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Do Verganti's (1999) ideas of Planned Flexibility still hold today?

Bachelor Thesis in Business Administration
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Abstract

Much can happen in 16 years to a field of expertise such as Management. For instance, the economy can fluctuate, fresh social trends can bring change and new innovations can shift the course of where society is headed. In 1999 Verganti conducted a research of companies' ability of incorporating flexibility into innovation processes. Distinction was made between anticipation and reaction capabilities, where anticipation required a great extent of homework in order to be accurate. He argued that depending on the environment of the industry in which the company operates, different degrees of reaction capabilities were required. However, he concluded that projects with complete lack of anticipation capabilities could not be successful. The aim of this study is to question whether the conclusion Verganti reached in 1999 still holds, or if projects solely relying on reactive capabilities actually can succeed in today's market. Interviews were conducted with two different project leaders operating projects within the vehicle and computer programming industry respectively. The project active in the vehicle industry typically uses an anticipative approach with very successful results. In contrast, the computer-programming project adopts a solely reactive approach, yet very prosperous within its industry.

Keywords: Planned flexibility, Verganti, flexibility, Product innovation management

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1 Introduction

Along with the rise of project management in the 1950's, project planning became an issue. Many studies have shown that planning is a factor that impacts project success greatly (Murphy et al., 1974; Pinto and Slevin, 1987). Dvir et al. (2003) performed a study on 110 projects and concluded that the initiation phase had the greatest impact on project success. The early phase of a project is characterized by a lot of uncertainties, but also that decisions taken in the early phase have a large impact on the outcome. The customer needs/wants and the technology to satisfy those needs/wants will most likely change during the project and hence the traditional linear models of project planning, where decisions are taken early on, have been criticized (Verganti et al, 2001). The later phase of a project however, is characterized by lower uncertainty but also that changes are harder to implement. (Olsson and Magnusson, 2007).

The commonly used model Stage-gate is a linear process where a task is performed and quality controlled at the next gate (Cooper, 1990). Previous studies have shown that the Stage-gate process is successful in stable environments (Cooper and Kleinschmidth 1996). However the value of Stage-gate has been questioned in uncertain and dynamic environments (Bhattacharya et al. 1998, Iansiti and MacCormack 1997). Instead, overlapping developing stages are proposed because new information regarding market need and technical opportunities will probably emerge during the project (Verganti et al.2001, Iansiti and MacCormack 1997).

Dvir and Lechler (2003) categorize change as the notions of plan and goal change. Changes in plans are usually caused by the environment or are just a result of poor planning. These changes cannot be controlled and the project manager can only try to, in the best possible way, deal with the situation. Goal changes are usually a response to stakeholder requirements. A goal change can be change in requirements, the inability to meet current requirements or the necessity of the projects end goal changes. Changes in goals can be somewhat controlled by collaboration between the project team and the stakeholders.

Goal changes were found to have the strongest negative impact on project success (Dvir and Lechler 2003). As goal changes lead to plan changes, the project managers have to control the negative effects of plan changes by sorting out all the goal changes that are not essential project success. Dvir and Lechler (2003) argue that freezing requirements as early as possible

can help avoid changes. Freezing the requirements and design can be another way to mitigate goal changes. Freezing appropriateness however depends on the technological uncertainty. Dvir and Lechler (2003) further stress that it is important to find the ”real” requirements of the customer as it can reduce the amount of changes in the later phases.

According to Verganti (1999), studies have shown that technological and market requirements often change during the course of the project and complicate the process – as a consequence freezing design should probably occur during a later phase of the project. Verganti (1999) highlights that the central part of conflict in product development projects is between making decisions during early or late stages of the project. Most companies recognize the importance of making good decisions early on as they realize that early decisions are unlikely to be changed later. However, the dilemma is that it is hard to make good decisions early on due to the high degree of uncertainty and therefore an alternative method is to delay decisions until better understanding has been achieved (Verganti 1999).

Studies have shown that companies that do not innovate will not prosper in the long run (Järrehult, 2015). Innovation can be achieved by either finding a new market and/or technology (Järrehult, 2015). A project that creates a new technology is called a product development project and this category of projects is therefore essential for companies to stay competitive in the long run. Building on that fact, according to Chatzoglou and Macaulay (1996) controlling and planning often tend to restrict creativity through formal control, which in turn affects project success and thus formal planning and control should be kept to a minimum.

A flexible product development process is characterized by the capacity to gather and respond to new information during later phases of the development phase. Verganti (2001) suggests three concepts that support such a process: greater investment in architectural design, earlier feedback on product performance from the market, and a development team with greater amount of experience. To capture maximum value of the flexibility, which is generated by investing in architectural design, the developing process need mechanisms for generating and responding to new information. The search process requires focus on major reasons of uncertainty, which can both be technological- and market related and requires search throughout the development. To allow quick and low cost changes in the design, a change to one part of the product architecture should have minimized impacts on the rest of the system.

Another required ability is to be able to integrate the information gathered from the search into the evolving design (Verganti 2001).

What defines a successful project? Nicholas (1989) states that a project is believed to be successful once the objectives or goals of the project are reached. Consideration must be taken to aspects such as time, cost and quality, although focusing on some criterion can result in a tradeoff effect on another. Setting up pre-determined goals means that the project leader agrees upon some loss due to tradeoff effects. Nicholas (1989) concludes that a project is regarded successful if the key participants of the project are satisfied.

1.1 Formulation of problem

There are many studies regarding the planning phases and flexibility in projects. However there are few studies that actually examine the relationship between flexibility and project success. Verganti studied this relationship in his paper called Planned Flexibility (1999) where he compared the degree that companies freeze decisions early, called degree of detailed anticipation, to the degree that companies actively examine the possible decisions but does not freeze until later, called degree of selective anticipation. His findings were that having a high degree of both detailed and selective, high degree of detailed and low degree of selective, and low degree of detailed and high degree of selective could all be successful. Nonetheless, he also found that having a low degree of both detailed and selective approach, which he calls postponers, could not be successful.

Vergantis study (1999) on planned flexibility presented some interesting findings such as the fact that companies that rely solely on postponing their decisions, having low degrees of both selective and detailed anticipation, cannot be successful. However, with the rise of methods such as Agile Project Management coupled with a higher rate of technological change, means that companies have smaller time-frames to launch new products. Verganti's model (1999) should thus be examined once again to see if his conclusion, that postponing strategies cannot succeed, still holds today. A new generation of project management has emerged since Vergantis study, which leads to the question: Does his conclusions regarding what approaches that are successful and not successful still hold?

1.2 Thesis aim

The aim of the study is to examine approaches to flexibility that allow for project success, by looking at degrees of flexibility of different successful project management styles for Swedish companies. The analysis will build on the most common models for project management as well as theories regarding flexibility with emphasis on Verganti's study of Planned Flexibility (1999). Since the aim of the study is to examine approaches to flexibility that allow for project success, the research question is: *Can a company classified by Verganti (1999) as a Postponer, where little focus is put on detailed planning and much of the process is left undecided as long as possible, be successful in today's business environment?*

1.3 Delimitations

The study looks at product development projects solely and can therefore not be generalized for all projects. Also, the study mainly uses Verganti's definition of flexibility and can therefore be limited in the way that it can speak for flexibility in general. Due to geographical limitations, focus has been placed on Swedish companies. As the thesis aims to analyse whether or not different degrees of flexibility still makes it possible for a company to be successful within its industry, a delimitation is that focus will lie on companies who perform well in their markets.

2 Methodologies

The study was initiated by conducting a thorough literature study on project management and flexibility during projects. The theory gathered in the literature study was then used to analyze two companies. The empirical data was gathered by interviews and material provided by the companies. Lastly, the study resulted in a conclusion based on how well the theory correlated with the empirical data. An iterative approach was used during the implementation of the study, which means that this study was by no means a sequential project. Knowledge and insights were gathered along the course of the project and hence there was a need to go back and adjust accordingly.

2.1 Research design and method

The study is categorized as a case study as the study will compare successful companies and the main purposes of a case study is comparing and illustrating different situations (Denscombe 2009). A qualitative analysis was chosen in order to allow a deeper understanding of the dimensions and implications of the findings (Starrin and Svensson 2006). The advantage of a qualitative study is therefore that it is possible to get more detailed data, which can be beneficial seeing as the concept of flexibility is very gunky (Denscombe 2006). Because of the choice of qualitative analysis, there is a risk of bias, however the authors of the study has tried to minimize this risk reflecting over subjectivity and thereby trying to stay as unbiased as possible in their interpretations.

Verganti's study in 1999 was quantitative while this study is qualitative, which creates an inherent weakness in comparing the studies although conclusions that can be drawn are still believed to be of significance and this study might even provide more depth than the study by Verganti (1999).

The selection of companies was influenced by the geographical proximity of the companies. The main deciding factor for the process of selecting companies was that the company should have had success with previous projects, thus being prominent in the industry. Swedish companies were chosen because of their proximity, but also because Verganti looked into Swedish and Italien companies and therefore Swedish companies.. Also, the authors wanted to look into the same industries as Verganti did to replicate his study as much as possible. Therefore, the vehicle, helicopter and white-goods industry were looked into initially in order

to replicate Verganti, One of the interviewed companies was chosen from these three industries to act as as a control company and see if this study would get the same results as Verganti. A successful truck company in the Gothenburg region was chosen because of the similarity to Vergantis choice of oject tot study, the proximity of the company and the fact that the company is very successful.. The computer programming industry was also looked into because it is renowned for agile methodologies and thus believed to be a postponing industry. A computer programming company that are dealing with mainly accounting and business services programming were chosen because they are one of the most successful computer programming companies in their industry.

2.2 Literature study

Initially, a deeper understanding of project management was needed in order to be able to answer the research question. Thus methodologies such as Stage-Gate, Waterfall, Concurrent Engineering and Agile Project Management were looked deeper into. Literature was found by searching in databases, consulting experts in project management and by manual searches in reference lists. All literature was critically reviewed to ensure that it was trustworthy. The literature study created an understanding of the subject that was deep enough to interview and analyze the companies.

Due to the vast amount of literature on flexibility it is very hard to define what the term "flexibility" actually means. This study relies heavily on the views of Verganti (1999) and Magnusson & Olsson (2007).

2.3 Interviews

A book on how to conduct interviews (Häger 2007) was also read due to the fact that the project included several interviews. The study of how to conduct interviews enabled more optimized interviews and thereby more relevant data. Unstructured interviews would not ensure that the right data would be received while a structured interview is hard because of the interviewees having different backgrounds, positions and perspectives Denscombe (2009). Hence, semi-structured interviews were deemed most appropriate.

Two interviews were conducted with two different project managers and lasted for about 2 hours each. The interviews were conducted using semi-structure and enabled a certain degree of freedom for the interviewees to get a fuller picture while at the same time ensured that the

desired information was collected. The same interview framework was used to make the interviews as compatible as possible.

The interviewed companies were chosen due to their representation of what Verganti (1999) considered to be a successful and a failing approach. The Brake project represents what he describes as a successful Stage-gate approach that is carefully planned. In contrast, the Computer-programming project represents a failing method of a loosely planned timeframe and unstructured process. Further, the interviewed companies were chosen based upon being successful, which is defined in this thesis as a project that achieves its set goals and objectives with agreed-upon tradeoff effects (Nicholas, 1989).

2.4 Critical review

The fact that the study is based on several sources of literature and people creates a need for critical review. The level of knowledge within the subject was initially low and experts helped guide the authors in what areas to focus on. The literature is without doubt credible, however the study might have been influenced by the views or opinions of the experts.

A large portion of the initial knowledge on project management was gained from Harvey Maylors book Project Management (2010). The knowledge gained from the book has, due to limited time, not been able to be verified from other sources. Therefore there might be risk that subjectivity from the author has influenced the study. There might also be reason to review the fact that the interviewees might have influenced the study due to subjectivity.

Furthermore, there is no evidence that the research methods and designs chosen are the best ones to answer the research question. There is also no assurance that enough interviews were conducted to create enough significance of the data. The study is influenced by a few project managers that are not necessarily representative for the population within the category. Furthermore, the selection process of companies was influenced by what companies that responded to our requests and were willing to be interviewed.

Difficulties can arise since this thesis is based on qualitative methods, whereas Verganti used a quantitative research approach. It can thus be difficult to justify drawn conclusions based on separate methods.

2.4.1 Validity

There is a risk that the interpretation from the interviews have been influenced by the literature study and that the conclusions were drawn in relation to the literature rather than reality. This risk was minimized by follow-up questions to create a deeper understanding of what the interviewees actually meant. To further increase validity, clear questions were posed. However, getting different perspectives was hard due to the fact that only one person was interviewed per company (Björklund and Paulsson 2003). The validity of the study was also increased by having the respondents approve the interview transcription. When drawing conclusions for a thesis based on qualitative data from a research conducted on quantitative data, there can be difficulties justifying the translation. However, since qualitative methods require interpretation and argumentation, the authors consider the validity of the thesis to be intact. Verganti's (1999) definition of flexibility, further described in chapter 3, has been used in order to justify translation from quantitative to qualitative methods.

2.4.2 Reliability

It has not been possible to control the genuineness of the data collected from the interviews. This is due to the fact that the projects were either already completed or had a longer time-frame than the study. Also, the interviewees were only interviewed once and could therefore not be controlled by a second round of interviews. The reliability of the interviews has therefore not been verifiable. However, having two interviewers present during each interview increased the reliability of the studies. The best way to test the study's degree of reliability would be by repeating it (Björklund and Paulsson 2003).

3 Models and theoretical framework

The following chapter reviews the history of project management, the most crucial models and concepts to create an understanding of project management, and also an in-depth description of Verganti's notion of planned flexibility. It is important to understand the concept of each and every model described in this chapter in order to grasp what is discussed in this thesis. Some models require knowledge of another model in order to make sense to the reader.

"Chicago's Millennium Park is one of many millennium projects around the world that ran into problems. It trebled its original US$150 million budget and was delayed by four years, finally being formally completed in July 2004: it suffered from a process that didn't work. The fast-track idea was applied to this project to allow construction work to start on converting the former railway yard into a park before the design work had been completed. The problem appears to have been that the designers, developers and various contractors before the start of works had not agreed the overall scheme for the park. As a result, features were added, then removed, work had to be done and then redone when the designs were changed, and the city found itself in contractual wranglings"
(Maylor 2010 p. 115)

The example above is a perfect illustration of the issues that are related to planning and executing a project. Humans have undertaken projects for millennia, but project management was not really recognized as a discipline until the 1950's. The 1950's is the starting point of what is called the first generation of project management, which is when planning processes and numerical methods for quantifying uncertainty started being developed. Before the 1950's there were no generally recognized methods or processes, instead much of project management was industry-specific practice. Many associations, such as Project Management Institute (PMI) for instance, were founded between the 1960's and 1970's.

The second generation of project management was during the 1990's (Maylor 2010) when the profession as a whole and also standards within project management was increasingly recognized. The third generation of project management has been ongoing since the 2000's and is characterized by acceptance of the need to develop project management, a large consultancy sector, minimum standards required to take on the role as a project manager, and the development of lean and agile project management.

There are many definitions of what a project is, but there are some common themes such as being unique, temporary and focused. This means that a project has some degree of novelty, has a defined beginning and end, and the task of a project is to deliver some kind of result. The PRINCE 2, which is a UK government, standard for project management, defines projects as: "A management environment that is created for the purpose of delivering one or more business products according to a specified business case. And: A temporary organization that is needed to produce a unique and predefined outcome or result at a given time using predetermined resources." (Maylor 2010 p. 5) PMI, which is the largest professional association for project managers in the world, defines the matter as: "A project is a temporary endeavor undertaken to create a unique product, service or result." (Maylor 2010 p.5)

While general management focuses more on maintenance, project management is more focused on innovation. General management is characterized by managing the status quo, having a consistent set of tasks and main task is optimization. Project management on the other hand is characterized by an ever-changing set of tasks, being predominantly concerned with innovation; main task is resolution of conflicts and containing intrinsic uncertainties (Maylor 2010).

Maylor (2010) describes the project process as a transformation of an input into an output. The project process also needs a set of mechanisms in order to happen, however there are also constraints that affect the project and needs to be considered. Inputs are needs or wants while outputs are satisfied needs. Constraints are factors such as time, cost, quality, political, economic, social, technical, environmental, legal and indirect effects. Mechanisms are means such as people, knowledge & expertise, financial resources, tools & techniques, and technology.

Maylor (2010) also separates a project into four distinct phases; define the project, design the project process, deliver the project, and develop the process. Maylor further stresses that costs are generally low in the beginning, but rises rapidly during the delivery phase. As of today there are many methodologies for project management such as Waterfall, Stage-gate, Agile/Scrum, PRINCE2 et cetera. (Workfront 2014) Waterfall is more of a traditional methodology that focuses on extensive planning while Agile for example is more iterative and

change driven. According to workfront.com there is no one-size fits all methodology; determining what methodology to use depends on the environment.

Maylor (2010) categorizes projects depending on their degree of uniqueness. Projects that have a very high degree of uniqueness and therefore aim to deliver an outcome that have never been done before, such as the first moon landing, are called 'first-timers'. Projects that have a slightly lower degree of uniqueness and therefore some aspects of similarity to previous projects either in the process or the desired outcome are called 'As…but…s'. In contrast, projects that have a low degree of uniqueness, resulting in known processes and outcomes, are called 'Painting by numbers'.

The higher degree of uniqueness a project has, the more uncertainty and risk emerges. It is therefore, according to Maylor (2010), good to categorize projects because 'As…but…s' and especially Painting by numbers do not need the same level of project management. 'First-timers' on the other hand need a high level of project management to be successful because of the great amount of uncertainty. Olsson and Magnussen (2007) define uncertainty as the difference between needed and available information.

3.1 Flexibility

When managing a project, there is always some degree of uncertainty. To be able to succeed in an unsure environment, qualities such as adaptability and robustness form what is described as flexibility. By postponing irreversible decisions and instead focusing on gathering crucial information, a company increases their flexibility. Generally, more information becomes available the further into the project one gets. With access to a wider span of information, it is easier making decisions that will benefit the company. In traditional project management, flexibility is not a desired characteristic of a project. However, in changing environments with a lot of uncertainty, a company needs to adapt in order to survive. As previously mentioned in the iron triangle model, time, cost and quality are the three important elements when deciding where to place focus on the project. Introducing flexibility into project management creates difficulties to plan and execute a project under stability, mainly in regards to time, cost and quality. On the contrary, when facing crucial decisions with little information available, making the wrong decision can become more costly than having the possibility to delay the decision (N. Olsson and O. Magnussen, 2007). This is illustrated in Figure 1.

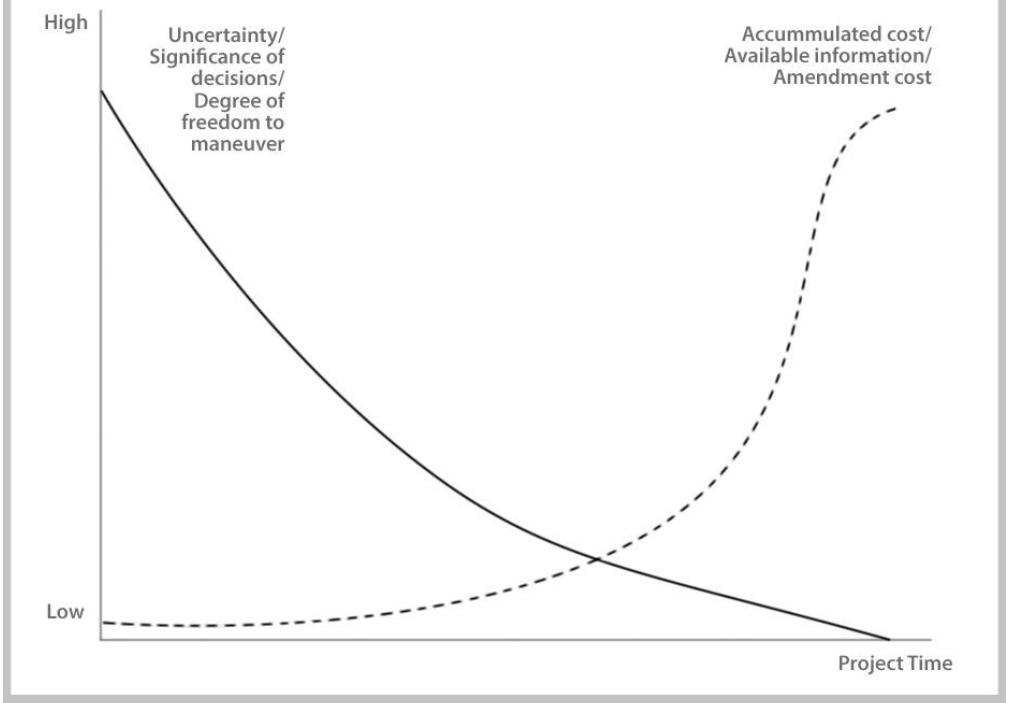


Figure 1: Illustration of uncertainty and significance of decisions in comparison to accumulated cost and available information

(N. Olsson and O. Magnussen, 2007)

3.2 TCQ

Before undertaking a project, it is important considering priorities and constraints. The iron triangle, a model based on the relationship between time, quality and cost (see Figure 2), emphasizes that one cannot maximize a project's quality, shorten the time-span and minimize costs simultaneously. One of the three elements has to be compromised in order for the other two to succeed, which implies the importance of setting one's priorities straight at an early stage (Maylor, H. 2010).

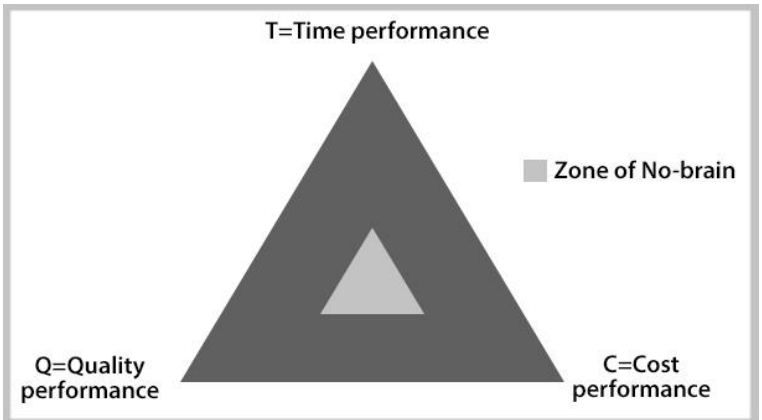


Figure 2: Illustration of the TCQ model

(Maylor, H. 2010)

3.3 Waterfall model

The waterfall model was created from managing computer programming development processes; although its underlying concept has been widely used regardless of what industry the company operates within. The essence of the model is to illustrate a waterfall where the water (or process) gradually moves towards its destination, at the bottom. Figure 3 describes movement within a process from stage to stage. The illustration is based on the original concept of Royce (1970), although made more general to suit all industries and their respective product innovation processes.

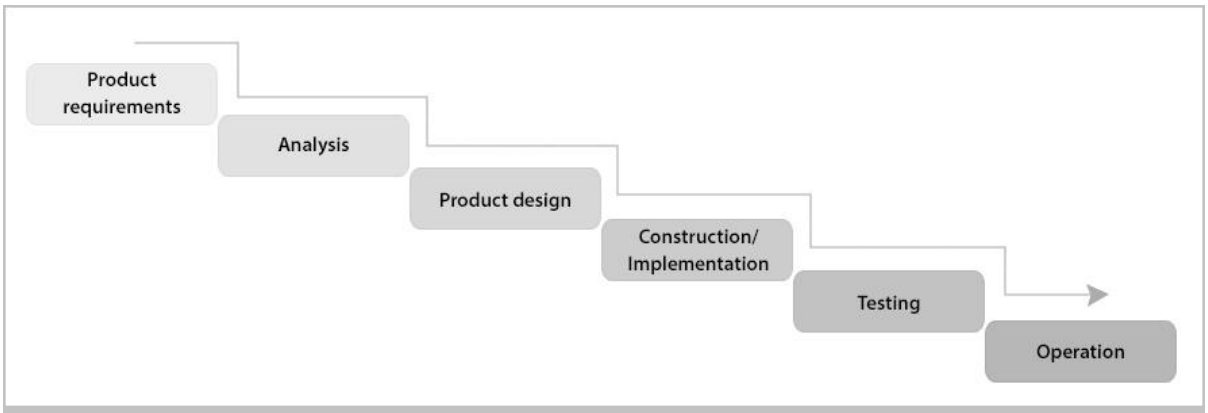


Figure 3: Illustration of the principle behind the waterfall model from Product requirements to Operation.
(W. Royce, 1970)

Implementation is done in three steps and begins by designing the product without involvement from analysts or engineers/programmers. Secondly, focus is put on allocating resources depending on the type of product the company is working on. It is important to allocate resources, even though uncertainty exists. Finally, documenting the process and illustrating it clearly is a requirement for all employees to get a deep understanding of what is required of them and how the process is planned (W. Royce 1970).

3.4 Concurrent Engineering

With the primary objective of decreasing lead-time yet improving the quality and cost aspects of the iron triangle, Concurrent Engineering (also referred to as Simultaneous Engineering) was developed during the late 80's to increase competitiveness. The main idea is to integrate the different development processes such as product design and production process.

Concurrent Engineering is a strategy to manage a product development project where focus is placed on different departments working parallel as much as possible, instead of sequential.

As illustrated in Figure 4, the individual processes of the project overlap each other in order to facilitate communication and teamwork between departments such as product design, materials selection and prototype testing. Some departments' processes are easier to place parallel with each other, requiring them to collaborate and communicate to reach common goals that work for both parties, whereas cooperation between other departments is completely irrelevant (Sohlenius, 1992).

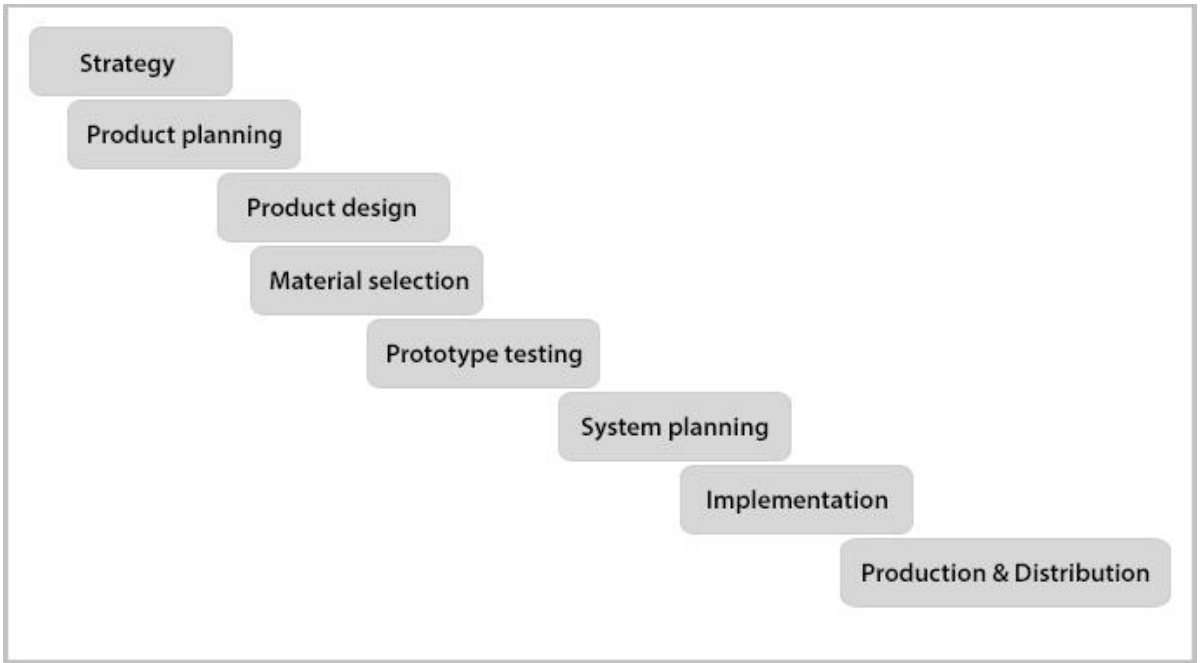


Figure 4: Illustration of Concurrent Engineering where tasks are performed parallel to each other in order to save time without sacrificing cost or quality.

(Sohlenius, 1992)

When managing a project it is possible to save time without compromising the last two elements of the iron triangle, cost and quality, argues Sohlenius (1992). By placing some processes parallel to each other, each process still receives the time originally intended for them without sacrificing cost or quality. All elements of the project remain the same, however accomplished within a smaller time frame by overlapping activities.

3.5 Stage-Gate

This model is often used in different companies and contexts to varying extents. It is thus important to understand the idea behind the model

The Stage-Gate model operates under the assumption that product innovation is considered a process, thus possible to manage. The model is broken down and divided into stages, described as workshops (see Figure 5). Each stage is separated by a gate that functions as a quality control checkpoint with demands on specific deliverables, which are determined

beforehand. The results achieved from a stage are critically evaluated at the gate with four possible outcomes, go, kill, hold or recycle. The size of the project determines whether or not senior managers act as gatekeepers since processes of large importance requires input from top managers. Responsibility lies in the hands of the project leader to manage the process from initiation to completion, ensuring consistency throughout each stage (Cooper, R. 1990).

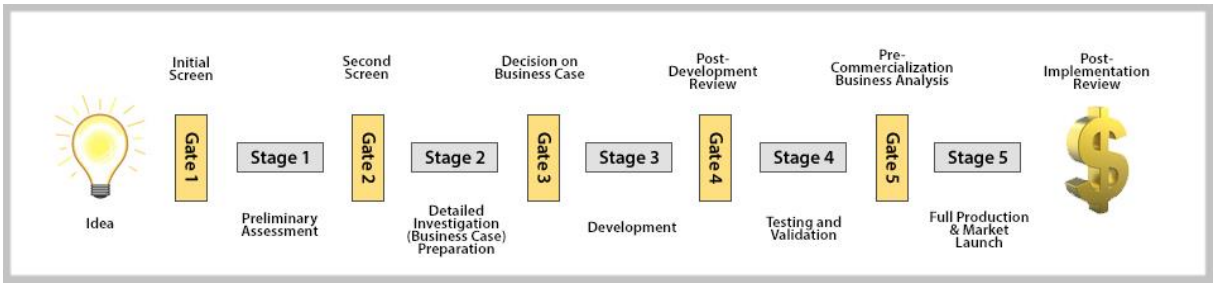


Figure 5: Illustration of the Stage-Gate model's process from idea to post-implementation review.

(Cooper, 1990)

Research has shown that product processes that are considered market failures generally showed lack in efforts during early stages of the process, also referred to as homework. Examples of early stage activities are market studies and assessments as well as marketing research. Complaints are often raised when an increased amount of homework is introduced, formulating that it would only extend the time required for development. Although increasing the time frame, doing a thorough job during the early stages of innovation process leads to improved results. When homework is done carelessly, two risky situations arises. First, questionable projects may falsely pass quality controls due to inadequate market research, thus leading to poor definitions of deliverables at each gate. This results in unnecessary expenditures and lacking quality of the final product. Second, a product is rarely launched having identical characteristics as the original idea, showing that as the company gains more knowledge of the product and its surrounding factors, the product design requires adjustments. If more time and energy is spent on doing homework, the natural evolution of the product can come at an early stage before entering production, reducing costs dramatically. An increased success rate and decreased costs, by making changes early on in the process, will improve quality although compromising time (Cooper, 1990).

According to Cooper (1990) Stage-gate systems often operate in a parallel manner due to urges from top management to decrease the time span intended for the process. In addition, better communication can be obtained between the various departments who are active in

different stages. Increased efficiency through enhanced communication and a parallel work process improves quality without sacrificing the element time – instead, cost can suffer.

3.6 Agile Project Management

With time, projects change, its resources, budgets, competition, markets, even the customer can change. Ignoring a continuously changing environment is more dangerous than spending time and resources on adapting to those changes. Agile Project Management has been developed to help managers operate in transforming environments; mainly computer programming development where technology-, competitors- and customer-needs progress rapidly. In this context, computer-programming development is seen as an alternative way of manufacturing or a construction project. The Agile model is mainly built on sequential processes such as the Waterfall model, where one element needs to be finished before moving on to the next. Agile Project Management supposes that change needs to be managed, rather than avoided for a project to succeed. Planning should only be done to the minimum and most crucial extent; otherwise it is only a waste of time and effort. The goal is to deliver a product to the paying customer, with the demanded functions as soon as possible. To understand the practice of Agile Management, three questions need to be answered: who is the customer, what is the feature and when is the feature done (Karlesky and Vander Voord, 2008)?

Defining the Customer

The company paying for computer programming development is obviously a customer, however the customer's role can be somewhat confusing. If a product is being developed for a team or an entire company, there still needs to be one person who keeps contact with the developer in order to avoid multiple messages and conflicting opinions. The chosen person from the customer (buying company) thus acts as their voice. The end user of the product can be different people, especially when a company buys a product aimed to be sold at a market, in which case it is crucial to incorporate user (end customer) feedback when the customer (buying company) make their decisions. Closing the gap between end user and development facilitates the making of the product and requires fewer adjustments later on in the project process (Karlesky and Vander Voord, 2008).

Defining the Feature

Features are viewed from the customer's point of view, which also determines the required functionality of the product. The product's functionalities should be described by the

customer in his or her own words explaining a desired behavior, not how the product should be built. The product needs to be evaluated and meet the needs of the end customer, thereby satisfying the buying company and making them willing to pay for the product. Features, also called stories, describe system behavior, thus referring only to final functionality and value to the end user. The main reason behind this thinking is that computer-programming development can be done in several ways and as long as the end user is satisfied when using the product, the structure of the underlying code is not what is important. This way of thinking might be strange in other industries, but perfectly normal and accepted in computer programming development (Karlesky and Vander Voord, 2008).

When the Feature is Done

In regular Project Management, a project is considered "done" when the developer is finished with his work and "done done" when the feature is fully complete. In Agile Project Management however, the term "done" can be measured and thereby determine the degree of completion. The feature is done once it has passed all tests and is accepted by the end user. Some tests can be automatically performed and validated by computers; others require human use (Karlesky and Vander Voord, 2008).

3.6.1 Scrum Management

Scrum is a type of Agile Management for product development focusing on working across the involved department functions. Each team consists of approximately seven people, self-managed and responsible for operating within the set framework. Repeated cycles or iterations, also called sprints, are generally set to two weeks or 30 days, during which the teams need to have completed a fully sellable product at the end of each iteration (James, 2010-2012).

The idea is that the Waterfall model approach is applied to all iterations, making room for flexibility within the project and allowing late stage alterations. Every iteration can thus be viewed as its own process, crucial to complete the actual project from vision to deployment on the market. As displayed in Figure 6, scrum offer customers the opportunity of requesting changes later on as the process develops from iteration to iteration (James, 2010-2012).

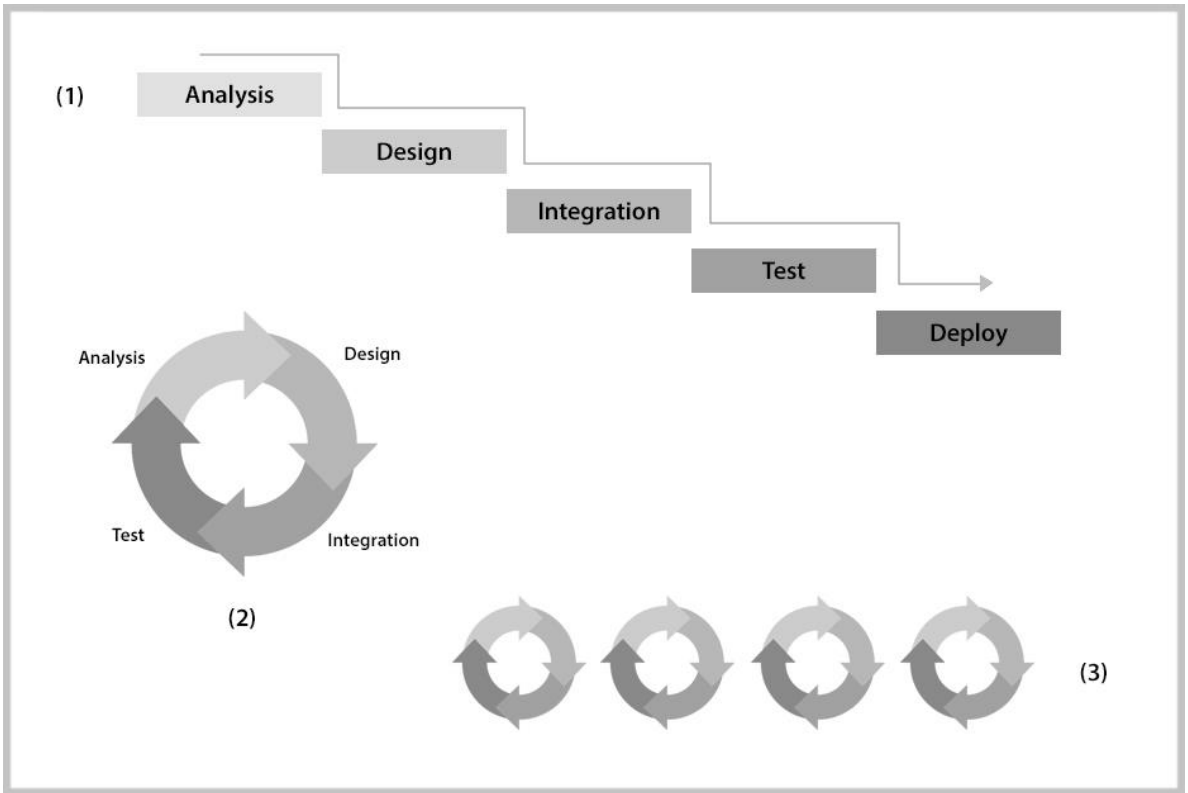


Figure 6: Illustration of the Scrum Management process with continuous iterations. Each iteration can be described through the Waterfall model seen in Figure 3.

All iterations contain the same steps, shown in the waterfall model (1), where the next task follows the previous upon completion. However the process can be seen as circular (2) since every iteration is repeated in the same way. When an interation is complete, the project is assessed and the decision is made to either deploy the product or issue another iteration.

(James, 2010-2012)

The Scrum framework pinpoints three different key roles within the process, product owner, Scrum development team and ScrumMaster.

Product Owner

James (2010-2012) continues to describe that one person is chosen to represent the customer and is responsible for making sure that the Scrum team can deliver an increased value to the customer. A Scrum team should consist of one Product Owner, autonomous from the ScrumMaster. This person solely holds the right to terminate or continue development of the product, thereby operating on a leading role. It is important for the product owner to take the stakeholder's interests into consideration when making decisions.

Scrum Development Team

The team is composed of different set of skills, making it multi-functional with capabilities from business analysis, developers, designers etc. As a self-managing team, communication is done through the product owner during the current sprint. To succeed during the sprint, efficient communication, teamwork and a great deal of discipline is required, since the team

manages itself. Working face-to-face is therefore often required to succeed with this kind of management and thereby incorporated into the Scrum framework. The team can select a leader within the team or choose the Product Owner as their team leader (James, 2010-2012).

ScrumMaster

Bottlenecks or other drawbacks can often occur during product development, according to James (2010-2012), and to facilitate the work of the development team a ScrumMaster helps settle issues that can arise. By removing external issues from the actual product development process, the development team can focus their time and energy on good performance on the outcome of the current sprint. The ScrumMaster does not hold any power to manage the development team, only coach them and helping in ensuring a stable process to achieve a product that passes the sprint.

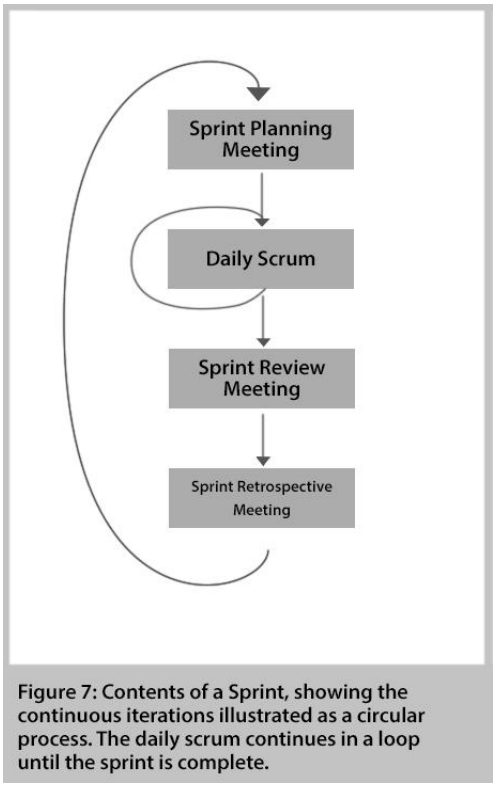


Figure 7: Contents of a Sprint, showing the continuous iterations illustrated as a circular process. The daily scrum continues in a loop until the sprint is complete.

(James, 2010-2012)

When introducing a new sprint, the Product Owner meets with the team to plan the upcoming process for the duration specified in the framework. Once the team has a clear picture of what is expected, they can start their daily scrum. The daily scrum consists of a short statement of what each team member accomplished the day before and what has been planned for today, including possible complications that can arise. In daily scrum, the idea is to remove individual work in order to facilitate teamwork and open communication. At the end of the sprint, a review meeting is held to demonstrate the product as a result from the ending timeframe. At this point, the product should be ready to ship and sell, making it a good opportunity to practically demonstrate the product to stakeholders. Before finalizing the sprint, a retrospective meeting is held to review the previous sprint. As illustrated in Figure 7, the team reviews what was done well and what was not during the iteration and what to consider for the next sprint (James, 2010-2012).

Scrum is one of the most commonly used approaches within computer programming development and is in many ways similar to the well-known theory of Lean Management. This type of management aims at offering a large degree of flexibility to the customer by arranging the work of those employed within the project through the Scrum framework (James, 2010-2012).

3.7 Planned Flexibility

An innovation project generally begins with product planning or product definition when trying to clarify what the company wants out of the process. Drawing up plans, setting requirements and specifying details can be a difficult task at an early stage of the process due to lack of information. Making large decisions in early phases restrains the company from future opportunities and does not leave room for reaction due to constraints caused by the locked in commitment. When reaching the phase of implementation it will be very costly, or even impossible to change the decision. Identifying downstream possibilities or constraints can be a difficult challenge in unstable and unpredictable environments, and wrongful decisions can lead to inadequate product quality. The further a company gets into a process, making adjustments and corrective actions affect cost and time dramatically. The result of this is that early decisions have the largest impact on the product's final outcome. In response, the concept of anticipation has had significant influence within this subcategory of project management. Anticipation stands for the degree of which a company is able to predict the future environment in terms of possibilities and constraints of the product. Factors to be taken into consideration are market requirements, utility of design, manufacturability of the product, relevance, authenticity, etc. To utilize the concept of anticipation, large efforts should be devoted to gathering information about what the future situation might look like, in order to facilitate early solutions to problems avoiding unnecessary sacrifices in cost and time. To aid anticipation, concurrent engineering can be used to enhance communication between units, thus setting early specifications of what restrictions each department has. Involving manufacturing and suppliers helps the project manager with early stage planning and anticipation (Verganti, 1999).

In contrast to anticipation, Verganti (1999) describes reaction and how it applies a completely different mind-set. Reaction refers to the ability to make changes during later phases of the process. The reaction approach has emerged due to the unpredictability of some situations,

where no amount of effort invested into anticipation will guarantee that the conditions found correspond with reality. Contexts where reaction can be relevant are swiftly moving industries where information does not become available until you enter the implementation stage, thus making the early stages less pivotal. Instead of spending time and energy on anticipating the future, the company can focus on deliberately delaying decisions to a time when more information is accessible and the situation is less uncertain. To be able to act in accordance to reaction, a higher degree of flexibility is required from the company in order to delay decisions.

Important factors to consider when examining the concept of anticipation and reaction are the different industries and environments in which they are operating. Planned Flexibility aims at showing that the importance lies in how the company manages early stages of the project rather than the importance of those early stages. More specifically, planned flexibility is the capability to integrate flexibility into the project process (Verganti, 1999).

Depending on the context in which the sampled companies operate, they devote different amounts of effort into anticipation and therefore require a corresponding amount of reaction. What was found by Verganti (1999) can be divided into two synthetic variables, Degree of detailed anticipation and Degree of selective anticipation (see Figure 8).

1. Degree of detailed anticipation: labels the amount of decisions anticipated and frozen during early stages, which offer little, or no room for revision further downstream.
2. Degree of selective anticipation: refers to the number of decisions carefully examined during early stages, however not frozen before implementation.

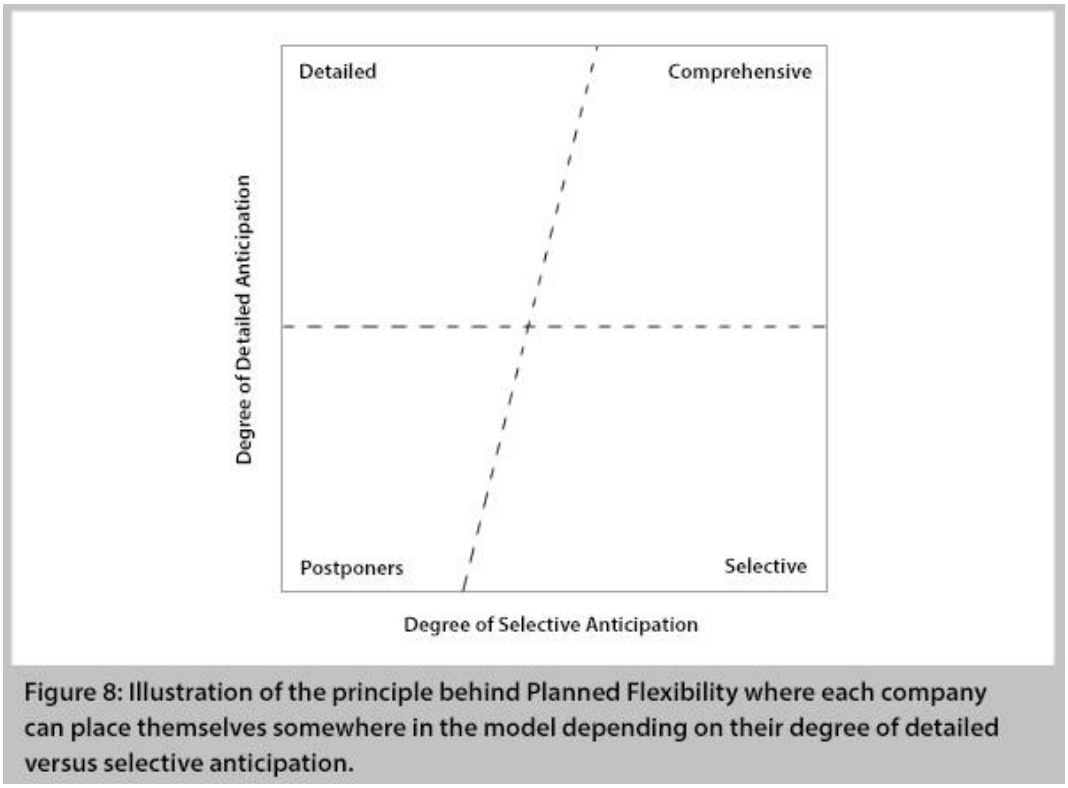


Figure 8: Illustration of the principle behind Planned Flexibility where each company can place themselves somewhere in the model depending on their degree of detailed versus selective anticipation.

(Verganti, 1999)

The Planned Flexibility model is divided into four categories, the detailed, selective and comprehensive approach along with the postponers. Through Verganti's research, the conclusion has been made that the most successful approaches were the first three, namely the detailed, selective and comprehensive approach.

The Detailed Approach

Understanding the Stage-Gate model will facilitate when trying to grasp the concept of the detailed approach.

Operating in this manner means detailed planning early on, thereby a high degree of anticipation. The individual phases are sequential, similar to the Stage-Gate model. Before entering the next stage, a gate must be passed where a quality control is performed, with the purpose of killing unprofitable projects and letting high potential projects further into its process. This type of approach wants to reduce late decisions and having to make corrective adjustments, thus requires a lot of effort put into reducing uncertainty about the future environment of the product along with its opportunities and restraints (Verganti, 1999).

The Selective Approach

Anticipation is made on a few, often broad decisions, to maximize the degree of freedom of noticing changes in internal or external factors and be able to adapt. Unexpected changes can therefore be fairly easy to take into consideration by adopting a reacting approach, rather than full-blown anticipative. Anticipation is not completely overlooked, instead resources are concentrated and all anticipative efforts are put into a few critical aspects of the project. The areas chosen to anticipate are generally the most uncertain and also most relevant to the life cycle of the product. Additionally, the decisions that are anticipated and frozen often require large amounts of resources, in terms of both time and cost, to adjust further downstream in the process. Aspects that mainly require anticipation are resource requirements, market needs, specific regulations, technologies or competitors situations. To over-specify product characteristics is rarely decisive here, leaving space for future decisions (Verganti, 1999).

The Comprehensive Approach

A combination of the detailed and selective methods is described by Verganti (1999) as the comprehensive approach. By attempting to make as many decisions as possible during early stages, based on anticipation, only a few aspects are left undecided and postponed. Several decisions are then frozen during the beginning of the project, leaving no room for flexibility during implementation. Decisions are strategically locked in to reduce cost.

The Postponers

In contrast to the comprehensive approach, the postponers do not anticipate in any way and start off their projects with implementation. These companies are generally small and rely entirely on the concept of reaction (Verganti, 1999).

None of the approaches on how to manage innovation projects has been considered a best practice on its own. Verganti (1999) argues that project success lies in the ability to implement the given approach, rather than just choosing one. As discussed earlier, the two capabilities include anticipation and reaction, both of which are woven into every day routines and values of the company. The degree of anticipation versus reaction needs to be embedded into managerial behavior, technologies and line of industry for instance. Reaction capabilities can be divided into five subcategories:

1. Flexibility in regards to product development processes, such as experienced designers, simulations, CAD and rapid prototyping.
2. Communication, with improved methods of communication to increase efficiency during problem solving.
3. Overlapped development activities in order to facilitate transition from concept and design development stages into implementation or similar.
4. Redundancies, which refers to allocation of resources that are supernumerary and might cause problems later on.
5. Flexible solutions where product design and architecture does not inhibit engineers and developers from being able to improve details.

In some cases, Verganti (1999) concludes that it is difficult excluding one of the capabilities entirely. Companies with highly anticipated decisions and lacking skills in reaction often (but not always) fail, showing that reaction capabilities are decisive within some industries and not as crucial in others. More specifically, a higher degree of reaction competencies are required if the company is having trouble anticipating downstream requirements and conditions.
Similarly, the anticipation capabilities have been divided into three categories of how anticipation works:

1. Systemic learning, one of the most important mechanisms, which is the capability of using information from previous work and projects about product life cycles and applying that to the current process.
2. Team working and communication, includes communication between departments to facilitate team working and drawing up the needs of processes further downstream. By involving major actors, the company gets information on what might restrain or foster the product further down the line.
3. Proactive thinking, by applying techniques for screening, quality function, determine cost, failure rate, effect analysis and so on, it is easier to always be one step ahead. By advocating proactive thinking, the company can be prepared of what is to come rather than reacting once it has happened.

Verganti (1999) argues that in order to prosper a detailed approach, a high degree of anticipation capabilities are required. The selective and comprehensive approaches also require the ability of anticipation, although not to the same extent.

Flexibility can be divided into two types, namely structural and planned flexibility. Structural flexibility refers to the ability to react as a result from practice and experience from completing multiple projects. Examples of this can be general skills of product and process design, teamwork capabilities or structuring projects. More specifically, structural flexibility is a capability that can be applied in any project and cannot be used to deal with uncertainty. Every project has their different critical areas, all of which has their own developed uncertainty. Structural flexibility is somewhat useless when it comes to dealing with unpredictable situations, thus leading to the concept of planned flexibility. Two steps are important to consider when applying planned flexibility, early identification of critical areas of the project and early planning for measures to be taken when trigger reactions arises. As a result, the level of planned flexibility is the deciding factor of a project's actual degree of flexibility (Verganti, 1999).

Regardless if critical decisions are deliberately delayed further into the project or locked in early on, the first phases (homework-stages) are crucial to reach success for any project. The only difference is how to view the early stages; if adopting a detailed approach, one can see the early phases as time for problem solving. In contrast, a selective approach recognizes that early stages are problem anticipation phases. Verganti (1999) concludes that no matter what approach the company uses, the early parts of the project are crucial to reach a successful result.

4 Empirical data

The following chapter describes the two investigated companies way of working with projects, both of which are successful on the market within their industry.

4.1. The Brake Project

Background

The interviewee is a consultant project manager for a truck project regarding brakes. The brakes will be used in the current generation of trucks and most likely in the coming generation as well. The goal of the project is to improve weight and cost of the brakes, but maintain performance. The project team consists of around 40 members with different backgrounds, but most of the members are engineers. The project started 2011 and is due 2017. The project's process can be illustrated through a Stage-Gate process with stages that are quality controlled at each gate. The further into the brake project they get, the more departments affiliate with the project (see Figure 9).

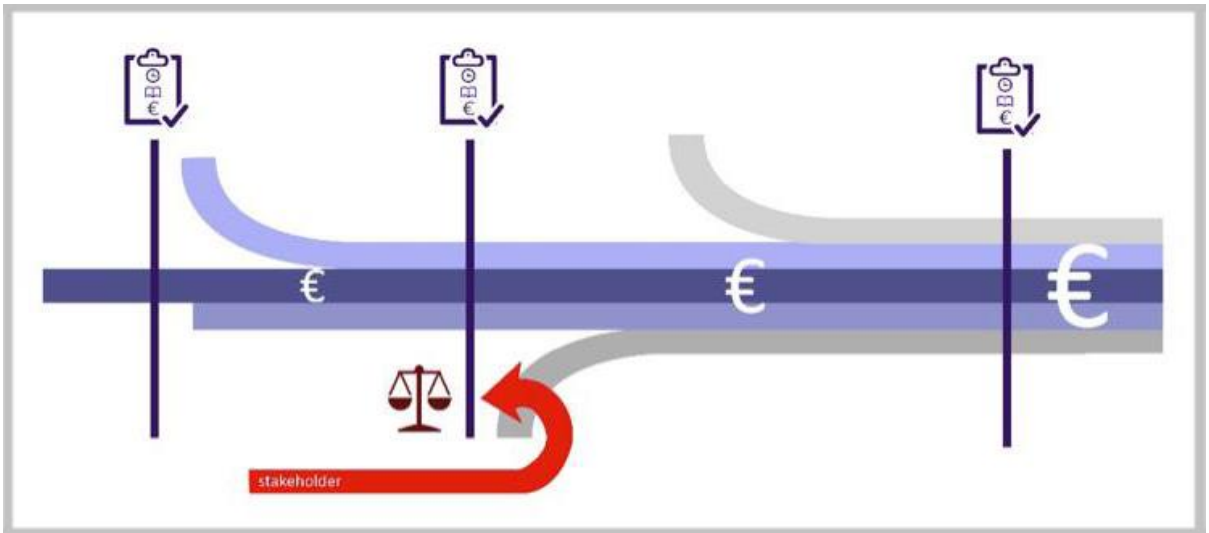


Figure 9: Illustration of the gates and concurrent activities within the brake project

Scope

According to the project manager (PM), the project's needs are always the same regardless of the size of the project. All projects require definitions on what to do during the project and setting up a plan/scope accordingly. This is done in order to avoid scope creep, which is costly. After the initial scope has been set, the method is to step by step, in detail, tear down the main goal into smaller objectives. The objectives are controlled through gates, by using checklists, in order to make sure that the plan is followed. A decision board decides whether the stage should be iterated or may pass the gate. The longer a project goes on, the more

people get involved and the more cross functional it becomes, which also means that the further a project goes in the wrong direction, the more expensive it is returning to the intended goal. One way to mitigate such risks is by using gates, which protect the project from going too far in the wrong direction.

Feasibility

The PM further states that, in a project there are typically between three to five scenarios that seem feasible. These scenarios are tested and prototyped in order to find the best alternative before spending a lot of money. Such pre-studies are essential because the later a mistake is identified; the more expensive it is to change. Furthermore, the later in the project things are added, the higher the risk of scope creep. Target Costing, Life Cycle Cost Analysis, Quality Function Deployment, Failure Mode Effect Analysis and so on, are examples of tools that are used in the beginning as an iterative process to evaluate feasibility and reduce costs. Uncertainties can be lowered early on in the project by using these methods, mainly by identifying risks, opportunities and cost.

Freezing Decisions

The PM stresses that different decisions are frozen at every gate. For product development there is a gate that locks a decision, after which a change to anything would be a complex and costly process. As an example, before production there is typically a pre-production where the product is tested so that the design can be frozen before full-scale production.

Team

The plan must be followed and the current status communicated at each gate. Also, risks and possible outcomes must be understood. Having a diverse team when discussing risks may yield in a better decision because of less group thinking. Furthermore, learning is essential for project management, both within one project and through many projects. Learning reduces uncertainty as the project team learns about the consequences of certain activities or methods. Previous experience is used to estimate the duration of activities, but is also used by the PM to know how well his team members usually estimate their activities. A PM will always want to add some margins to time estimates and therefore, knowledge of the individual members' estimation accuracy can be very helpful. The scenario however is often that there is not a lot of space for margins because usually as much as possible has to be squeezed within a set date for when the project should be finished.

The strength with concurrent engineering is that the diverse group has different experiences and sees different problems that they want to fix, which makes for a good end result. However, the PM describes that a disadvantage to concurrent engineering is that usually some functions don't care that much about the early phases of a project as they have other projects that they are working on. In such a case the project manager is responsible to spread enthusiasm and engage people.

Platforms and design

The PM elaborates on the benefits of using platforms by illustrating that the brake project is a brake that will be in the next generation of trucks, but more importantly they will replace the old brakes in the current truck generation. Such a change of brakes is only possible due to the truck being designed as a platform. In other words, individual parts of the platform can be changed without changing the surrounding areas of the platform. However, the flexibility of the platform is somewhat limited and some changes might still mean that the whole platform needs to be changed.

To avoid problems with the platform, the company has a specific department that works with ideas and patents. The idea is to work with the early ideas before they are introduced to the project in order to get mature ideas and lower the risk of failing parts. Nonetheless, some parts still have to be removed from the scope later on in a project because they are not mature enough, which is costly. "If a you find an opportunity very late in a project, including that feature will be a huge challenge because of the deadline. At some stage, you have to freeze the design and the later that is, the more expensive. If you listen too much, you will never be able to set a plan, so it's about balance."

4.2 Computer-Programming Project

The project's way of working is based on an Agile method of Scrum Management. It is thus necessary to have common knowledge (described in chapter 3.6) of the process of Scrum.

Background

The project is a computer-programming project that aims to enhance the performance of an existing computer program for accounting purposes. The project consists of two teams with six to seven people in each. One team has the main task of creating the functionalities while

the other has the main task of integrating the computer programming with other systems. The project was started in 2014 and is due 2015. It consists of three-week sprints, the first of which is decided by a discussion between the team and the customer (product owner).

Feedback

There are two ways to quickly receive and process feedback, either the computer programming is updated after each sprint or the feature is tested individually before, which means that testing can begin immediately and thus feedback is quick. A support company that has a lot of user experience conducts testing and ultimately decides what features are approved. Such a feedback system prevents all potential issues from stacking up and they are instead dealt with as the project progresses. After the project, a feedback session is held with internal parts of the company to learn from the experiences of the project. Continuous progress and constant learning is a major responsibility of the PM.

Process

The project consists of a pre-project and a project phase. The pre-project phase includes getting the stakeholder requirements and prioritizing these according to how complex and important they are to the stakeholders. The pre project phase allows an approximate understanding of what is to be delivered during the first sprint and also an overall idea about the rest of the project. A product backlog is used and is a list of requirements from the customer. The backlog will most likely change during the course of the project as uncertainties becomes more clear and the most essential requirements known. This means that the decision, for the exact features that will be in the final product, is not taken before the implementation phase, instead it matures as the project progresses.

The project team works in the user environment in order to get the right features into the final product by having a dialogue with the customer. One tool that is specifically important for improving dialogue is visualization because it is something that easily can create a tangible discussion. Visualization lowers the uncertainty by sketches for example and is used especially in the beginning of a sprint. If the uncertainty is too high for a sprint, the sprint can either be postponed to a later stage when the uncertainty is lower or a sprint can be used to gain more knowledge and create a preliminary solution.

Product architecture

When it comes to product architecture, features or modules are created so that the whole system performance is not affected. Thus, individual modules or features can be changed without impacting the larger system and allows late changes at a low cost. Also, the system can be tested in many ways without being complete by focusing on the main components first, hence creating its main structure.

Team

The teams are cross-functional and thus contain a broad spectrum of competences. The main issue for the team is to identify what the customer wants and provide a solution. One very important member of the team is therefore the solution architect, who is responsible for translating the customer needs so that the team understands it. To create a high performing team, the team needs experience, but more importantly it needs strong competence together with a customer usability approach. The customer usability approach means that the team must create something usable for the customer; otherwise the performance of the system has no point. Furthermore, a short meeting is held every day to keep everyone up to date with the project and feedback. The project manger argues that the main issue when it comes to reacting to new situations is enabling the team to realize all the possibilities.

5 Analysis

The following chapter analyses the empirical findings in relation to the theoretical framework using analysis models based on Verganti's definition of Anticipation capabilities as well as Structural and Planned Flexibility (see appendix).

5.1. Brake Project

Anticipation Capabilities

According to Verganti (1999), a company can deal with uncertainties in two different ways; either by devoting effort to lower them during early stages or by being flexible during the implementation phase. According to the Project Manager in the Brake Project (PM), planning means everything when it comes to project success, and late changes always imply increased costs and use of time. To reduce risk the group sets objectives controlled at a gate, which is preceded by a specific stage. This is a typical Stage-Gate approach, where Cooper (1990) describes that the project cannot be completed before the product has been approved at every stage. In this project however, a mix of Stage-Gate and Concurrent Engineering is used since stages can overlap one another to enable cross-functional teamwork. As the PM mentions, this is mainly to reduce cost since making changes later on will result in complex restructures that require a lot of resources. When managing such a large and sophisticated project, a Stage-Gate model helps protecting the project from going in the wrong direction. Such reasoning from the PM is in line with Verganti's claims to devoting effort to lower uncertainty in the early stages.

Lowering uncertainties in the beginning is a main issue in the project, which can be remedied by anticipating risks and opportunities. According to the PM, the team needs to have knowledge about possible consequences of not being able to anticipate uncertainties. Learning is considered very important to understand the entirety, thus being able to make reasonable estimations. The PM finds it important to have a team that really knows the product, which will make anticipation a lot easier. The capability to do this in a successful manner is identified as the most important anticipation mechanism by Verganti (1999), referred to as systemic learning. Hence, this anticipation mechanism is used by the company.

The PM stressed the importance of having as many people involved as possible in an early phase. The pre-project team was cross-functional, which means contributions can be made with a wider spectrum of knowledge and experience. This type of teamwork and

communication is one of the anticipation mechanisms identified by Verganti (1999). People from different functions usually have a lot of ideas and have identified problems they would like to fix. To enable cross-functional operation, Concurrent Engineering is useful by having overlapping stages. Although, one identified problem with cross-functional teams is that it can be difficult getting different functions engaged as they have multiple projects running simultaneously.

Another anticipation mechanism that Verganti (1999) describes is *encouraged and supported proactive thinking*. This is applied in the Brake project by the use of different estimation tools such as quality function deployment, target costing and life-cycle cost analysis. Many different concepts are evaluated during the pre-project, where some of these were prototyped and tested in order to find the best solution. The use of prototypes allows for testing many different alternatives and together with the estimation tools it is possible to proactively identify issues and handle them early on.

Structural flexibility and reaction capabilities

Verganti (1999) defines structural flexibility as the skills, project tools and working methods that together create a foundation for reaction capabilities. When it is difficult for the company to anticipate the future of some factors, reaction instead of anticipation capabilities are necessary in order for the company to be successful. The key is to be able to adapt to changing environments. Verganti (1999) further described flexibility as the ability to make late changes in the project, without substantial increases in cost and time. The PM notes that in their case, pre-studies are essential because the later you realize a mistake; the more expensive it is to change. Some parts might have to be removed from the scope later on in a project because they are not mature enough. If you find an opportunity very late in a project, including that feature will be a huge challenge because of the deadline. In the brake project platforms are used, which allows individual parts to be changed without affecting the surrounding areas of the platform, which has allowed for making improvements to the brakes later on. This is comparable with the flexible design architecture suggested by Verganti. Another approach that aligns with a more flexible structure is the concurrent engineering, which allows different functions to communicate and work in parallel.

Planned Flexibility

Planned flexibility essentially means that in order to enable flexibility during the implementation phase, it has to be planned for during early stages. The first criterion for planned flexibility is the capability to identify the required criteria's early on in a given project (1999). Within the Brake project, the stage-gate process helps to identify critical areas, needs and the scope of the project early on through target costing, life-cycle cost and Quality Function Deployment, Failure Mode and Effect Analysis et cetera. At every gate, specific decisions are frozen, leaving no room for change later on. For product development, you always have a gate after which a change to anything is a huge and complex process. The second criterion for planned flexibility is to plan and trigger reaction measures to manage the identified critical areas. Since decisions are frozen as early as possible in the Brake project, reaction capabilities are not of much use to the company.

5.2 Computer-Programming Project

Anticipation capabilities

Not much planning is done beforehand during the computer-programming project. Instead, they believe it is important to begin the project as soon as possible and be flexible in their way of working. The development team receives information of what is expected in the form of a product backlog. The customer (the buying company) specifies wanted features in the product backlog, which can change during the process. This shows that no anticipation is used in the way Verganti (1999) argues is necessary in order for the project to be successful. Instead of conducting research in order to anticipate, the computer-programming project initiates implementation right away.

Instead of anticipation, the computer-programming development team focuses on reaction capabilities. This can easily be seen in their way of working. Teams of six to seven people operate under a project manager (PM) during three-week-sprints; described by James (2012) as Scrum Management. Ongoing interaction between the customer and the team directs the process with little information in advance. In the end, consideration is always taken to the customer since the project will not be finished until the customer is satisfied. In contrast to Verganti (1999), who says that without anticipation a project cannot be successful enough to be market leading, the computer-programming development team successfully uses a Postponing method leaving few aspects planned beforehand.

Structural flexibility and reaction capabilities

The company running the computer-programming project operates in an industry that is rapidly changing and developing. Few aspects are predictable, making anticipating approaches unbecoming. It is therefore inevitable for the project development team to concentrate on reaction capabilities. Verganti (1999) states that Planned flexibility requires the framework of the product to be able to adopt changes later on in the process without decisive implications on the project's performance. This is true for the project as the PM describes, during a sprint when the team is working on a feature, it is done in a separate module so that any step in the wrong direction could be reversed without impinging the fundamental product. However, a central difference to Planned Flexiblity (Verganti 1999) is that in the programming project there is no planning involved in order to be flexible. The PM further notes that by applying Agile working methods and the architecture of their project, the entire process enables changes very late in time. Further, structural flexibility is according to Verganti (1999) useless for dealing with uncertainty which is what the agile methodology is all about and structural flexibility is thus not used or at least not an essential capability of the project team.

Verganti (1999) highlights the need for early feedback when speaking of reaction capabilities. By testing the current product before starting an iteration and leaving room for quick feedback from the customer upon completion of a sprint, the PM sees the close interaction between customer and the development team throughout the project. Together with feedback from the customer, the support company conducts tests and contributes with final feedback. Receiving input from several angles at multiple occasions supports Verganti's (1999) idea of frequent learning cycles.

Planned flexibility

Within the computer programming industry, experimenting is necessary since no guidelines exist for what is to be done. To be able to successfully create a product in this setting, wide competence and comprehension of the subject is required. One aspect that Verganti (1999) fails to incorporate into his concept of Planned Flexibility is the need to apprehend customer usability along with advanced technical skills. These two factors are key to success, according to the PM. The computer-programming project uses skilled cross-functional teams that have experience from the industry, making them able to understand the context and experimenting until reaching a successful result.

To prosperously incorporate Planned Flexibility into a project, Verganti (1999) stresses the need to identify critical aspects of the project early on. The computer programming development team does this by continuously using the backlog that identifies important features required by the customer as soon as the need appears. As the project progresses, knowledge and experience increases making them able to communicate and finding a fitting solution to the customer's needs. The backlog only states requirements and customer needs, and thus demand minimal detailed planning.

On the contrary, Verganti's (1999) requirement of early planning for reaction to those chosen critical areas is not met within the computer programming project. Their way of operating is more spontaneous, where the PM says that they deal with a problem once it appears and do not plan any further due to difficulties in anticipating possible problems when working with computer-programming. Although the computer-programming project does not meet all of Verganti's criterions, they appear to be successful within their industry.

6 Discussion

The following chapter discusses the findings of the study.

As implied in the analysis, the brake project fits well with Verganti's findings while the computer-programming project does not. Due to the fact that this study has a different research design than Verganti's, there are some issues regarding the categorization of the projects. However, the categories can be deducted by a comparison with Verganti's conclusions.

The brake project does not have a flexible product development process that allows the team to respond well to emergent opportunities and most decisions are anticipated and frozen before implementation. Hence the degree of detailed anticipation is high. The degree of selective anticipation is harder to estimate, but since most decisions are frozen at an early stage the degree of selective anticipation should be low (see figure 10). Also, a high degree of selective and detailed anticipation i.e a comprehensive approach would imply planned flexibility. The first criterion for planned flexibility seems to be fulfilled for the brake project, but the second criterion is fuzzy. Some capabilities tend to implicate that the second criterion is fulfilled through having a platform, earlier described. Other capabilities such as the difficulty of changing during the implementation tend to contradict the second criterion and the criterion is therefore not fulfilled. The fact that the project does not have planned flexibility further indicates that the approach used is detailed. According to Verganti, it is possible to have successful project developments without the ability to be flexible such as a detailed approach, but the company must operate in a relatively stable environment and also possess great anticipation capabilities, which is also true for the brake project.

The computer-programming project on the other hand relies solely on reactive capabilities, which means that no decisions are frozen in beforehand and the degree of detailed anticipation is therefore low. A low degree of detailed anticipation and a high degree of selective anticipation i.e a selective approach would imply planned flexibility (see figure 10). However, none of the criteria for planned flexibility is fulfilled and thus implies a low degree of selective anticipation. The use of the backlog indicates some sort of selective anticipation,

but on a low degree as well due to the fact that it is constantly updated as important features are discovered and it is therefore not crucial to anticipate before the project starts. A low degree of both selective and detailed anticipation implies that the company is using a postponing approach. The reason why the computer programming company can have both low detailed and selective anticipation is because of its reactive capabilities and therefore there is no need for anticipating.

Both the brake project and the computer-programming project incorporate several models into their way of managing projects. By mixing models such as Stage-Gate, Waterfall and Concurrent Engineering, the brake project has accomplished in finding the mix that suits them the most. Similarly, the computer-programming project has adopted a pure Scrum Management method with iterations based on Waterfall to optimize their way of managing.

Much has happened within the IT-industry since Verganti drew his conclusions in 1999. The need for computer software products has increased largely since every human's everyday life includes several software programs. The industry itself develops rapidly as new technology is introduced, creating demand for products that did not exist earlier. As a result, the need for programming and other types of computer development projects have significantly increased. With daily use of smartphone applications and computer programs to run errands and handle communication regardless of age, the target group has become very large. Flexibility has become a key word within the IT-, smartphone and computer industries due to rapid changes in customers' preferences and high demand.

The IT-industry experiences large changes every year, whereas the transportation industry might change over a decade or two. Both projects operate in completely separate environments, which can be an important factor behind why they require such different approaches to succeed. The brake project incorporates several factors which are costly to change at a later stage, such as contracts with suppliers for raw material. This requires the process to be more carefully planned where decisions are frozen to save cost. Since large breakthroughs rarely happen, this type of company can afford locking in decision to save cost. The computer-programming project on the other hand, does not require raw material since smaller changes can be done by a few working hours, making it much more flexible. However, the industry can experience rapid changes just over-night, thus freezing decisions could be devastating to the company as it would make them unable to adapt to quick changes.

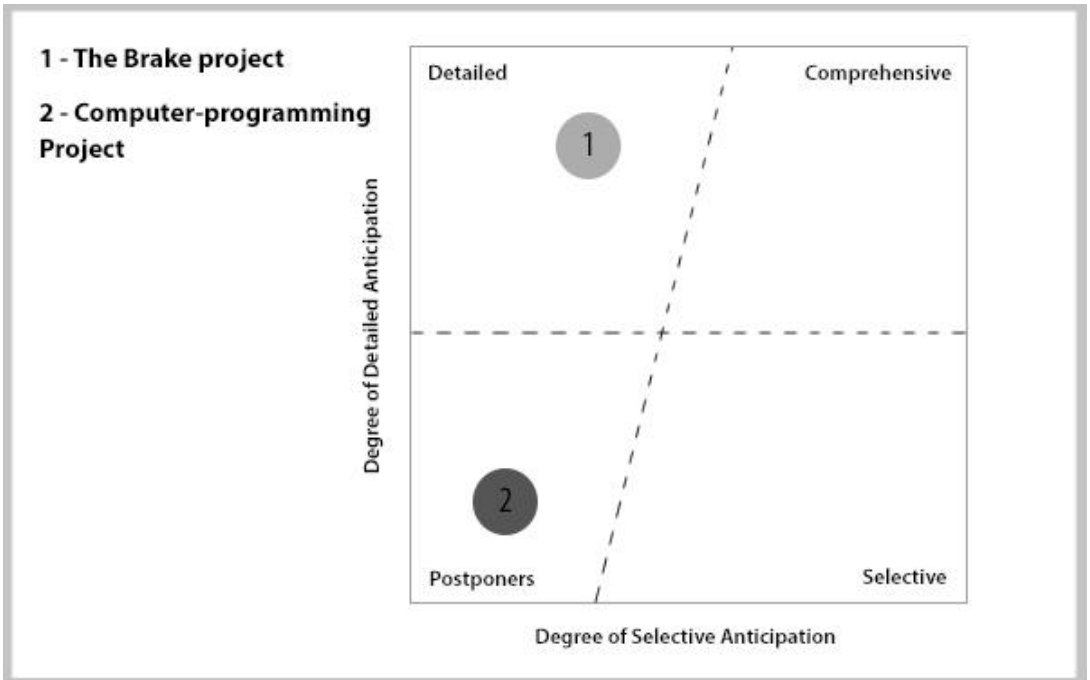


Figure 10: Illustration of the principle behind Planned Flexibility where each company can place themselves somewhere in the model depending on their degree of detailed versus selective anticipation.

Based on the concept of Verganti, 1999.

Computer-programming development is arguably unique in the sense that the product development and end goal is so flexible. In the early phase of the brake project the end goal is very clear. Conversely, in the computer-programming project the end goal is vague. Also, each added feature in a computer-programming project adds value whereas each step in a brake project does not add value unless the full product is launched. It would therefore be interesting to study another industry than computer programming, that create physical products, to investigate if postponing strategies can be used in these industries as well.

During this study, the authors have found similarities between planned flexibility and risk management. An important difference however is that planned flexibility looks more at opportunities, but also at risk. Consequently, the concept is broader than risk management.

7 Conclusion

The aim of the study was to examine approaches to flexibility that allow for project success by looking at different successful project management styles for Swedish companies and was done by looking at two different companies. One company was implementing a project regarding brakes and the other company was implementing a project regarding computer programming. The research question posed in this study is: *Can a company classified by Verganti (1999) as a Postponer, where little focus is put on detailed planning and much of the process is left undecided as long as possible, be successful in today's business environment?* This study has proved that a successful programming company using the agile methodologies, which has been classified as a postponing strategy, can be successful in today's business environment.

As earlier discussed, the brake project is considered having a detailed approach, which according to Verganti (1999) was supposed to be one of three successful ways to manage product innovation projects. The computer-programming project however, is categorized as a user of the postponing approach, also referred to as the one approach that hinders projects and companies from being successful and market leading (Verganti, 1999). As can be seen in the interviews with both projects, success does not necessarily depend on which approach the company uses. Both the detailed approach and a postponing work method have had great results within their industries.

In Verganti's (1999) words, the very low level of both selective and detailed anticipation that the computer-programming project has, should mean that they significantly underperform in the market. However, the extremely fluctuating environments of the computer and software industry experiences large changes in trends and requirements, which makes it nearly impossible to predict. How is it possible to predict an upcoming feature or trend when it can arise by going viral in a day? The features demanded by the customer can change over night in a programming project, making it irrelevant to dedicate time to detailed planning.

The results of this study can certainly be questioned, especially in regards to the amount of interviewed Project Managers. For this exact reason, a decision was made to use qualitative analysis in order for the results to be interpreted without the use of an extensive population. The validity is therefore considered adequate for this research to be able to reach the

conclusion that Verganti's (1999) findings do not hold today and leaves room for further research. Companies can be successful when adopting a postponing method, and is in some cases even required of the company in order to succeed within its industry.

It appears that no generalization can be made as for what actions should be taken during the planning phase in product development projects, in order to make the project successful. Placing the postponing approach into a category of poor performance is not a valid assumption under today's circumstances. The business climate in many industries has experienced major changes since the introduction of smartphones and digitalization of daily routines. This rapid change has lead to increased uncertainty and unpredictable futures where anticipation is even more complex than it has ever been. It can thus be questioned whether or not detailed planning is excessive in some cases. Verganti's (1999) model however, cannot be rejected completely. His conclusion that the postponing method is unsuccessful does not hold according to this analysis, whereas the rest of the model still works in today's business environment.

Further Research

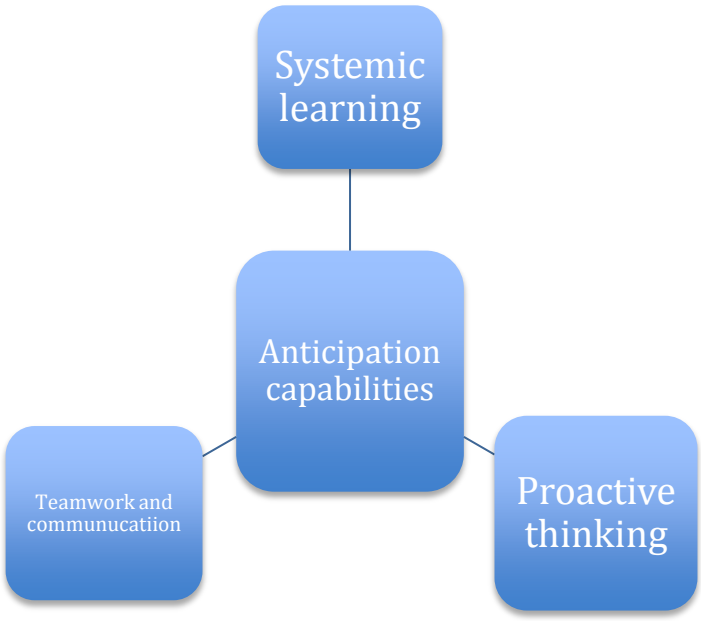
After 16 years of economic upturns and downturns, new trends and changes in social behavior, further research must be conducted in order to make assumptions that are valid today. What Verganti (1999) confirmed more than one and a half decade ago, was most likely a sound assumption at that point in time. Both companies studied in this thesis operate in completely different environments, which demands different methods to reach success. The transportation industry develops slowly in comparison to the IT-industry. Plenty of room is left for research within this newly, rapidly changing and continuously growing industry of Information Technology. Much is yet to be discovered on how to optimize management in an industry largely affected and driven by change and innovation caused by both companies and individuals in their everyday life.

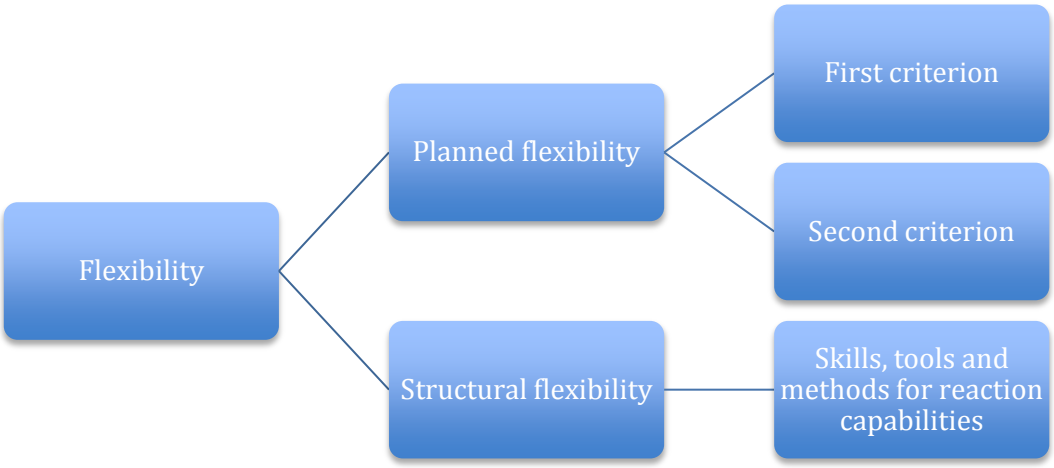
Times change and management needs up-to-date assessments of what holds today, thus leaving room for further research. Considering these aspects, one can wonder what to expect from the 16 years to come?

Appendix

Analysis Models

Two models for analysis, based on the literature review of Verganti (1999), are illustrated below and are used to analyze the empirical data.





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