to make sufficient estimations.

In a survey conducted by Heemstra(1992), he found that only 51 of the 364 organizations used models for effort estimation, he also found that the ones using a model made no better estimations than the non-model users. He also discovered through his survey that an expert judgment was just as good as the use of models.

Rashmi and Chauhan(2013) writes that an Algorithmic estimation method is being proposed considering various factors and thereby estimating a more accurate estimations for effort, cost, duration and release date when using the Scrum methodology. They support their theory by saying that the effectiveness and feasibility of the proposed algorithm was shown in three cases where different levels of factors are taken and compared. However, Lang(2011) proposes that a fixed price budget is the very best option for the team and for the customer. He also highlights that for cost estimation in Agile to be successful it is vital for experience and past projects to be fully documented and used as guides to estimate similar future projects.

Both Bhalero(2009) and Litoriya(2012) are stating that Algorithmic estimation is the way to go. Litoriya(2012) evolves this by writing that it is critical for all involved stakeholders to have accurate software cost estimation. He writes that the estimations can be used for among things contract negotiations, monitoring but especially for control. He explains that underestimating the cost may have several consequences for a project such as overruns of budget, underdeveloped products and poor quality and failure to finish the project in time. Furthermore he states that over estimating may result in too many resources committed to the project or during contract bidding that can result in not winning a contact, which can lead to loss of jobs. So Litoriya(2012) therefore draws the conclusion that we must know the behaviour or impact of each cost driver and scale factors because they can be very helpful for predicting the accurate cost of a project. He therefore suggest that building data mining and learning techniques into existing software estimation techniques such as COCOMO II can effectively improve the performance of a proven method.

Agile methods have become the mainstream of software development according to Bhalero(2009) due to their easy and advanced way of working. Some of the more common used practices in Agile, according to him, include meeting processes, simply design and team collective software development etc. He writes that by using the previous mentioned practices you can address the problems of volatile requirements. By using the practices Bhalero(2009) expects to be able to reduce cost of changes at later stages of software development. He is also stating to make clear that the Agile methodology due to its way of taking in
continuous changes to requirements do not hold up in the practice of early estimation of size, cost and duration of a project. His opinion is that mostly relying on expert opinion and historical data for estimation of cost, size and duration, does not actually consider the vital factors affecting these attributes for project estimation. Bhalero(2009) believes that in the absence of historical data and experts, exiting agile estimation methods such as analogy and planning poker become unpredictable. Therefore he makes the conclusion that the need for an algorithmic method is evident, a simple algorithm that takes the different factors regarding cost, size and duration in to account when calculating.

He also believes that this gives inexperienced practitioners basis to estimate more precisely.

Lang(2011) however advocates for a fixed project scope, where a budget is agreed in the beginning, that he also claims to be the most common method in use. Depending on the project, he states that in some cases, that either the schedule van be moved or the functionality could be changed. According to Lang(2011) when a fixed price is used the number of developers can be assigned and delivery calculated consequently. He furthermore states that in the usage of fixed price enables the project to be more efficient in the usage of resources and time with a fixed time schedule. Mansor(2011) also believes in the fixed price methodology and states that it helps in risk sharing between the customer and the developers. Obukhova(2010) adds to this that she believes that fixed price is the nature of Agile and still can work in a flexible manner. She states for it to work there needs to be a combination of industry experience and accurate estimation of scope, planning and effort from the team.

3.4 Traditional and Agile cost estimation

Emphasized by Mansor(2011)is that choosing the correct cost estimation technique is vital for ensuring that the results are accurate. Different approaches used in the cost estimation process may produce different accuracy in the results he furthermore states.

He also writes that there are a few studies that been conducted about integrating more than one technique with each other, this is called hybrid technique. Nevertheless, he claims that no one can claim which technique is the best practice. Therefore, there is no right or wrong in the approach of choosing a technique for a project, only the very importance of choosing the right one that suits the particular project. But he also raises a warning that combining different techniques for cost estimation might cause an increase in cost and time. Mansor(2011) writes that the crucial question in software development is how to complete a project within the boundaries of specified time, budget and resources. One of the main contributors to project failure according to O’Brien(2004) is time, more precisely the schedule overruns. He states that if proper and complete resource identification and usage is identified the process for cost estimation will become easier and more accurate. Also he believes that in common practices, cost estimation process is crucial.

The accuracy of cost estimation is according to Mansor(2011) depending on how software development projects define the resources needed and the quantity of the resources.
Zhang(2006) has listed the most important points of accuracy of cost estimation:

1. It can help classify and prioritize development projects with respect to an overall business plan.
2. It can be used to determine what resources to commit to a project and also the best usage of these resources.
3. It can be used to assess the impact of changes and support re-planning.
4. Projects can easier be managed and controlled when the correct resources are located.
5. The customers expect the costs of development to be in line with the estimated costs.

In Agile, active customer involvement is the main focus according to Mansor(2011). He believes that the team must ensure strong communication between them and the customer and other stakeholders. He furthermore states that since Agile provides less process compared to traditional project methodologies in software development, the simplicity of the process becomes one of the most important success factors in Agile cost estimation.

Haughney(2014) writes that a project can succeed even if it is late and over budget, if it delivers enough benefits to the business. Understanding and communicating the benefits and cost is the key to success or failure of a project he states.

### 3.5 Business Value of cost control

According to Rico(2009) there are numerous types of metrics for measuring the business value of any investment such as agile methods. Virtually any textbook on business value or Return of Investment (ROI) will have a virtual smorgasbord of metrics, models and measurements.

Further Rico(2009) states that the two most basic inputs into almost any measure of business value are (1) cost and (2) benefits. That is, one must count up all of the costs associated with what one desires to do. He further states that costs generally include training, materials, consulting, development and maintenance—often called total life cycle costs. He also writes that there is also a myriad of benefits, such as increased productivity, reduced life cycle time, lower development costs and lower maintenance costs. Rico(2009) writes that ROI is a classical measure for estimating the business value of Agile methods, although it is accused of being too optimistic. For that reason, Net Present Value (NPV) is advocated by economics experts, because it takes the time value of money into account. However, real options analysis (ROA) is a better measure of business value, because it takes time, inflation and risk into consideration. The value of ROA and ROI becomes similar, because NPV dramatically understates benefits, all of the above is all according to Rico(2009).

As Milanov(2009) writes in his paper the critical mass of functionalities can be defined by the client only, that is that only the software solution purchaser who defined the required functionalities, features and quality of specific software solution can estimate which minimum set of functionalities and features of the software solution from a particular moment in the market can lead to the beginning of the ROI.
ROI is a percentage rate that measures the relationship between the amounts the business gets back from an investment and the actual amount invested according to Whitten(2004). However, Milanov(2009) states that ROI is a common way to measure the business value of Agile methods for developing new software products.

\[ \text{ROI} = \frac{\text{Benefits} - \text{Costs}}{\text{Costs}} \cdot 100\% \]

Explanation:
- Benefits, total amount of money gained from Agile methods (including economic benefit from using new system)
- Costs, total amount of money spent on Agile methods (including training, coaching, automated tools etc.)

Comparing the traditional method to the ROI of Agile methods is significant, because of the lower costs, fewer defects and lower total life cycle costs according to Rico(2009).

NPV according to Rico(2009) is very similar to ROI, both formulas use costs and benefits as an input. Second both subtract the cost before stating the benefits. However NPV takes to additional inputs- discount rate and time- before making the final valuation.

\[ \sum_{i=1}^{\text{Years}} \frac{\text{Benefits}_i}{(1 + \text{Rate})^{\text{Years}_i}} - \text{Costs}_0 \]

ROA has an additional input, which NPV does not have: risk. Rico(2009) explains that to a certain extent, ROA is based on the time value of money but also on risk.

\[ N(d_1) \times \text{Benefits} - N(d_2) \times \text{Costs} \times e^{-\text{Rate} \times \text{Years}} \]

\[ d_1 = \frac{\ln(\text{Benefits}/\text{Costs}) + (\text{Rate} + 0.5 \times \text{Risk}) \times \text{Years}}{\text{Risk} \times \sqrt{\text{Years}}} \]

\[ d_2 = d_1 - \text{Risk} \times \sqrt{\text{Years}} \]

### 3.6 Agile cost factors

The success rate for Agile projects compared to the non-agile projects are three times more according to the 2011 CHAOS report from the Standish Group. The report goes so far as to say “The Agile process is the universal remedy for software development project failure. Software applications developed through the Agile process have three times the success rate of the traditional waterfall method and a much lower percentage of time and cost overruns.” The definition of project success according to the Standish Group(2011) is that the project is on time, on budget and has all the requested features.

In an article written Ballard(2014) he states that when Agile projects go wrong, they can go spectacularly wrong. He furthermore writes that Agile methodology is meant to deliver flexibility to IT projects by using iterations, this to be able to involve customers more directly and have a quicker adaptation to changes. He is stating that customers are not paying a fixed price for a complete project, they are
paying for commitment of resources, but the lack of clearly defined project roles and requirements is a problem for Agile projects.

In the CHAOS Manifesto 2013 the Standish group writes that the Agile process is perceived as the universal remedy of software development project failures. They are basing this statement on that the Agile process makes it easier to break up larger projects into smaller projects, they believe that the secret lies in the trial and error and delivery in iterations. As the team can deliver functionality in small bits or steppingstones, the team can stay focused, as every iteration is a significant deliverable. The Standish group(2013) writes that the usage of iterations allows for tangible inspection, either visually or hands-on.

According to Moczar(2013) Agile does not take in to account that every change has a cost. Resulting in what he believes is that people often change significant things late in the process using the rationale that is an agile project, and should therefore be able to handle it. He states that as that happens, defects that might have been easy to fix at one point get harder and more difficult to amend, based on that the code base keeps changing.

“A project is a temporary and one-time endeavour undertaken to create a unique product or service that brings about beneficial change or added value”

Unknown

3.7 Agile Cost Control

One of the main principles of the Agile methodology is the acceptance of the ever changing requirements, but this is also a major factor in the cost estimation problems faced in Agile, according to Lang(2011).

Cao(2013) writes in the article that traditional funding decisions are made largely based on well-understood functionalities that the system will provide. They further state that however, Agile development is most appropriate when the functionalities and the priorities assigned to them are evolving. Therefore he thinks that it is fairly difficult to develop accurate estimates of costs during the early stages of a project because Agile development is characterized by unstable problem domains, requirement volatility and dynamic planning and design phases.

Furthermore Cao(2013) explains that traditional funding processes require that non-functional requirements are explicitly identified and considered during the design of the architecture. In Agile development, the implementation of non-functional requirements is often delayed to later development cycles. Without detailed upfront design, estimating the cost and schedule associated with these requirements is challenging. Also, non-functional requirements are dependent on the functional requirements that are continuously evolving Cao(2013).

In the paper by Cao(2013) he writes that Agile development emphasizes collaboration between customers and developers, rather than the use of phased milestones, heavy documentation, and formal reporting procedures. Instead, continuous control mechanisms such as feedback from short iterations, informal
communication, and constant collaboration between customers and development teams are used.

The following two cost models are solutions to the cost problems in the Agile methodology as stated by Cao(2013):

- fixed price and negotiated scope-contract. Senior managers set aside a fixed amount that will be invested in the project, which was charted to provide ad-hoc reporting and querying capabilities.
- pay as you go-model is, where the project is treated as several mini projects each of which developed a small set of features. Costs and schedules is agreed upon for each of the mini projects that lasts from four to six two week development cycles.

Stated by Franklin(2008) is that the key to success is first hand collaboration between the users during the proposal and contract development phase process to ensure enough correct user stories. Furthermore to be able to estimate the magnitude of scope themes and define tangible milestones that allow payment on delivery of theme components at each sprint cycle as well as larger milestones as releasable software deliverables. And Cao(2013) writes that a commonly adopted strategy for developing initial budget and schedule estimates involves seeking inputs from project personnel with relevant experience from similar projects. He writes that the initial planning process is carried out at a coarse level. He explains that known functionalities are broken into tasks and the cost and schedule for each task is estimated, many of these tasks may be discarded and some added. Further in his studies he conducted he found that his case studies had adopted the following strategies:

EConnect uses a version of this strategy: They estimate the size [of stories] by three different categories: known stories, stories without enough information and unknown stories. They add different buffers to each category. For unknown stories, they add 100% and for known [stories], only 10–20%.

From Cao(2013) case studies he further states that a project manager in OnlineSecurity described the process as follows: “During the early iterations they added 50% to any estimates whenever anyone was computing a project completion date. Once they had a few iterations under their belt and their velocity was stable, they dropped the multiplier down to 25%. Thus, initial estimates were typically provided with considerable buffers (30-50% on average) and these were continuously adjusted based on status changes.”

Cao(2013), based on this states that this practice addresses the conflict of ‘upfront vs. evolving functional requirements’. Project cost is estimated by experienced engineers based on their understanding of high-level requirements.

3.7.1 Agile Documentation

Islam(2013) writes that Agile methodology values face to face communication over formal processes. He then further explains that Agile is a people-oriented methodology and when there is more interaction between developer and customer, more chances of less documentation. On the other hand he believes that, too much documentation could also be hard to maintain and update.

Cao(2013) states that Agile development emphasizes collaboration between customers and developers, rather than the use of phased milestones, heavy documentation, and formal reporting procedures. Instead, continuous control
mechanisms such as feedback from short iterations, informal communication, and constant collaboration between customers and development teams are used.

### 3.8 Management responsibility

According to Wideman (2005) if the executive management has a profound understanding of the project process and takes responsibility, then you can have an effective project cost control. It is vital that the management takes responsibility in the key decisions points throughout the project's life span. For a avoid problems and obstacles they must also, according to him, have an understanding for risk management so that at minimum avoid the most obvious risks.

The backing of senior management is crucial for a project is agreed by Haughney (2014), this to be able to deliver the needed changes. He believes that without the backing of senior management the project will proceed very slowly and the management must be the ones that drive the change forward and the project is that mechanism.
4. CASE STUDY

This chapter will present and discuss the findings of the research. The findings will include the views of the people interviewed at the case study company. Furthermore, this chapter will reveal the result of the case study described in section about methodology.

The structure for this chapter is as follows:
- A brief introduction of the case company
- Presentation of the results found in the interviews.

As previously presented, this is a qualitative data collection, meaning the focus is on the cost handling and control in the Agile Scrum methodology used at the company. The findings of the data presents the problems that are faced using Agile Scrum and also on having a sufficient cost control and handling at the company. The information used for this part of the thesis is from the face-to-face interviews held at Betsson. Appendix A includes the interview guide used in all the interviews to ensure validity throughout the process.

4.1 Betsson Group

Betsson AB (Publ) is a fast growing company with more than 50 years’ experience in the gaming industry. For the last 15 years the company’s amusing and fun games have been available online. The core business of the company is investing and administering shareholdings in companies which, through partners or by themselves, offer gaming to end users via the internet. Betsson AB owns a number of companies which operate games directed at end consumers through partnerships and through its own web sites, some of the most well-known websites are Betsson.com, betsafe.com, nordicbet.com, oranjecasino.com, krroncasino.com and casinoeuro.com. The web sites offer Poker, Casino, Sportsbook, Scratchcards, Bingo and Games. The company’s customers primarily originate from the Scandinavian countries and other parts of Europe. Betsson AB is listed on NASDAQ OMX Nordic Mid Cap List, (BETS) according to http://www.betssonab.com/en/About-Betsson/ [Accessed 2014-09-20]

4.2 Agile at Betsson

Betsson uses the Agile Scrum methodology in their software development projects. By using the Agile approach, management is letting the people involved in the software project adapt to changing circumstances, rather than trying to impose rigid formal controls, as in traditional linear development methods according to Augustine(2005). (More precisely the company has adapted Agile methodology with Scrum)

Agile was introduced in the end of 2008, in 2009 the employees where educated and certified. In 2011 product owners where designated.

There are many reasons for Betsson choosing to go Agile but one of the foremost is that the industry needed something that was more flexible and more mobile that waterfall or Rational Unified Process (RUP).

There are a total of nine different teams using Agile Scrum where the number of employees varies from two to six depending on the team.
4.3 The qualitative data of Betsson-Interviews

The interviews revealed a number of both positive and potential problem areas in using Agile Scrum as the development method in interaction with cost control and handling. The research was able to triangulate perspectives and to develop an assessment of different problem factors across all management levels.

During the interviews other problem areas were found and they are stated in this thesis even though they do not directly affect the cost control they indirectly have an effect on cost handling for the company.

To meet the expectations of this report it is stated that the actual level of management was not considered when gathering the data. All employees were treated as equally important and several of the areas considered in need of improvement where mentioned at several occasions.

Agile as a methodology

All the people that were interviewed thought that Agile methodology has been accepted as a well working methodology and is implemented according to Agile methodology.

The company has educated and is continuously educating Scrummasters and teams that work in two week sprints. All the teams have their own velocity in the matter of storypoints that they assess there work effort in the sprints this also verified with the Scrummasters that were a part of the case study. All teams has access to a Scrum Director to help them in Scrum. The controller explained that each team estimates how much the velocity of a storypoint is for that particular team, based on how effective they are and also based on their previous achievements. This was also verified to be the working process by the others being interviewed for the thesis.

The product owners work in getting the balance of priorities, being available to the team and being responsible for ensuring that the right product is built. They are also ensuring that the team has the correct information and specification for building the needed product.

During the interviews the following routines were described: Every day the teams have stand-up meeting (daily Scrum) to provide a status update to the team members. The “semi-real-time” status allows participants to know about potential challenges as well as to coordinate efforts to resolve difficult and/or time consuming issues. The meetings are usually held standing up to remind people to keep them short and to-the-point. The meeting is not allowed to exceed 15 minutes and the following three questions are to be answered at this meeting:

1. What did I accomplish yesterday?
2. What will I do today?
3. What obstacles are hindering my progress?

There is a Pre-planning where you go through the backlog and ensure that all requests are ready to be planned in to the sprint. It may be broken down with estimation of the feature or if something is still unclear an investigation can be started.
Planning Meetings are held just before the start of the sprint. It is decided what amount of tasks is to put in the actual sprint. The amount is based on the velocity (history from the amount accomplished in the previous sprints).

At the end of a sprint cycle, two meetings are held, the Sprint Review Meeting and the Sprint Retrospective.

At the Review Meeting the team should review the work that was completed and the planned work that was not completed. Present the completed work to the stakeholders (aka. a demo).

At the Retrospective, all team members, the Scrummaster and product owner are working together to learn from the sprint that has passed. Improvements in work methods are identified, and a number of things are selected and corrected for future sprints. The main questions to be asked at these meetings are:

1. What went well during the sprint?
2. What could be improved in the next sprint?

Cost Control and handling
As explained by the controller at the Case study company the current cost control structure is that every Development Center at the company has a specific hourly cost per employee and also one per consultant. This cost is calculated and managed by the Tech controller. He is in charge of handling all costs that is to be calculated and managed for tech.

He then compiles the hours being reported on each project by the employees/consultants in the time reporting system Tic-Tac. By doing this he gets a complete cost picture of the company’s IT base in Stockholm. This of course hangs solely on that the employees log their time on the different time codes available in the tool. There is an ongoing discussion on both how to make this manageable but also a source for accurate numbers,

Controller is in charge of having the correct codes in the tool but cannot do this without the support from the product owners and Scrummasters.

The teams feel that their time should not be spent on a timekeeping tool and want to have as few time codes as possible. This of course leads to the presence of somewhat “generic” time codes that are difficult to assess. The teams have some issues with the time reporting since there is taken no consideration for live maintenance and a team can have up to seven different projects ongoing at the same time. But since it is the business side that is in charge of deciding what they have to prioritize they cannot really control their own workload. However there are some discrepancies between the different teams where some feel that business has a better understanding and listens to the teams input.

There are several time codes being used to granulate the reported times so that the cost calculations will be as accurate as possible.

- CAPEX is used for Capital Expenditure where new development is used as a guideline.
- **OPEX** is used for Operation Expenditure where maintenance is used as guideline.

The projects have several activities in the time system tool where personnel can report time to explain where they spent the time e.g. normal, meeting or education. The above was explained and verified to be the current way of working not only theoretically but also in actual practice by all interviewees. Based on the people working on the specific project an average hourly rate is calculated to give a cost for the time reported for the specific project. This is also handled by the controller.

The controller further explained that existing time codes are for projects that are considered “big” and that other smaller development work is simply registered as other e.g. Mobile general maintenance, support, or SEC operations.

With the structure of the organization there is close to no time estimation before a project is begun. The problem being that each team works individually but is still very dependent on each other and there is currently no method that can take all the dependencies into account for calculating a total amount to a specific project.

To make it easier one of the product owners explained it by comparing the situation to building a house, each Agile Scrum team is responsible for a specific part for the house:

- Team A - Wall
- Team B - Roof
- Team C - Window

Each team can do an estimation for the time they need to complete their specific task, however if team A builds the wall wrong in the tiniest bit team B cannot fit the roof and team A has to rebuild the wall and therefore team C cannot do anything due to the dependencies towards team A.

Even if all Agile Scrum teams where to give time estimations on their part of the house, there is no way for estimating the total time of the project including dependencies and other problems between the teams. It can be as simple as one team having misinterpreted the specification of the feature to throw the time estimation of the project completely off.

In the words of software development told by the Scrummasters, time estimation is only for the actual development of the feature however the time for testing, deploy in QA, deploy in production is not factored in at all. Neither is taking the dependencies between the teams e.g. platform needs to be done before site can finish their part.

They explained that this could lead to an extremely wrong estimation even if all the teams where to estimate there expected time for a specific project. The Scrum Director believes that the dependencies between the teams should be solved by the product owners. However that is not the case in the current set up but he is working hard to get them to the level where they together can sort many of the existing dependencies and leave the teams to be more productive and efficient.
The CTO is aware that finance is struggling since there are no real descriptions or budgets for the projects, he further stated that through the usage of Agile Scrum there is knowledge of how much money has been spent after each sprint of a project. That gives, according to him, the advantage of having an exact number on what has been done and gives a maximum on how much money is being spent.

He also sees Agile Scrum as the possibility of breaking down huge projects like e.g. implementing a CRM system that would take the involvement of all teams almost a year to getting smaller functional working parts that can be used immediately instead of a big bang.

He agrees that the management needs to be clear in their priorities and communicate this to all involved people in the company. For bigger items that effects the company there is a roadmap forum where the top management discusses and agrees on a priority. The smaller items the management leaves up to the product owners to priorities.

The Development Center manager explained that there is no actual follow up on the project and the amount of hours spent nor any real budgeting in money only in time if any.

There is no tracking of time spent either, this was also confirmed by the controller when interviewed. She would like to achieve more transparency which would benefit the employees working with Agile Scrum as well as the company.

**Time thieves**

As a project evolves the business has the possibility through Agile to evaluate and change the specifications of the needed features along the way. This can in many ways change the time estimated for a project (in sprints). All people interviewed stated that currently there is no way of tracking these changes. So a team can go from expecting to spend X amount of time to Y and when trying to figure out where exactly the time was spent there is nothing to look at. This was also verified to be true by the controller.

There are some product owners that keep track of these changes but there is no actual support for such logs or demand for them to be kept.

The same holds true for the smaller projects that have no given time codes in the time reporting system, it is up to the product owner to keep track of the actual time spent on different features.

**Maintenance**

In the time estimation for different features there is no consideration given to for regular maintenance. In the software development there is a continuous need for bug fixing and maintenance to keep the codebase alive and well. This was clearly stated by all people interviewed who had a daily contact with a Scrum team. Also, the CTO at the company was aware of the problem and is trying to find a solution. However this is difficult being that there are no estimations made for the projects. He is considering working with buffers.

**Communication**

There is a constant problem with presenting accurate numbers for the cost of projects. This was agreed by all people interviewed. Being that the time estimates
are difficult to make there is close to no accurate numbers for a specific project before it has begun. There is however a price on it after it has been completed. This is of course a problem for the management that needs an estimate for deciding what projects to include in the company’s roadmap. Even though the people interviewed agreed that presenting accurate numbers were important they all had several different views on the actual problem at hand. Some thought that the management still has a tendency to ask for numbers that work with a Waterfall methodology and not Agile development methodology. Others did not understand the problem behind not being able to present accurate numbers for a complete project before starting.

They all agreed that there is no particular structure on reporting. Some indicated that since the top management does not follow up on the numbers that are being reported, they do not feel like wasting their precious time on such reports.

**Ownership**

One of the key components in the Agile methodology is that business has full comprehension of their role in the collaboration between business and development teams. They need to make sure that the tasks they are asking to be developed are explained in a sufficient and adequate manner. The case company is working hard on making sure that business takes on the role. The Scrum Director is continuously working on educating business and establishing a culture where everyone knows the crucial and important roles to make Agile Scrum work efficiently. However many of the people interviewed felt that this responsibility is not always clear or completely understood. Making it hard for the Agile Scrum teams to deliver what the business is asking for due to faulty or unclear directions.

However there where some teams that felt that their roles were very clear and they had no problem with responsibility from business, the Scrum Director also confirmed that this is a difficult problem to generalize and also in the gambling industry the turnover on personnel makes it a problematic factor. He also wishes to have a clear structure regarding ownership within the company and is working on a structure where the business has true ownership in the organization.

In one of the interviews it was stated that there is no general understanding for what generates value for the company; all have to be done fast with instant delivery. Many of the teams also openly question whether there is any ROI knowledge among the business side and do they know how/when to expect value/yield. The requirement from business varies in quality between the teams, this is confirmed by the interviewees.
5. ANALYSIS & DISCUSSION

As Jamieson (2005) points out there is a number of problems with the current estimation model in Agile Scrum, one of them being that the customers often must allocate a budget to a project before they even have a complete understanding of the expected requirements.

Ballard (2014) further states that the lack of clear defined projects roles and requirements is a problem for Agile and Scrum. And even though Agile is considered a universal remedy for software development in the way it can be flexible, he also writes that it can also go spectacularly wrong.

Agile Scrum can easily adopt to last minute changes of the requirements, according to Cohn (2005), because it works in an iterative and incremental manner.

In the study conducted by Popli and Chauhan (2014) it has been observed that current estimation methods which are used in Agile are not efficient because they do not consider any mathematical formula for accurate calculation of effort and cost.

Even though Litoriya and Kothari (2013) has in their paper broken down software cost estimation techniques to be classified under algorithmic and non-algorithmic models. And the theoretical study makes this technique easy to understand. The case study conducted shows that the company is in need of an estimation technique but based on the existing studies there are no technique that are easily adopted on a multi layered and dependent environment with several different Agile Scrum teams.

The usage of PBI’s is mostly used for long-value metrics for the Agile Scrum team and does in a way assist in the cost control by estimating the actual productivity of a team, but it does not, based on the study, help in calculating the actual cost for an entire project, only for the actual task that are ongoing in a particular sprint Chauhan (2013). And further it is vital that an Agile Scrum team has some actual data to build such velocity on Popli and Chauhan (2010). Further stated by them; that after PBI and the Sprint Backlog is prepared, estimation is done form the historical data from the previous projects or from the expert opinion approach.

There is nothing that speaks against the need of sufficient cost estimation for a company of any size. None of the people that participated in the interviews conducted for this thesis denied the importance of cost and also having sufficient cost control, so based on data collected in this study an Agile way of cost control is as important as it is in any other software development methodology. But the importance of how it is valued varies from person to person and sometimes depends on their position and involvement in the companies Agile Scrum process.

Mansor (2011) emphasizes the importance of choosing the right cost estimation technique. He also writes that sometimes choosing a few different techniques might be best choice for some projects. Based on the study made for this thesis two different methods stand out as the way to go, fixed price and an algorithmic estimation.

Lang (2011) proposes that a fixed price budget is the very best option for the team and for the customer. Rashmi and Chauhan (2013) believes that an algorithmic
estimation considers more factors and thereby estimates the more accurate release date, cost, effort and duration of a project.

Based on the literature study conducted there is a sufficient amount of data available where the authors believe they know the best way to go when it comes to cost estimation in Agile Methodology but there is no actual data available on cost estimation in a live environment in an actual company that is beyond pen and paper.

The case study shows that it is clear that a cost estimation method is needed at the company but given that there is no clear and easy adoptable method the company is very vulnerable in this matter.

Much of the data regarding cost estimation in regards to Agile and Scrum in some ways talks against each other.

On one hand many celebrate Agile Scrum for being flexible and being built in iterative steps that gives the possibility of tangible inspection.

On the other hand the Agile methodology makes it hard to give accurate estimates of the cost due to the constant changes made, and since the changes may or may not be significant the code base keep changing consequently the continuous evolving of costs.

Based on the data that this thesis is built upon it is almost impossible to give a clear answer on what cost estimation technique is the best way to go. It is clear that cost control is affected in all Agile projects in several different ways in both time, cost and scope but there is no clear way how the cost should be managed in way of methods and techniques.

Any of the given methods can be celebrated or torn-down and to be fully academically correct more case study companies should have been included in the thesis. Companies that have adopted a cost estimation methodology and also companies that are in need of a methodology, all should have the usage of Scrum methodology as the common denominator. That would have given this thesis a deeper and better foundation to make an actual conclusion on what estimation technique is to be recommended to a company using Agile Scrum as a software development methodology. And consequently been able to fully draw the correct conclusions for how cost control is affected and managed in the best possible way.
6. RECOMMENDATIONS

This section of the thesis will summarize the findings from the conducted research, as well as suggest some recommendations that are based on the theoretical framework. The chapter from the Case study included the findings from the empirical research that was carried through. The given solutions are merely recommendations that hopefully can give the company some more transparency and clarity in making better use of Agile.

The 14th century logician, William of Occam wrote “Entities should not be multiplied unnecessarily”. Albert Einstein restated this in “Everything should be made as simple as possible, but not simpler”. Hence it is believes that large projects should be broken into smaller projects and phases. Each phase should then provide an immediate and direct business benefit. http://www.projectsmart.co.uk/six-rules-for-great-it-project-success.php [Accessed: 2014-09-20]

The above is a good explanation of the choice of using Agile development methodology at the case study company. With the usage of Scrum the company can achieve a clear focus by working in smaller, simpler iterative, it is then also easier to see what the customer is getting but moreover to estimate the value of the money, time and effort being invested. Other positive aspects of this approach is that smaller iterative are easier to manage, quality proof, fix, tweak, debug and modify according to requirements. Also projects that are built on iterative are easier to pause stopped completely and the resources can then be put in to other activities or projects.

Cost Control and handling

Problem: There is a problem getting a complete an accurate cost estimates towards projects involving several Agile Scrum teams. The dependencies between the teams are not calculated in the costs and there are several factors that easily without taken in to consideration making the estimates and budgets erroneous from the beginning.

Recommendation: Mansor(2011) is right stating that choosing the right cost estimation is vital to ensure the right results. In Agile it is very difficult to estimate cost and time due to its dynamic nature Cohn(2005). Solving this particular problem is not as simple as anyone could have hoped and I advise a solution that is in favour of both Rashimia and Chauhan(2013) and Lang(2011).

By combining both mathematical and fixed price I think that the problem might not be solved completely but it will give a much better estimate for upcoming projects at the company.

By using the already existing cost estimation techniques used in each Agile Scrum team, the team should be able to give an estimate on how many storypoints they plan to use towards a specific project. This number stands of course only for their part of the project and does not take any consideration towards other teams.
And being that the core of the problem is that it is not possible to get a complete estimate for an entire project, I believe that the entire project should be calculated on a combined cost from all the Agile scrum teams plus an additional cost. The additional cost can be calculated through using mathematical algorithms where all dependencies, maintenance, bug fixes and other errors are calculated as a buffer to be added on. The calculation should involve people that have the knowledge of all risks involved in Agile Scrum methodology and past projects. The second alternative is using a fixed price as a percentage of the combined total from the Scrum teams. Critical Chain Project methodology suggests minimum of 20% buffers to a project. Many finance Organizations expect a 10-15% cost buffer over initial estimates on major projects. Both above suggestions should take the projects size and area in to consideration.

There is also the aspect of using Agile that you will always know what the minimum cost for a project will be, of course the downside is that you do not know the complete cost until you have a finished product.

**Time thieves**

Problem:
Changes that are made along the way to projects that manifest themselves by being time consuming and delay the project. When the project is over there are no logs in which the changes made can be tallied up and the wasted time and effort translated into cost.

**Recommendation:**
In the bigger projects were there is a need of keeping track of time and changes in the sprints I would suggest that the product owner keeps a log where the changes asked to be made by the business is logged. This will then show when and why a specific project ran over the estimated schedule. The company might also want to consider using a template so that all the product owners log in a comparable way.

As Schmidt(2005) stated it is the unnecessary changes that along the way that causes project overruns and delays. However as Agile is constructed to be a flexible system that takes constant changes into consideration by working in sprints Cohn(2012). The changes should however be monitored and logged to be able to have a transparent reporting in the end of the project.

**Maintenance**

Problem:
In the time estimation for different features there is no consideration taken for regular maintenance.

**Recommendation:**
As mentioned earlier a buffer should be calculated for all projects so that each team has time to do the needed maintenance.

**Communication**

Problem:
Presenting numbers to management that works in both Agile and Waterfall. Reporting structure of the projects.

**Recommendation:**
First step is to make sure that all involved parties have the right understanding and education in Agile and Scrum.

Further I strongly believe that if the other recommendations in regards to cost estimation and business value are implemented the communication with upper management in regards to IT projects will improve.

A proper reporting structure should be organized to get:
- transparency
- follow up
- measurement

This is not only in regards to Agile Scrum projects but all projects across the company on both the IT and business side. The numbers that are produced by the projects must be followed up on and used to improve the project structure and communication.

To improve the communication between business and IT and to additionally minimize dependencies between the Agile Scrum teams the following structure is being suggested by the company’s Agile Coach.

There should be a project office responsible for all projects and they are responsible for sending out initiatives that should be picked up by the different Product Owners.

When such an initiative is received, the Product Owners meet to discuss the initiative and break them down to team specific initiatives where they can do an estimation of time. Also the Product Owners are in these meetings to discuss dependencies between the teams. By making the Product Owners responsible for the communication the responsibility is taken from the Agile Scrum teams so they can focus on developing the solutions, without worrying about dependencies to other teams. Also by having the initiatives coming from a central place in the organization the follow up and reporting can be more efficient and transparent.

The Product Owners will translate the storypoints to man weeks that the project management office will then be able to translate to money and budgets. This setup will not only enhance the project structure but also the project flow at the company. There would be clarity towards who is responsible for projects and how all communication should be executed.

By using the strategy by Wideman(2005) having a baseline which can be compared to the actual outcome of a project. However that risk and costs are factors that must be taken into account and managed all through the projects lifetime.

**Ownership**

Problem:
Making business take ownership and responsibility of the tasks they are asking to be developed and that they are documented in a sufficient and adequate manner
**Recommendation:**
First step is to make sure that all involved parties have the right understanding and training in Scrum and Agile. As Wideman(2005) points out if the executive management has a profound understanding of the project process and takes responsibility, then you can have an effective project cost control. Meaning that the management should know what Agile Scrum is and what their responsibilities in that regard.

Another tool that should be used for making the projects more transparent for both IT and business is using a business value. According to Rico(2009) the two most basic inputs into almost any measure of business value are (1) cost and (2) benefits. By using a business value measure the business according to Milanov(2011) needs to define which minimum set of functionality and features of the software solution in what moment on the market can lead to the beginning of the return of investment.

By making the business aware of the value they will be clear and precise in what they want delivered. Further by setting some business value on projects that are quite common in the gaming industry the knowledge of how and when will increase for all involved parties.
7. CONCLUSION AND FURTHER RESEARCH

To conclude the study it is clear that cost control and cost estimation is a problem when it comes to any of the Agile methodologies including Scrum. Several theoretical methods and techniques are available but there is a gap to actual methodologies being used in the software development projects at various companies today. Being that the Agile Scrum methodology is so flexible and works in several iterations the cost for every change also has an increase in the cost of the actual project.

The way Agile and Scrum is constructed does give the development leeway to adjust to new requirements and constant changes without needing to change everything every single time. By using the Agile methodology the management has the ability to see in a transparent way what the outcome is of the invested money, time and effort.

However the downside is that using this method the senior management usually has a hard time understanding why IT cannot deliver the correct figures so that they can make better long- and short term plans for the company.

Agile methodology and in the case study company Scrum, is an excellent choice for a company where the requirements are constantly changing and there is a constant need of being a head in the industry.

However it is crucial that a company using the Agile Scrum methodology finds a cost estimation technique that gives cost estimation on the on-going projects. A method that will work together with the teams and also give the management the ability to budget and plan for both the short and long term future.

The conclusion for answering the question “How is cost control affected and managed in Agile driven development projects?” is quite complex and very individual to each company using an Agile methodology. There is however a need for a more easy and manageable cost control structure and implementation both from management and development sides. Having a flexible and easy adjustable software development at any company should not be sacrificed by insufficient cost control. These two must co-exist side by side to have a successful company both in development and profit.

7.1 Further Research

This paper explored the usage of Agile methodology and how cost control is affected and managed in Agile driven development projects. There are several studies made, which can be used in calculating estimates for Agile projects but there is a need for exploring how to calculate an estimate for projects that include several Agile Scrum teams.
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8.2 Oral References

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9. ABBREVIATIONS

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<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>APM</td>
<td>Agile Project Management</td>
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<tr>
<td>DSDM</td>
<td>Dynamic Systems Development Method</td>
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<td>LSD</td>
<td>Lean System Development</td>
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<td>NPV</td>
<td>Net Present Value</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>PBI</td>
<td>Product Backlog Item</td>
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<td>PMBOK</td>
<td>Project Management Body Knowledge</td>
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<td>ROA</td>
<td>Real options Analysis</td>
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<td>ROI</td>
<td>Return of Investment</td>
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<td>RUP</td>
<td>Rational Unified Process</td>
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<td>WBS</td>
<td>Work Breakdown Structure</td>
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<td>XP</td>
<td>Extreme Programing</td>
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APPENDIX-A

Interviewguide

Themes:
Scrum
Cost
Control

-How is costs handled in projects?
-Is there a budget for projects?
-How often does a project go over budget?
-How and how often is there a control that a project is following the projectplan?
-How are controls made to validate how a project is time/cost compared to how much is finished of the project?
-Is there any estimation made on the final cost of the project? Time?
-What is done when a project seem to be over budget in regards to time/budget?
-How is it ensured that a project fulfils the requirements?
-Is there a demand to be done on time?
-Is there any fixed costs in regards to storypoints? Hours/weeks/days?
-Is old data/history used?
-How is a day calculated?
-What is a storypoint?
-Are the storypoints the same for all teams?
-How are the resources allocated?
-Is the Agile/scrum sufficient methodology?
-What kind of numbers/statistics are presented to management?
-Does management have an understanding for Scrum?
-Is there a support for Scrum in the company?