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Agile Project Management: The Degree of Agility in Projects

A quantitative study of factors that affect the degree of agility in projects

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Forewords and acknowledgements

This master thesis is the final part of the Master's degree in Business and Administration at the School of Business and Law, at the University of Agder (UiA), in Kristiansand.

The aim of this research was to explore factors that affect the degree of agility in projects. Working on this thesis have been highly educational, interesting, and challenging, and we have gained a lot of knowledge regarding agile management methods in project work. This topic was highly relevant for both of us, as project work and project management are fields we both wish to work within in the future.

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Abstract

Agile project management methods have become more prevalent in recent years, as a response to rapidly changing business requirements, technologies and market conditions. The traditional, plan-driven approach was unable to handle these changes, as it is more efficient with projects that are stable. Research on the agile management methods in projects have become quite extensive over the last decade. The main focus has been on the adoption of the approach as a whole, meaning that the choice of being agile seems to be a matter of binarity. However, some researchers state that a project might not favor a pure methodology. The aim of this research was thus to explore factors that affect the "degree of agility" in projects. The hypothesis in this research consider how team size, customer involvement, organizational culture, complexity in the environment, and project planning affect the degree of agility in projects. The moderating effect of expertise among team members was also included.

A quantitative method was chosen for this research. To explore the research question, an online questionnaire was utilized to collect data. The questionnaire was distributed by several project organizations across the Nordic countries, and a total of 98 respondents completed the questionnaire. To further analyze the results, PLS-SEM was utilized. The results showed that the independent variables customer involvement, organizational culture, and project planning all have an affect on the degree of agility in projects. This research contributes by presenting a new perspective on agility, by identifying factors that can increase the degree of agility in projects.

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1. Introduction and relevance

Organizations have become more project based throughout the years, in order to achieve their business objectives more economically (Blomquist & Müller, 2006, p. 52). This has led to a greater focus on utilizing the right project management method, to execute projects more efficiently (Jerbrant, 2013, p. 365-366). Research claim that the agile management methods might impact project success, as they can reduce costs and improve productivity, quality, and the business satisfaction (Mishra & Mishra, 2011, p. 549).

The use of projects in organizations have increased gradually during the past decade. Organizations have become more project-based (Project-Based Organizations) by executing different projects simultaneously. Throughout the years the projectification of society, along with projects being used as a part of modern and organic organizational model, have grown tremendously. For this reason project management methods have become significantly important (Jerbrant, 2013, p. 365-366).

In recent years, markets have become more volatile, which have created more uncertainty in the global economy. This has also affected project situations, as they have become more complex, uncertain, and time-limited (Christopher, 2000, p. 1). To be able to adapt to the volatile environment, changing technologies, markets, social conditions, and more complex and dynamic systems, a new and more flexible management method was needed. The traditional project management approach did not match with the changes in the environment, as it is more effective with projects that are stable (Augustine, Payne, Sencindiver & Woodcock, 2005, p. 85). The agile project management approach thus emerged as a response to rapid changes in the environment, and the inability of the traditional method to handle these changes (Abrahamsson, Conboy & Wang, 2009, p. 281; Hoda & Murugesan, 2016, p. 245).

The agile management methods have been widely used in recent years, as the management methods provide a more flexible scope than the traditional approach. Unlike the traditional approach, where the plan for the project is created in advance, the agile methods utilize an iterative planning approach, meaning that the plan for the project is gradually created as the project moves forward. This makes the management approach responsive to rapid changes in

the environment. Further, research have accounted for the transition from traditional to agile methods, successful implementation of the approach, and whether agile management methods can be applied to other industries than software and IT (Qumer & Henderson-Sellers, 2008;Conforto, Salum, Amaral, Silva, & Almeida, 2014;Chow & Cao, 2008). For this reason, the applicability of the agile methods, specifically in projects, is highly relevant.

Despite the prevalence of the agile methods, Abrahamsson et al., (2009) point out some important shortcomings in agile research. Among others, the research expresses a need to "*extend the applicability of agile methods*". Agile management methods are mainly used within the software development and IT industry, however, researchers such as Conboy (2009) states that the agile approach can be applied in a broader context, to suit other environments. A suggestion for solving this problem is to combine the agile methods with the plan-based approach (Abrahamsson et al., 2009, p. 281-282). It is therefore highly relevant to clarify the degree to which agile methods can be implemented in organizations or in projects (Qumer & Henderson-Sellers, 2008, p. 1899).

Further, Qumer and Henderson-Sellers (2008) state that it can be challenging to adopt the agile methods successfully. As it can also be inconvenient for organizations to be completely agile, some might choose to retain elements from the traditional approach for an agile project. However, managers might find it difficult to assess which elements to chose, that are appropriate for their situation (Qumer & Henderson-Sellers, 2008, p. 1899). It is thus highly relevant to explore factors that might affect the degree of agility in projects.

1.1 Research gap, and research goal

Agile project management methods have become more prominent in recent years, and a lot of research on this topic has been conducted. The focus has, however, mainly been on the agile approach as whole, meaning the transition from the traditional to the agile approach, and successful implementation of agile management methods. Based on previous literature, it appears that being agile might be a matter of binarity, meaning an all-or-nothing approach (Greenfield & Short, 2004, p. 123). Qumer and Henderson-Sellers (2008) do, however, state that organizations might find it difficult to be completely agile in all aspects (Qumer & Henderson-Sellers, 2008, p. 1899). This is further supported by Sheffield and Lemetayer (2012), who state that projects might not favor a pure methodology (Sheffield & Lemetayer, 2012, p. 462). Research has suggested combining elements from the traditional and agile

approach as a solution for this matter, meaning applying the agile methods to some degree (Abrahamson et al., 2009, pp. 281-282). There are, however, limited research on the "degree" of agility. This research thus attempts to present a new perspective on agility, where the research goal is to explore factors that affect the degree of agility in projects. The basis of this research is Qumer and Henderson-Sellers' (2008) 4-DAT approach, and their characterization of agility, as well as recurring critical success factors related to agility based on previous research. This research is further limited to the degree of agility in "projects".

1.2 Structure of the research

This study commenced by providing the introduction and relevance for the research topic. Further, the literature review will be presented, to provide a theoretical context for the selected topic, before introducing the hypothesised model. Next, the process of collecting data through an online questionnaire will be provided, before the results are analyzed. Finally, a discussion and conclusion regarding the finds in this research will be presented.

2. Literature review

In this section literature that recognize the selected topic for the research will be presented, in order to provide a theoretical context. Literature on traditional and agile project management approaches will be presented, to distinguish the differences between the approaches. Further, a more thorough presentation of the agile methods will be introduced, to provide background for the research model and hypotheses. This section will also elaborate on factors that are critical for successful implementation of the agile management methods.

2.1 Traditional project management

The traditional approach to project management is defined by simplicity, predictability and linearity, where boundaries are well defined to make planning easier (Spundak, 2014, p. 941). An important characteristic of traditional project management is thus thorough, up-front planning and documentation, in order to pursue the original plan without applying many changes. The approach is designed in a hierarchical structure, where the project manager is responsible for formulating a schedule, organizing the project teams, and making sure projects are conducted according to the plan. As traditional project management is dependent on a high degree of predictability to be successful, potential problems and risks are identified before the project starts (Larson & Gray, 2011, p. 339,583-584;Fernandez & Fernandez, 2008, p.15). The main purpose of the traditional approach is optimization and efficiency, in

order to complete the project within scheduled time, budget, and scope (Spundak, 2014, p. 941).

In recent years, markets have become more volatile, which have created more uncertainty in the global economy. This has also affected project situations, as they have become more complex, uncertain, and time-limited (Christopher, 2000, p. 1). These circumstances made predictability and planning more challenging, leading many professionals to believe that a more flexible approach was needed (Larson & Gray, 2011, p. 583;Fernandez & Fernandez, 2008, p.10). The "one size fits all" method is difficult to apply in more complex project management situations, as different situations require different solutions (Fernandez & Fernandez, 2008, p.13). Based on these factors, a more "lightweight" or "agile" approach was needed.

2.2 Agile project management

The agile project management approach has been prevalent in recent years, as project environments has become more dynamic. These project environments require more flexibility and the ability to adapt to changes, which is prominent in agile project management methods. For the agile methods to work, a significant degree of interaction within the project team is needed, as well as active cooperation with customers and main stakeholders (Conforto, Salum, Amaral, Silva, & Almeida, 2014, p. 24). This way, customers and stakeholders are more involved in the project process and are able to suggest changes along the way. Typical characterizations for agile project management are thus, according to Conforto et al., (2014), active collaborations, quick feedback, and the possibility to make changes throughout the project life cycle. Further, there are several different approaches that can be applied in order to implement agile methods in project planning. A few of the most important ones are; Scrum, extreme project management, adaptive project management and dynamic project management (Cervone, 2011, p.19).

2.2.1 Traditional versus Agile project management

A substantial amount of research has been conducted on traditional and agile project management methods. In order to underline the main differences between the two management approaches, table 2.1 was constructed. The table summarizes the main characteristics of each approach, and is based on literature by Nerur, Mahapatra & Mangalaraj (2005), and Larson & Gray (2011).

Characteristics	Traditional	Agile
Planning	Up-front	Continuous
Scope	Fixed	Flexible
Customer's Role	Important	Critical
Customer interaction	Low	High
Organizational Structure	Centralized	Decentralized
Role Assignment	Individual – favours specialization	Self-organizing teams – encourages role interchangeability
Management style	Command-and-control	Leadership-and-collaboration
Uncertainty	Low	High
Changes	Avoid changes	Embrace changes
Project type	Simple	Complex

Table 2.1: Traditional project management vs. agile project management (Nerur, Mahapatra, & Mangalaraj, 2005, p. 75; Larson & Gray, 2011, p. 585)

From table 2.1, it appears that the traditional method can provide simple, yet well-planned projects, with a high degree of predictability and low uncertainty. However, as the management method attempts to avoid changes, it can be difficult to implement in more complex, and dynamic environments. In volatile environments it can therefore be more suitable to apply agile management methods (Nerur et al., 2005, p. 75). The agile methods will be further elaborated on in the following sections.

2.2.2 Agile project management and the iterative approach

Agile project management can be defined as "*an approach based on a set of principles, whose goal is to render the process of project management simpler, more flexible and iterative in order to achieve better performance (cost, time and quality), with less management effort and higher levels of innovation and added value for the customer"* (adapted from Amaral, Confronto, Benassi, & Araujo, 2011; Confronto & Amaral, 2010), quoted in (Conforto et al., 2014, p. 22). This definition can be further elaborated on by explaining the iterative planning approach.

Instead of creating a plan for the entire project, agile project management relies on revision and improvement of each project phase, using iterative planning. The project is thus continuously developed through a series of incremental iterations over time (Conforto et al., 2014, p.24).

An iteration is a short time frame, that normally last from one to four weeks (Larson & Gray, 2011, p. 585). When using iterative planning, the plan for the project is frequently updated, often after each iteration (Conforto et al., 2014, p. 24). At the end of each iteration, there is a feedback loop, where progress is revised and adjusted for improvements. Then a new iteration cycle begins. The iterative strategy can be classified as a "learn-by-doing" strategy, as intermediate solutions are used throughout the process to uncover the final solution (Fernandez & Fernandez, 2008, p. 12). Additionally, the approach is used to improve communication, increase cooperation and prevent interruptions and obstacles (Cervone, 2011, p. 20).

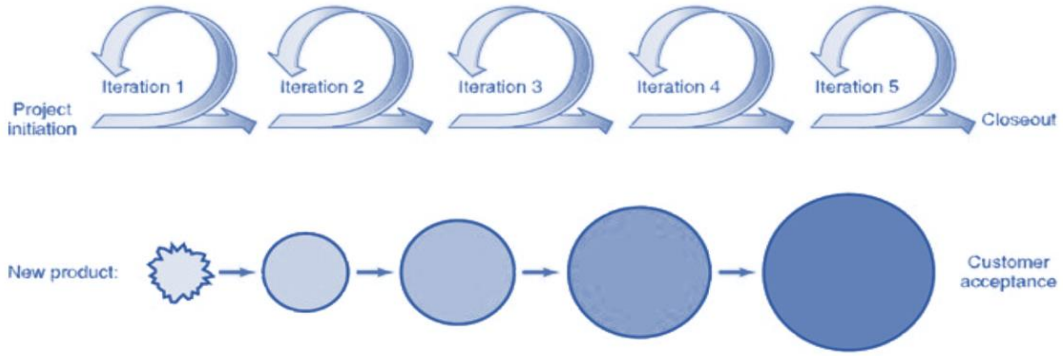


Figure 2.1: Iterative Product Development Source (Larson & Gray, 2011, p. 585)

There is a number of important advantages of using the iterative approach. According to Larson & Gray (2011) and Fernandez & Fernandez (2008), the most prominent ones are:

- *"Continuous integration, verification, and validation of the evolving product.*
- *Early detection of defects and problems*
- *Customers can review current solution for suggested improvements.*
- *Adapts to changing business conditions"*

(Larson & Gray, 2011, p. 586;Fernandez & Fernandez, 2008, p. 12)

Even though the iterative approach has many advantages, there are also factors that can make it difficult to implement in certain industries. While collaboration with customers and stakeholders is an important task in project planning, it can be difficult to attain active customer involvement throughout the project. Due to unpredictability and rapid changes, it can also be challenging to specify the final solution of the project in advance (Fernandez & Fernandez, 2008, p. 12).

2.2.3 Agile project management and industry

Industries involved with developing new and advanced products or technologies, are often faced with challenges regarding planning and control (Conforto et al., 2014, p. 21). Rapid changes in the environment, especially concerning technology, require more innovative solutions. Research has proven that the iterative approach can be more fitting than the traditional "plan-driven" management methods for such industries (Larson & Gray, 2011, p. 586).

An example of an industry characterized by such advanced technology and rapid changes, is the IT and software development industry. Software development is according to Nerur, Mahapatra and Mangalaraj (2005) "*a complex activity characterized by tasks and requirements that exhibit a high degree of variability."* (Nerur, Mahapatra, & Mangalaraj, 2005, p. 74). Over the past decades, project managers have experienced difficulties with combining software development and traditional project management methods. The extensive project planning phase was considered to be too time consuming, resulting in resources being expended, and project requirements needing change, before the projects could commence (Cervone, 2011, p.18). These were the main reasons why the "Manifesto for Agile Software Development" was developed in 2001 (Conforto et al., 2014, p. 22). The Manifesto is based on four core principles:

1) *Individuals and interactions over processes and tools.*
2) *Working software over comprehensive documentation.*
3) *Customer collaboration over contract negotiation.*
4) *Responding to change over following a plan.*

(Cervone, 2011, p.19)

Agile project management is mainly derived from these four principles, however, they are slightly adjusted to fit not only software development, but also other industries as well.

Even though agile methods and practices are widely used in the software and IT industry, professionals argue that the approach can be applied in projects within other industries that resemble software projects. These are innovative projects in dynamic environments, characterized by constant change (Conforto et al., 2014, p. 22). Still, some organizations should be cautious when considering the implementation of agile project management

methods, as they might not satisfy the need for budget, scope and schedule control, or be compatible with the organizational culture (Larson & Gray, 2011, p. 593).

2.3 Factors related to the implementation of the agile methods

This far, the agile approach has been presented in order to provide an overview of what the approach constitutes, and how it differs from the traditional management approach. Based on the studied literature, it appears that a substantial amount of research has been conducted on the agile management approach as a whole. The application of the agile management approach thus seems to be presented as a binary choice, however, a project might not favor a pure methodology (Sheffield & Lemetayer, 2012, p. 462). The focus of this research is thus the "degree of agility" in projects, meaning whether the approach can be applied to some degree. For this reason, exploring factors that affect the degree of agility in projects is highly relevant.

As there are limited research on the degree of agility, it is challenging to identify which factors that might increase the degree of agility in projects. However, there are extensive research on factors that are crucial for successful implementation of the agile management methods. For this reason, factors that affect the degree of agility in projects will be explored by looking into previous studies on critical success factors in agile project management. As critical success factors are assumed to affect successful implementation of the agile methods, they might also, similarly, affect the degree of agility in projects. Therefore, three different studies on success factors in agile project management will be explored in the following sections. This will be done in order to identify the most prominent and recurring factors.

2.3.1 Chow and Cao (2008): Categorization of success factors

In 2007, Chow and Cao attempted to identify possible success factors in agile software development projects. This was accomplished by reviewing previous literature on failures and success factors (Chow & Cao, 2008, p. 962). Based on the literature they used, they were able to classify success factors in agile projects into five different categories; organizational, people, process, technical, and project (Chow & Cao, 2008, p. 963).

The organizational dimension, is based on the organizational culture, focusing on cooperation and communication between team members, rather than having a hierarchical structure. The people dimension describes the high competence and expertise of the team members, while

the process dimension is strongly focused on the agile-oriented process and communication. The technical dimension includes delivery of substantial features, and applying a simple design. The final dimension is project, which points out the importance of a small project team, with a dynamic, and accelerated schedule (Chow & Cao, 2008, p. 963). An interesting observation here, is that many of the factors Chow and Cao found, can be directly linked to the principles in the "Manifesto for Agile Software Development", which was mentioned earlier.

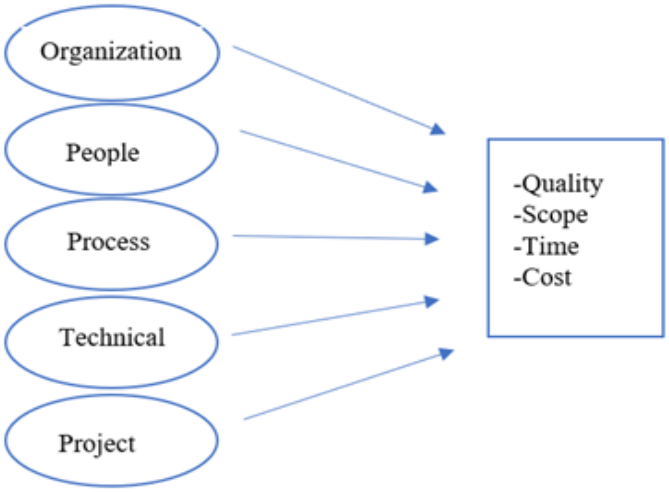


Figure 2.2: Success factors and attributes, based on Chow & Cao (2008)

Chow and Cao further refer to Cohn and Ford (2003) and Lindvall et al. (2004), and their characterization of success. They narrow the success factors down to four attributes that illustrates the perceived level of success in a project. These are; quality (delivering good product or project outcome), scope (meeting all requirements and objectives), time (delivering on time) and cost (delivering within estimated cost and effort) (Chow & Cao, 2008, p. 963). Conforto et al. (2014) have made similar observations regarding success factors in agile project management, though they refer to them as "APM enablers".

2.3.2 Conforto et al. (2014): APM enablers

Conforto et al. (2014) defines "APM enablers" as *"internal or external factors to the organization that are directly or indirectly related with the implementation of the agile project management approach that may impact the performance and use of a given practice, technique or tool"* (Adapted from Almeida, Conforto, Silva & Amaral, 2012). In their research, Conforto et al. (2014) were able to find several different enablers, and further

classify them into four categories; organization, process, project team and project type (Conforto et al., 2014, p. 25). In the organization category, the focus is on decentralized decision making and organizational culture. The process category focuses on frequent development milestones, while the project team focuses on team expertise and team size. The final category is project type, which focuses on collaborative work and goal clarity. Similar observations can also be found Lindvall et al., (2002).

2.3.3 Lindvall et al. (2002): Empirical findings in agile methods

A study on agile methods was conducted by Lindvall et al., in 2002, by gathering experiences and information from agile professionals. The empirical findings from this study identified three important success factors regarding agile project management; culture, people, and communication. Agility is highly dependent on the culture in an organization, meaning employees must be willing to adapt to agile practices. A crucial element is also to employ competent people, that can be trusted to make proficient, and independent decisions. Finally, the organization should facilitate efficient communication within the project team (Lindvall, Basili, Boehm, Costa, Dangle, Shull, Tesoriero, Williams & Zelkowitz, 2002, p. 203).

Based on the research conducted by Chow & Cao (2008), Conforto et al., (2014) and Lindvall et al., (2002) it is evident that they have arrived at similar success factors and categories. This indicates that many of the same success factors are recurring when it comes to agile project management research. Based on these observations, team size, expertise of the project team, and organizational culture appear to be recurring factors in all of the studies. These factors will thus be further elaborated on in section 2.5.2 and 2.5.4. Further, customer involvement, complexity in the environment, and project planning will also be included, as these are also considered to be important factors related to agility. The justification of the selected factors is also elaborated on in section 2.5.2-2.5.6.

2.4 Measuring the degree of agility in projects

The implementation of the agile approach, as mentioned, appears to be a binary choice. However, it can be challenging for organizations to be completely agile in all aspects (Qumer & Henderson-Sellers, 2008, p. 1899). Further, Sheffield and Lemetayer (2012) state that a project might not necessarily favor a pure methodology (Sheffield & Lemetayer, 2012, p. 462). To what degree a project is agile, and factors that contribute to increase the degree of agility in projects, are thus highly relevant topics.

Qumer and Henderson-Sellers (2008) conducted a research on several approaches to assist organizations with the transition from a traditional to an agile management approach (Qumer & Henderson-Sellers, 2008, p. 1899). They developed The Agile Software Solution Framework (ASSF), where the Agile Toolkit and the Four Dimensional Analysis Tool (4-DAT) were included. The latter approach, also referred to as the Agility Calculator, facilitates the examination of the agile methods from four dimensions, and measures to what degree a method is agile with five attributes (Qumer & Henderson-Sellers, 2008, p. 1901, 1904).

The four dimensions of the 4-DAT are the following; method scope, agility characterization, agile value characterization, and software process characterization. An overview of these four dimensions and their respective attributes can be found in table 2.2. Although the approach is developed in regard to the software industry, it can be adjusted to fit other industries as well. Using the 4-DAT to provide reports, can help organizations to assess whether to adopt agile methods. The approach, and mainly the second dimension, can be used to quantitatively measure the agility in projects. The attributes are based on the Agile Manifesto, and can be found in other research as well (Qumer & Henderson-Sellers, 2008, p. 1904). Qumer and Henderson-Sellers (2008) observations also coincide with the findings in Chow and Cao (2008), Conforto et al. (2014), and Lindvall et al. (2002), regarding success factors and characteristics of agile methods.

4-DAT (Four-dimensional analysis tool)	**1. Dimension (Method Scope) Scope**	**2. Dimension (Agility Characterization) Features**	**3. Dimension (Agile Value Characterization) Agile values**	**4. Dimension (Software Process Characterization) Process**
Attributes	• Project size • Team size • Development style • Code style • Technology environment • Physical environment • Business culture • Abstraction mechanism	• Flexibility • Speed • Leanness • Learning • Responsiveness	• Individual and interactions over processes and tools • Working software over comprehensive documentation • Customer collaboration over contract negotiation • Responding to change over following a plan • Keeping the process agile • Keeping the process cost effective	• Development process • Project management process • Software configuration control/support process • Process management process

Table 2.2: 4-DAT and corresponding attributes (Qumer & Henderson-Sellers, 2008, p. 1904)

Qumer and Henderson-Sellers (2008) further state that their approach is extensible, meaning that items or dimensions can be added or subtracted if found necessary (Qumer & Henderson-Sellers, 2008, p. 1901). For this reason, some adjustments and additions have been made in this research.

A combination of the four dimensions in Qumer and Henderson-Sellers (2008) and elements from other research conducted on agile methods are elaborated and explored, in order to achieve the purpose of this study. This is done through considering several success and indicative factors related to agility, as independent variables influencing the degree of agility in projects.

2.5 Factors that affect the degree of agility

Based on the 4-DAT approach and the previously studied success factors, a number of hypotheses have been derived, in order to explore factors that might affect the degree of agility in projects. The background for the hypothesized relationships in this research will thus be presented in the following sections.

2.5.1 Degree of agility

According to Greenfield and Short (2004), the agile methodology is seen as methods that are limited to small projects and cannot be applied to larger situations. It seems that their adoption of the method is a matter binarity, which means an all-or-nothing approach (Greenfield & Short, 2004, p. 123). However, it might be difficult for organizations to be completely agile, and therefore it is important to define to what extent the agile methods can be used (Qumer & Henderson-Sellers, 2008, p. 1899).

The five attributes of the second dimension (agility characterization) in the 4-DAT approach, characterize agility in projects. To correspond to the aim of the study, this dimension will thus form the foundation for measuring the degree of agility in projects. The attributes of the second dimension include flexibility, speed, leanness, learning and responsiveness. Flexibility is about being able to quickly react to expected and unexpected changes that might occur during a project, whereas speed concerns providing results quickly. Leanness involve if the method is following the shortest time span, and uses economical, simple and quality instruments for the production. Learning concerns applying updated prior knowledge and experience to create a learning environment. The last attribute addresses the responsiveness

of the method to occurring changes and problems, in other words how sensitive the agile method is to the surrounding factors (Qumer & Henderson-Sellers, 2008, p. 1904). To measure the degree of agility in projects, the chosen critical factors for this study will be measured against these attributes.

2.5.2 Team size

Team size is one of the factors concerning the implementation of the agile methods, and can be found in the first dimension of the 4-DAT approach mentioned in Qumer and Henderson-Sellers (2008). It has been stated that a small project team is ideal when implementing agile management methods, and Chow and Cao (2008) have listed team size as one the indicators of success regarding agile project management (Chow & Cao, 2008, p. 963). According to Bustamante and Sawhney (2011), the agile approach is most efficient when the team is small, and ideally not surpassing nine people (Bustamante & Sawhney, 2011). There are, however, some experts claiming that the method can be just as effective with large teams, consisting of up to 150 people. A topic for discussion is thus what the optimal team size should be, in order for the agile methods to be most efficient (Lalsing, Kishnah & Pudaruth, 2012, p.117).

The importance of individuals and interactions over processes and tools within a project team, is stated in the third dimension of the 4-DAT approach (Qumer & Henderson-Sellers, 2008, p. 1901). Team size can affect the communication and performance of the team. Communication is an important factor in making agile methods work, as the approach attempts to avoid extensive detailed planning, and rather use communication as a tool to pursue an efficient work environment. The larger the team is, the more complicated communication gets, as there are more people to interact with. This can potentially cause miscommunication, or even lack of communication (Lalsing et al., 2012, p.120).

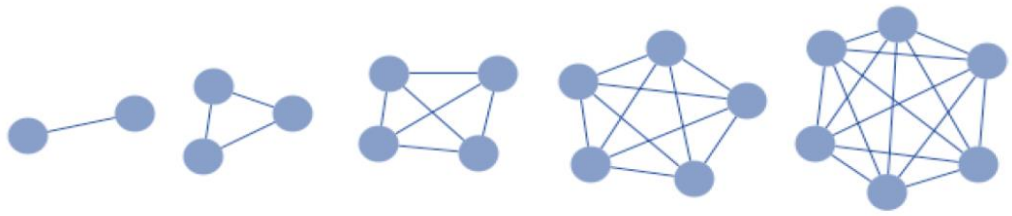


Figure 2.3: Overview of communication complexity with larger teams (Lalsing et al., 2012, p.120).

A study was conducted by Scott W. Ambler in 2010, regarding success rates in agile projects. The study proved that the success rate for small teams, consisting of not more than eleven people, was 83%. The success rate for medium-sized project teams, with a maximum of twenty-five people, was 70%. Finally, for large teams consisting of more than twenty-five people, the success rate was 55% (Lalsing et al., 2012, p.118). Based on this study, it seems that team size has an impact on project success and efficiency; the smaller the team size, the more efficient the agile methods are. Based on these studies, we thus hypothesize the following:

Hypothesis 1. *A small team size is positively related to the degree of agility in projects.*

Furthermore, the expertise and competence of the team members are crucial factors in agile project management (Conforto et al., 2014, p. 25;Chow & Cao, 2008, p.963). People with high competence are usually more reliable, and can be trusted to participate in the decision making process. Agile project organizations thus often focus more on hiring few, but highly competent people (Lindvall et al., 2002, p. 203). We therefore hypothesize the following:

Hypothesis 2. *Expertise among team members has a positive moderating affect on the relationship between a small team size, and the degree of agility in project*.

2.5.3 Customer involvement

Customer collaboration is featured in the 4-DAT approach as one of the attributes in the third dimension, which is the Agile Values (Qumer & Henderson-Sellers, 2008, p. 1901). The agile approach reduces extensive up-front planning for projects, as much planning is developed incrementally throughout the project life cycle. For this reason, the agile method is dependent on a high level of communication between team members, and active customer involvement (Serrador & Pinto, 2015, p. 1042).

Misra, Kumar, and Kumar (2009), have identified three customer centric issues, which are; customer commitment, customer collaboration, and customer satisfaction. These factors are stated to have a positive impact on success. The agile management methods attempt to develop projects to satisfy customer needs, and therefore customer commitment and collaboration with the project team is required (Misra, Kumar & Kumar, 2009, p. 1879). Customers should therefore participate early in the project process, when goals are

established, as well as be motivated and active, and provide feedback throughout the life cycle of the project (Serrador & Pinto, 2015, p. 1042). Consequently, customer involvement seems to be an important factor regarding the level of agility in projects, and we have thus arrived at the following hypothesis:

Hypothesis 3. *Customer involvement is positively related to the degree of agility in projects.*

2.5.4 Organizational Culture

Business culture plays a crucial role when implementing agile management methods. This statement is supported by several authors, and it is also mentioned in the first dimension of the 4-DAT approach (Qumer & Henderson-Sellers, 2008, p. 1901). Organizational culture can be described as a shared belief system, that affects the behavior of employees and project teams in an organization. There are several agile experts claiming that organizational culture is affecting the degree to which the agile methods are implemented in organizations (Strode, Huff & Tretiakov, 2009, p. 2-3). For certain organizations, the culture is not compatible with the implementation of the agile methods. The agile method author, Beck states: " *If an organization's actual values are secrecy, isolation, complexity, timidity and disrespect; suddenly expressing the opposite values through a set of new practices will cause trouble rather than create improvement"* (Strode et al., 2009, p. 3). In other words, the organizational culture must be open for the changes that follow the agile methods.

Organizational culture can be explained by looking at three different levels of the organization. At the organizational level, researchers suggest that the agile method is more compatible with an adhocratic and decentralized structure, while the traditional method is more suitable with a hierarchical structure. This is due to the less formal structure of the agile methods (Strode et al., 2009, p. 7). At the group level, agile organizational culture is based on good relationships between the team members, motivation, shared responsibility, self-management, and willingness to cooperate and take risks (Sheffield & Lemetayer, 2012, p. 461). The team should also be co-located, and participate in daily communication regarding the project. Finally, at the individual level, project team members should have sufficient competence to understand and outline potential risks and changes in the project. They should also be able to affect the outcome of the project, organizational goals, and value provided to customers (Conforto et al., 2014, p. 28).

Organizational level	Group level	Individual level
• Good structure • Adhocracy • Decentralization	• Collaboration • Communication • Willingness • Motivation	• Competence • Responsibility • Engagement

Table 2.3: Levels of organizational culture

Based on these finds, it seems that these fundamental factors of organizational culture are considered necessary, in order to properly apply agile management methods in organizations or projects. How susceptible organizational culture is to changes, affects the level to which the agile method is implemented. Based in this, we have derived the following hypothesis:

Hypothesis 4. *Organizational culture has a positive affect on the degree of agility in projects.*

2.5.5 Complexity in the environment

The first dimension of the 4-DAT approach, the Scope, include physical and technological environments (Qumer & Henderson-Sellers, 2008, p. 1901). Rapid changes in the global economy, technology and society over the past few decades have increased complexity, and new perceptions on how to manage this have been proposed. The fundamental changes in the world calls for a management approach that can fulfil the requirements for handling complex and unpredictable environments (Saynisch, 2010, p. 22-23).

Simple project environments are often characterized as stable and linear, with predictable patterns. For such environments, the traditional management approach can be suitable, as it makes up-front planning and risk calculations easier to develop and foresee (Saynisch, 2010, p. 23; Sheffield & Lemétayer, 2013, p. 462).

However, for complex project environments that are characterized as more unstable and non-linear, the traditional approach loses its efficiency. These characteristics makes it difficult to predict potential risks and obstacles in a project (Saynisch, 2010, p. 23). Mary Poppendieck (2000) suggests that; " (..) *when we are dealing with a market economy that changes all the time, and with technology that won't stand still, learning through short cycles of discovery is*

the tried-and-true problem-solving approach" (Schwaber, 2000, p. xii). According to Poppendieck (2000), a suitable approach for complex environments is agile management methods, where short cycles of discovery are achieved through the iterative approach. The iterative approach facilitates gradual planning throughout the project life cycle, and is thus more fit to use in high changing markets. Similar observations can be found in Vazquez-Bustelo, Avella and Fernández (2007). They state that firms that need to adapt to high levels of dynamism and complexity, and unpredictable changes in the environment, should exhibit high levels of agility (Vazquez-Bustelo, Avella & Fernandez, 2007, p. 1308, 1312).

Increased complexity in the environment, corresponds to increased use of agility, as the traditional method cannot solve the challenges caused by complexity (Saynisch, 2010, p. 23; Serrador & Pinto, 2015, p. 1042). Based on this, we hypothesize the following:

Hypothesis 5. *Complex environments, with high levels of dynamism, are positively related to the adoption of agile management methods, and thus the degree of agility in projects.*

2.5.6 Project planning

The development style, and to respond to changes over following a plan are elements of importance regarding project planning in the first and third dimension of the 4-DAT approach, respectively (Qumer & Henderson-Sellers, 2008, p. 1901). Planning an entire project in advance can be challenging when dealing with uncertain, and complex environments. An up-front planning approach therefore requires predictability in order to foresee problems and risks that might occur subsequently in a project. However, innovative projects are volatile, and therefore exposed to changes and risks in the environment, making predictability difficult. This is why an incremental and iterative planning approach might be more suited for these projects (Conforto et al., 2014, p. 27-29; Serrador & Pinto, 2015, p. 1041-1042).

Conforto et al., (2014) conducted a research on the use of agile project management in 2014. They found that many project managers unconsciously utilized the iterative planning approach to a certain degree, even though they had a traditional mindset and used traditional tools and techniques. The reason was that, in most cases, managers were responsible for planning the project in advance, which was time consuming and required heavy documentation. These finds indicate that companies using the traditional approach might

encounter limitations, mainly when operating with innovative and technologically advanced projects (Conforto et al., 2014, p. 27-28).

Based on the literature on project planning, it seems that less upfront planning leads to increased use of the iterative approach, which again makes a project more agile. From this, we have derived the following hypothesis:

Hypothesis 6. *Less upfront project planning is positively related to the degree of agility in projects.*

2.6 Hypothesized model and hypothesis

This research was conducted in order to explore different factors that might affect the degree of agility in projects. Based on the literature review and research mentioned earlier, several variables were included, as they were assumed to impact the degree of agility in projects. The selected variables include a small team size, a high degree of customer involvement, organizational culture, complexity in the environment, and less upfront project planning. These variables were all assumed to have a positive direct effect on the degree of agility in projects.

One moderating variable was also included in this research, namely the expertise of team members. Based on the studied literature, this variable was assumed to have a positive moderating effect on the relationship between a small team size and the degree of agility in projects.

Based on the literature review, previous research and finds, we have derived the following research model and hypothesis:

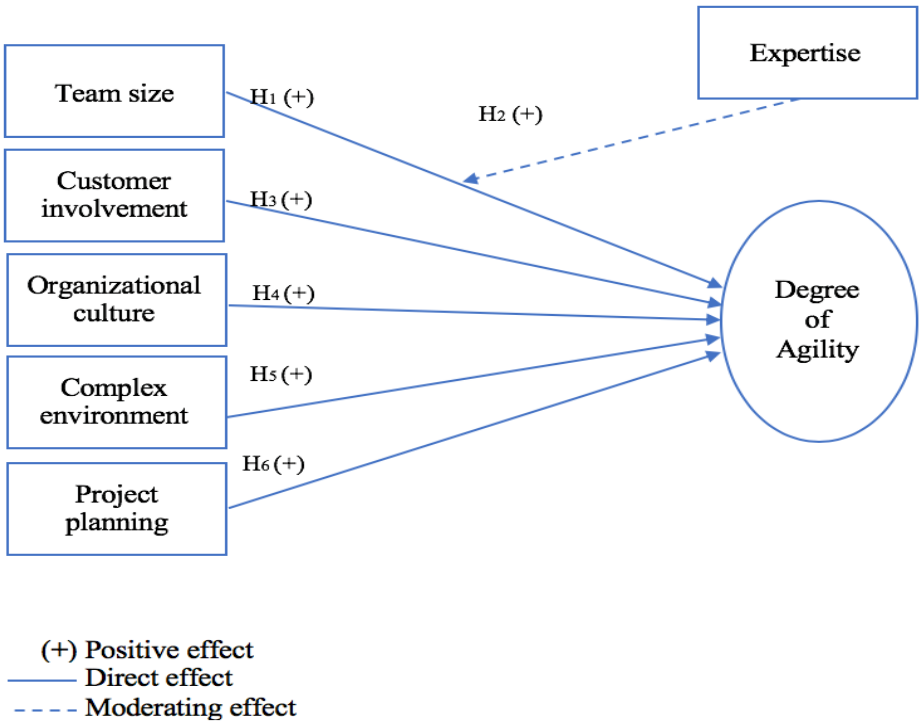


Figure 2.4: Structural Model

H1 : *A small team size is positively related to the degree of agility in projects.*

H2 : *Expertise among team members has a positive moderating affect on the relationship between a small team size, and the degree of agility in projects.*

H3 : *Customer involvement is positively related to the degree of agility in projects.*

H4 : *Organizational culture has a positive affect on the degree of agility in projects.*

H5 : *Complex environments, with high levels of dynamism, are positively related to the adoption of agile management methods, and thus the degree of agility in projects.*

H6 : *Less upfront project planning is positively related to the degree of agility in projects.*

3. Method

In this section the process for the data collection will be explained, as well as the operationalization of the chosen variables for this research. Further, the preparation of the data material will be presented, before tests regarding reliability and validity will be conducted.

3.1 Data collection

A quantitative approach was selected for this research, and the data collection was done by utilizing an online questionnaire created in the program SurveyXact. The purpose of the data collection was to measure the factors that affect the degree of agility in projects.

3.1.1 Online questionnaire

To construct the online questionnaire, the Scandinavian questionnaire tool program SurveyXact was used. By utilizing this program, it was possible to explore the strategies and methods that were used during the respondents last completed project, which was necessary in order to measure the degree of agility.

Electronic or online questionnaires are commonly used, as they have many advantages. An online questionnaire provides fast and easy distribution, making it possible to cover a wide geographical area (Sekaran & Bougie, 2016, p. 143). This was crucial for this research, as it required a certain amount of respondents to provide valid results. As the research required feedback from people with experience within project management, the questionnaire was distributed to project organizations in Norway, Sweden, Denmark and Iceland. This was done in order to reach out to more respondents, and to get a more representative sample. As the survey could only be distributed to, and answered by project managers and workers, obtaining the required amount of respondents was challenging. The questionnaire was thus also distributed to several companies and project managers in Norway. It was assumed that the Nordic countries had sufficient English knowledge. The questionnaire was therefore only distributed in English. However, some of the contacted organizations translated the information regarding the research on their website. According to their experience, more people would read and respond to the survey when it was written in their native language.

Another advantage of online questionnaires is that respondents are given the possibility to answer the questionnaire at their own convenience (Sekaran & Bougie, 2016, p. 143). This

means that they can answer it anywhere, and at their own pace. This is a convenient feature, as it was assumed that most of the respondents were in full time equivalence, and had a busy schedule.

There are, however, also certain disadvantages related to the use of online questionnaires. When distributing questionnaires, problems regarding sampling often occur, and the response rates are typically low. This causes difficulties when establishing the representativeness of the sample, and makes it more challenging to generalize findings (Sekaran & Bougie, 2016, p. 143). Another disadvantage is the inability to clarify possible doubts or questions the respondents might have (Sekaran & Bougie, 2016, p. 144).

In order to make the questionnaire more structured, it was divided it into seven sections, where each section consisted of questions that measured different variables in the research model. This was also done in an attempt to make it more comprehensible for the respondents, as each section consisted of questions related to a specific topic. The questionnaire was also made as short and concise as possible, as this was suggested by Sekaran and Bougie (2016), to improve the response rate (Sekaran & Bougie, 2016, p. 144). A short description of the aim and the background for the research was provided on the first page of the questionnaire, in order to give the respondents an insight to agile management methods and their characterization. Lastly, the respondents were asked to refer to their last completed project when they answered the questionnaire, to avoid bias.

When constructing a questionnaire, existing scales and questions are commonly used, in order to sustain the validity and reliability of the research (Tyssen et al., 2014, p. 381). However, already validated questionnaires from previous studies were difficult to find, as there are limited research on this particular topic. The questions for this particular survey were thus constructed based on indicative factors of agility and critical success factors, provided in previous studies and literature. The background for the questions is elaborated on in previous sections in this research, as well as in section 3.2. The questionnaire is attached in Appendix A.

3.1.2 Sampling frame and distribution

A sample can be defined as a subset of the chosen population, where the population is the group of elements or people of interest (Sekaran & Bougie, 2016, p. 237). According to Sekaran and Bougie (2016), *"A reliable and valid sample should enable us to generalize the findings from the sample to the population under investigation"* (Sekaran & Bougie, 2016, p. 257). The size of the sample is, among other things, dependent on the variability in the population and desired confidence level (Sekaran & Bougie, 2016, p. 259). According to Gripsrud, a convenient sample size should contain about 200 subjects (Gripsrud, Olsson, & Silkoset, 2010, p. 140). A rule of thumb when utilizing PLS-SEM is, however, that *"the minimum sample size must be ten times the maximum number of arrowheads pointing towards a latent variable"* (Hair, Hult, Ringle, & Sarstedt, 2017, p. 24). With a total number of six independent and moderating variables in our model, the utilization of PLS-SEM required a minimum of 60 respondents. Based on the work of Cohen (1992), our model, with a minimum R^2 value of 0.10, a significant level of 5%, a statistical power of 80% and a maximum number of six predictor variables, would need a minimum sample size of 130 (Hair et al., 2017, p. 25-26).

As this research was dependent on response from people with experience within project-based work, this became the target population. In order to reach out to the target group, several project organizations in the Nordic countries were contacted. This was done to reach out to more respondents, and to get a more representative sample. Several project organizations responded and agreed to distribute the survey to their members. Most of the organizations published information on the research and a link to the questionnaire on their website, whereas some included this in their weekly newsletter or sent it out via email to their members. A few also published information and the link to the questionnaire on social media accounts such as LinkedIn and Facebook.

The project organizations that distributed the questionnaire were; Norsk Forening for Prosjektledelse (NFP), Svenskt Projektforum, Project Management Institute (PMI) Norway Chapter, Prosjekt Norge, Dansk Prosjektledelse, PMI Sweden Chapter and The Project Management Association of Iceland. As most of these organizations published information on the research and a link to the questionnaire online, it was difficult to predict how many people the survey reached out to. Further, since there was limited information regarding the size of all these organizations, it was also challenging to predict how many people that

received information on the study via email, or through a weekly newsletter. As it was difficult to obtain the required amount of respondents, several Norwegian companies and project managers were also contacted and asked to participate in the study. This was done in an attempt to increase the response rate.

Many online questionnaires, including the one used in this research, are published through a link on websites or other media sites, leading to non-probability samples, and often sample selection bias. This type of invitation increases the self-selection bias, which can affect online research significantly. Subjects of the sample can voluntarily participate in the online questionnaire, which might decrease the respondents' incentives to complete the survey. This might lead to a systematic bias. Further, as mentioned earlier, the response rate is a major challenge, as it is generally very low. These complications with sampling in online survey often cause an inability for researchers to generalize their findings to the whole population (Sekaran & Bougie, 2016, p. 265).

The data collection period lasted from February 14th to April 25th, meaning approximately for two and a half months.

3.1.3 Ethical considerations

Protection of personal data is important when conducting research. The University of Agder's code of practice for processing personal data in research oblige researchers to notify the Norwegian Centre for Research Data (NSD) about new projects containing personal information. To assess whether NSD had to be notified about this research, a notification test was conducted. The result showed that this research was not subject to notification. SurveyXact made it possible to create, distribute and analyze data anonymously. This information was given on the first page of the questionnaire, and respondents were aware that personal information would not be exposed. The result form from the notification test is attached in Appendix B.

3.2 Operationalization of variables

Abstract concepts can be difficult to measure, and a reduction is thus needed to render them measurable in a tangible way. This is done by investigating the behavioral dimensions, facets or characterizations denoted by the concepts, which is called operationalizations (Sekaran & Bougie, 2016, p. 195). This section will explore the measurement of the variables, as well as

the constructs and their corresponding items. As mentioned earlier, the items assigned to measure the constructs are created specifically for this research. This is due to the unavailability of already validated items and scales in previous studies. A complete overview of the constructs and their corresponding indicators, and items can be found in Appendix C.

A 5-point Likert scale (with the following anchors; 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree or Disagree, 4 = Agree, 5 = Strongly agree) was mostly used to measure the agility in the respondents last completed project, and to determine how strongly the respondents agreed or disagreed with the statements (Sekaran & Bougie, 2016, p. 207).

3.2.1 Dependent variable

The primary interest in this research was to measure the degree of agility in projects, which is the dependent variable, in order to inspect factors that have an affect on the degree of agility in projects (Sekaran & Bougie, 2016, p. 73). The degree of agility is measured using the second dimension of the 4-DAT approach in Qumer and Henderson-Sellers (2008). The construct for degree of agility include 4 items, such as "the management method used produced quick results" (Qumer & Henderson-Sellers, 2008, p. 1904). A 5-point Likert scale was utilized, and for all items it was assumed that higher values indicate a higher degree of agility.

3.2.2 Independent variables

Independent variables are variables that have an affect on the dependent variable, the degree of agility, and the effect can be either positive or negative. This means that changes in the dependent variable is caused by changes in the independent variables (Sekaran & Bougie, 2016, p. 74). The independent variables chosen for this research, are based on Qumer & Henderson-Seller's (2008) 4-DAT approach related to degree of agility, as well as other research conducted on agile project management and success factors. The independent variables include a small team size, customer involvement, organizational culture, complexity in the environment and less project planning.

Qumer & Henderson-Sellers (2008) question whether agile methods favor small or large teams in their 4-DAT approach. Research conducted by Bustamante & Sawhney (2011), Cao & Chow (2008), and Lalsing et al., (2012) suggest that a small team is more fit for agile methods. To measure this variable, respondents were asked how many people, on average,

they normally work with on a project. This variable was thus measured using a single-item construct. Even though researchers are encouraged to use multi-item measures in their constructs, measuring self-reported facts, such as age, with a single item is considered as commonly accepted practice (Wanous, Reichers & Hudy, 1997, p.247;Bergkvist & Rossiter, 2007, p. 175).

The items related to customer involvement were based on Qumer & Henderson-Sellers' (2008) third dimension in the 4-DAT approach, specifically regarding customer collaboration over contract negotiation (Qumer & Henderson-Sellers, 2008, p. 1904). The topic was further elaborated on in Misra, Kumar, & Kumar (2009), and to some degree in Serrador & Pinto (2015). The items were also based on indicative factors from Stankovic, Nikolic, Djordjevic & Cao (2013), and Chow & Cow (2008). The construct for customer involvement includes 6 items (e.g. "customers provided feedback during the duration of the project" and "customers were satisfied with the outcome of the project"). The items were measured using a 5-point Likert scale, where it was assumed that higher values were related to a higher degree of agility for most of the items.

Organizational culture and its related items were based on Qumer and Henderson-Seller's (2008) business culture scope in the 4-DAT approach, and whether the method specified a collaborative, cooperative or non-collaborative culture (Qumer & Henderson-Sellers, 2008, p. 1904). The literature on organizational culture and agility is quite extensive, and the topic was thus further elaborated on based on Sheffield & Lemetayer (2012), Strode et al., (2009), and Conforto et al., (2014). The items were also based on indicative factors from Stankovic et al. (2013), and Chow & Cow (2008). The construct for organizational culture includes 4 items (e.g. "there was good cooperation between team members" and "the project manager and team members shared the same objectives"). All items were measured using a 5-point Likert scale, where higher values were assumed to relate to a higher degree of agility.

Complexity in the environment and its related items were based on Qumer and Henderson-Sellers's (2008) method scope in the 4-DAT approach, specifically regarding technology environment and physical environment (Qumer & Henderson-Sellers, 2008, p. 1904). Based on Saynisch (2010), Vazquez-Bustelo et al. (2007), Serrador and Pinto (2015) and Sheffield and Lemetayer (2013), the topic was further elaborated on. The construct for complex environments includes 3 items (e.g. "the project was exposed to rapid changes in the

environment"). A 5-point Likert scale was again utilized, and for all items, it was assumed that higher values were related to a higher degree of agility.

The items related to project planning were based on the first and third dimension in Qumer and Henderson-Seller's (2008) 4-DAT approach, particularly development style and responding to change over following a plan, respectively (Qumer & Henderson-Sellers, 2008, p. 1904). These factors are related to the iterative approach, and were further elaborated on based on Conforto et al., (2014), and Serrador & Pinto (2015). The items were also based on indicative factors from Stankovic et al. (2013) and Chow and Cow (2008). The construct for project planning includes 3 items, such as "the plan for the project was adaptable to changes from the environment" and "the plan for the project was gradually constructed as the project moved forward". All of the items were measured using a 5-point Likert scale, and it was again assumed that higher values were related to a higher degree of agility.

3.2.3 Moderating variable

A moderating variable is a variable that has a contingent effect on the relationship between the independent and the dependent variable (Sekaran & Bougie, 2016, p. 75). Moderating variables have the possibility to strengthen or weaken the relationship between two constructs in a model (Hair et al., 2017, p. 243). Qumer and Henderson-Sellers (2008) have stated that the 4-DAT approach and their corresponding attributes are extensible (Henderson-Sellers, 2008, p. 1901). For this reason, we have chosen to add a moderating variable, namely expertise.

The items related to expertise were based on Conforto et al., (2014), Chow & Cow (2008), and Lindvall et al., (2002), who all share similar views on the importance of expertise and competent people in agile project management (Conforto et al., 2014, p. 25;Chow & Cao, 2008, p. 963;Lindvall et al., 2002, p. 203). The items were also based on indicative factors from Stankovic et al. (2013). The construct for expertise includes 2 items; "I had sufficient knowledge to work on the project" and "the people on my team had sufficient knowledge to work on the project". The items were measured using a 5-point Likert scale. High values regarding the respondent's own level of expertise, and their evaluation of their team's level of expertise, were assumed to strengthen the relationship between the independent variable, team size, and the dependent variable, the degree of agility. Table 3.1 provides a summary of the utilized constructs, and their respective sources.

Constructs and scales	Type	Source
Team size – 1 item	Reflective	From Qumer & Henderson-Sellers (2008), Bustamante and Sawhney (2011), Lalsing et al. (2012) and Stankovic et al. (2013) and Chow & Cao (2008).
Customer involvement – 6 items	Reflective	From Qumer & Henderson-Sellers (2008), Serrador & Pinto (2015), Misra et al. (2009) and Stankovic et al. (2013) and Chow & Cao (2008).
Organizational culture – 4 items	Reflective	From Qumer & Henderson-Sellers (2008), Strode et al. (2009), Sheffield & Lemetayer (2012), Conforto et al. (2014) Stankovic et al. (2013) and Chow & Cao (2008).
Complexity in the environment – 3 items	Reflective	From Qumer & Henderson-Sellers (2008), Saynisch (2010), Vazquez-Bustelo et al. (2007), Serrador & Pinto (2015) and Sheffield & Lemetayer (2012)
Project planning – 3 items	Reflective	From Qumer & Henderson-Sellers (2008), Conforto et al. (2014), Serrador & Pinto (2015), Stankovic et al. (2013) and Chow & Cao (2008)
Degree of agility – 4 items	Reflective	From Qumer & Henderson-Sellers (2008)
Expertise – 2 items	Reflective	From Lindvall et al. (2002) and Conforto et al. (2014), Chow & Cao (2008) and Stankovic et al. (2013).

Table 3.1: Used constructs and scales and their respective sources

3.2.4 Control variables

When a cause-and-effect relationship between the dependent and independent variable is hypothesized, there is a possibility that another factor might also affect the dependent variable. In this case the relationship between the dependent and independent variable will be spurious, which means the relationship is not valid (Sekaran & Bougie, 2016, p. 168).

In this research, the following 9 demographic control variables were included; age, gender, industry, project position, education, years in full time equivalent, experience with project work, percentage of working hours used on project work and size of the company. The chosen variables were adapted from Sherehiy & Karwowski (2014) and Stankovic et al.

(2013), and were measured on a nominal category or interval scale (Sherehiy & Karwowski, 2014, p. 468; Stankovic, Nikolic, Djordjevic & Cao, 2013, p. 1671).

Variables such as level of education was measured by a category scale, where the respondents had to select among the different options. For other variables, such as age and size of the company, the respondents had to manually write down the answers using numbers.

3.3 Data analysis: PLS-SEM

To analyze the hypothesized model in this research, Partial Least Squares Structural Equation Modelling (PLS-SEM) was utilized. The analysis was conducted in SmartPLS 3, and guidelines by Hair et al. (2017) was followed. SmartPLS 3 made it possible to examine the relationships between the variables, as well as test the validity and reliability of the utilized constructs and their items, and the significance of the constructs. Further PLS-SEM is practical when using a small sample size.

3.3.1 Data preparation and examination

According to Sekaran and Bougie (2016), the collected data needs to be edited before further analysis can be completed. This means that the collected data must be examined for illogical or inconsistent answers, as well as missing values or omissions (Sekaran & Bougie, 2016, p. 276).

When the collection of the data for this research was completed, a total number of 131 respondents had answered the survey. However, 34 of the respondents had missing values, which was a quite high number. How these values are to be treated, are addressed in Hair et al. (2017) and Sekaran and Bougie (2016). According to Hair et al. (2017), missing data in a questionnaire should not exceed 15%. They further state that a reasonable limit of missing data for an indicator should not exceed 5% (Hair et al., 2017, p. 25, 56). Due to these limitations, 33 of the respondents with missing values were deleted from the dataset, and not included in the analysis. One of the respondents with missing values was however included. The reason was that the dataset was relatively small, and the respondent had answered every question related to the dependent and independent variables. The only questions that were left out were those related to the control variables, meaning background information. These omissions might be related to the respondent's willingness to answer these questions. We

decided to assign these unanswered items mean values, based on the completed answers for this section (Sekaran & Bougie, 2016, p.57, 276-277).

Further, the illogical, inconsistent or extreme values in the dataset were assessed. One respondent had answered strongly disagree on every item in the questionnaire, and that the project team normally consisted of 0 people. As these answers were inconsistent and could have biased the results, the respondent was removed. One person stated that out of total working hours, 110% of the time was used on project work. As this person had misunderstood the scale of the question, this item was adjusted.

After editing the data, a total of 98 respondents were used for further analysis. According to the model presented by Cohen (1992), our model, with 6 predictor variables, should have a sample size of at least 130 respondents (Hair et al., 2017, p. 26). Even though the sample size for this research was smaller than what is recommended, it was still larger than the rule of thumb suggested in Hair et al. (2017), as they recommend a sample size of 10 times the number of independent variables, meaning 60 respondents (Hair et al., 2017, p. 24). As the sample size was larger than the rule of thumb suggested in Hair et al. (2017), we proceeded with the analysis.

Another important factor that needs to be considered before further analysis and tests can be conducted, is coding of the data. Coding is a very important factor when a multivariate analysis is applied, because it helps assess when and how scales should be used (Hair et al., 2017, p.9). When using Likert scales, like in this study, coding is crucial, as the requirement of equidistance needs to be fulfilled. A good Likert scale should have "*clearly defined linguistic qualifiers for each category".* This means that the distance between the different categories should be the same, and that the scaling should be symmetric (Hair et al., 2017, p.9-10). This requirement should be fulfilled in this study, where the categories are given values; strongly disagree (1), disagree (2), neither disagree nor agree (3), agree (4) and strongly agree (5). Further, some of the items were reverse coded. These were items where "strongly agree" indicated a lower degree of agility (e.g. "the project environment was stable and predictable").

3.3.2 Data distribution

In order to assess if the collected data is normally distributed, the dataset should be examined for skewness and kurtosis. Skewness measures to what degree the variable's distribution is symmetrical. Kurtosis measures if the distribution is too peaked, meaning that the distribution is relatively narrow. When measuring skewness and kurtosis, a general rule is that both measures should be between -1 and +1, where values close to 0 indicates that the collected data is normally distributed. Values below -1 or above +1 indicate that the distribution is either skewed, or too peaked or too flat, meaning non-normal (Hair et al., 2017, p. 61).

When measuring the skewness and kurtosis of the dataset, the majority of the items were within the general guideline of -1 and +1, or slightly outside this interval. There was however one item with a relatively high skewness of 2.168 (item 1.1). As for the kurtosis, item 1.1, 3.5, 4.2, 4.4 and 9.2 had relatively high values, of 5.164, 3.473, 6.430, 2.757 and 2.073 respectively. As PLS-SEM is a nonparametric statistical program, it does not require normal distribution of the data. This means that high skewness or kurtosis values for some of the items should not create any problems when analyzing the data in SmartPLS 3. However, extremely non-normal values might cause a problem when determining the significance of the parameters, and should therefore be kept in mind (Hair et al., 2017, p. 61). A table of the skewness and kurtosis can be found in Appendix D.

3.3.3 Common method bias

To clarify the quality and the validity of the conclusions made in regards of the relationships between the measures, it is important to check for any measurement errors, that is, method biases. Method biases have both random and systematic components, where the latter is more serious because it gives a different explanation of the relation between measures of different constructs that is independent of the hypothesized one. Systematic measurement errors are mainly caused by method variance, which concerns variance that is related to the measurement method rather than to the chosen construct. Common method biases provide an alternative explanation for the correlation perceived between the measures (Podsakoff, MacKenzie, Lee & Podsakoff, 2003, p. 879) .

To check for common method bias in the dataset, a Harman's single-factor test was applied, as this was proposed by Podsakoff et al. (2003), and also executed in Tyssen, Wald and Heidenreich (2014). When conducting the test in SPSS, the results showed that the general

factor accounted for 21, 5% of the total variance, which is below the general level of 50% (Tyssen, Wald & Heidenreich, 2014, p. 383). This indicates that common method variance should not be a considerable problem in this research (Podsakoff et al., 2003, p. 889). Further, another test for common method bias was conducted, by applying a Lindell-Whitney marker variable test, as this was suggested by Lindell & Whitney (2001), and also executed in Tyssen et al. (2014). A marker variable test includes the implementation of an unrelated marker variable in the model. Common method bias is present if the correlation between the marker variable and the constructs in the research is high (Lindell & Whitney, 2001; Tyssen et al., 2014, p. 383). The Lindell-Whitney marker variable test was conducted twice, using the respondents' project position and the industry they worked within as marker variables. The results of the tests showed that the highest correlation for the marker variables "project position" and "industry", and the constructs in this research were 0.143 and 0.125, respectively. This indicates that the highest level of variance shared were 2.045% and 1.563%, meaning that common methods bias should not be considered as a problem in this research.

In addition to implementing statistical remedies, Podsakoff et al. (2003) also recommend procedural remedies (Podsakoff, 2003, p. 887). As suggested in Podsakoff et al. (2003), and also executed in Tyssen et al. (2014), the questionnaire was divided into different sections, in order to separate the different variables (Podsakoff, et al., 2003, p. 887; Tyssen et al., 2014, p. 383). Another remedy used, was that the respondents were able to answer the questionnaire anonymously, which could reduce the likeliness of them editing their response (Podsakoff et al., 2003, p. 888). Tyssen et al. (2014) also recommend using already established scales (Tyssen et al., 2014, p. 381). However, such scales were difficult to obtain for this study. For this reason, it was important to check the collected data for validity and reliability, and this is explained in section 3.3.5.

3.3.4 Model Estimation

A path model was developed in order to illustrate the hypotheses and variable relationships, and further examined in SmartPLS 3. The model consists of a structural model (inner model) and measurement models (outer models). The structural model concerns the relationships (paths) between the constructs, whereas the measurement models represents the relationships between the constructs and the indicator variables (Hair et al., 2017, p. 11-12). Figure 3.1 represents the structural and the measurement models for this research, and displays which

items that were used to measure each latent variable. For example, item 7.4, 7.5 and 7.6 were used to measure the latent variable project planning.

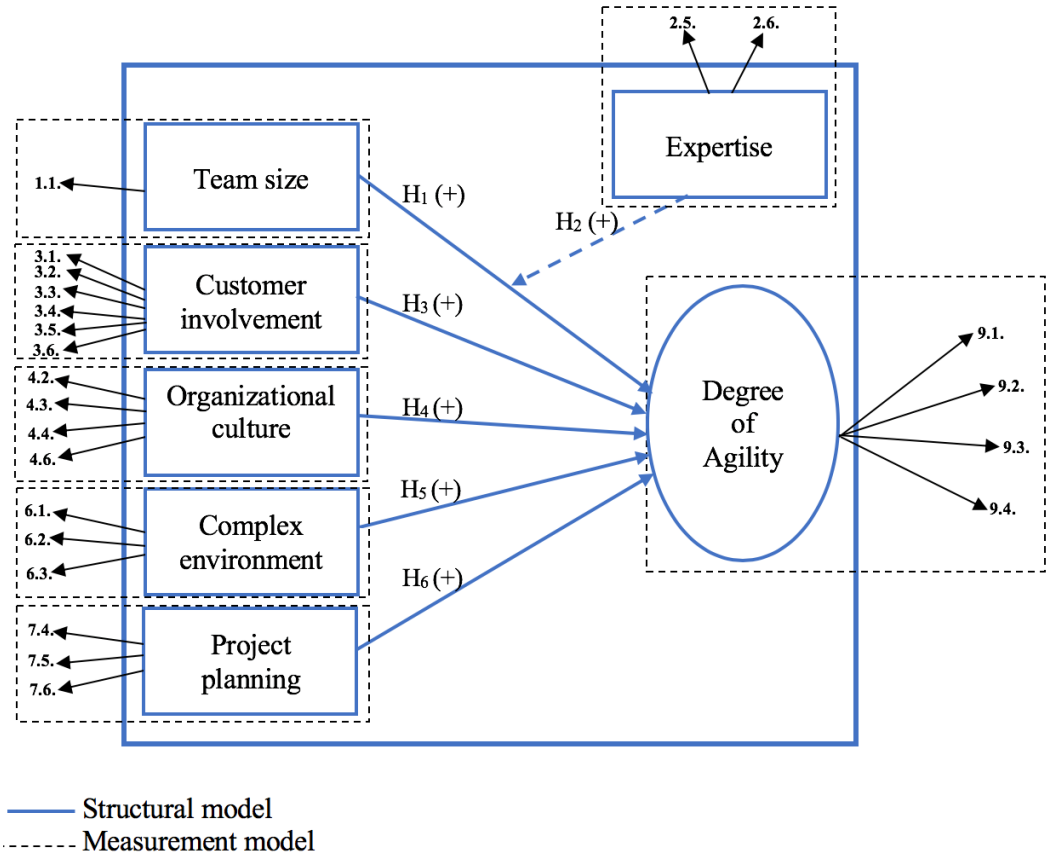


Figure 3.1: Structural and measurement models

Further, to define the direction of the relationship between the constructs and their related items, it is important to distinguish between two types of scales. With a reflective scale, all the items are expected to correlate, and they share the same basis, which is the construct. An increase in the value of the construct will correspond to higher value for all the items of this construct. When a construct is an explanatory combination of its associate indicators, a formative scale will be used.

In this case the items were not necessarily related to each other. If one of the indicators changed, it would translate to a change in the score of the overall construct, despite the value of the other indicators (Sekaran & Bougie, 2016, p. 225-226). For these reasons, all the scales in the model of this research are reflective, as the items share the same common basis, a construct. The direction of the arrows representing the relationship goes from the construct to the items. In this research, it was assumed that an increase in the value of the construct,

would result in an increase in the value for all the items representing it. The assessment of the reflective scales was based on the literature provided by Hair et al., (2017) and Sekaran & Bougie (2016), as previous studies were lacking information on this matter.

Before any further evaluations, it was important to ensure that the model converged, meaning to assess if the algorithm used in SmartPLS 3 converged after a low number of iterations. Hair et al. (2017) suggested a maximum number of 300 iteration for this algorithm (Hair et al., 2017, p. 91). Our model converged after only 9 iterations, and we could thus proceed with the evaluation of the measurement models.

3.3.5 Evaluation of the measurement models

In order to determine the quality of the results, it is crucial to evaluate the internal consistency reliability and validity of the reflective measurement models. Reliability considers the extent to which a measurement is without bias, in order to confirm its consistency. Validity is related to the goodness of measures, meaning, for this research, that the items measure the constructs they are intended to measure (Sekaran & Bougie, 2016, pp. 220, 223). As the scales used in this study have not previously been validated, it was vital to assess the validity and reliability before further analysis were conducted. In this section the assessment of the measurement models will be done, by evaluating the composite reliability, convergent validity and discriminant validity (Hair et al., 2017, pp. 106, 111).

Internal consistency is traditionally measured by Cronbach's alpha, which utilizes the intercorrelations of the indicator variables to yield an estimation of the reliability. However, Cronbach's alpha tends to underestimate the internal consistency, and for this reason, it is more appropriate to avail composite reliability. This measure evaluates the indicator variables' outer loadings, and varies between values of 0 and 1. Higher values of composite reliability indicates higher reliability, yet satisfactory values should be between 0.7 and 0.9. Values below 0.6 indicates low internal consistency reliability (Hair et al., 2017, p. 111-112).

Table 3.2 summarizes the composite reliability for this research, and as can be observed, all the values lie between 0.7 and 0.9, except for expertise and team size. Expertise has a value of 0.694, and as this value is close to the limit of 0.7, this would most likely not cause any problems for further analysis. Team size on the other hand has a value of 1. The reason is that

team size is measured using a single-item construct, meaning that the relationship will always be 1 (Hair et al., 2017, p. 108-109).

Constructs	Composite reliability
Team size	1.000
Expertise	0.694
Customer involvement	0.872
Organizational culture	0.846
Complexity in the environment	0.827
Project planning	0.811
Degree of agility	0.832

Table 3.2: Composite reliability

Convergent validity considers to what degree different measures of the same construct correlate positively. This is established by looking at the outer loadings and the average variance extracted (AVE). The size of the outer loadings is referred to as indicator reliability, where high outer loadings for a construct means that the items have much in common. Indicator reliability thus concerns the communality of an item. A general rule is that the outer loadings should be 0.708 or higher, as the square of this number equals 0.50. The reason is that a variable should explain at least 50% of the variance of each item. Values below 0.4 should be removed, yet values between 0.4 and 0.7 should be taken into consideration, and only removed if it increases composite reliability or the average variance extracted (AVE) (Hair et al., 2017, p. 112-113). For this reason, item 2.7 was removed from expertise, 4.1, 4.5, 4.7, 4.8, 4.9 and 4.10 from organizational culture, 6.4 and 6.5 from complexity in the environment, 7.1, 7.2 and 7.3 from project planning and 9.5, 9.6 and 9.7 from degree of agility, due to low outer loadings. A table of the outer loadings can be found in Appendix E.

Average variance extracted (AVE) is equal to the communality of the construct, meaning the mean value of the squared loadings of the items of the construct. Similar to indicator reliability, the items should have a value of at least 0.50, as this equals the squared number of 0.708. This means that the construct should explain at least 50% of the variance of its items (Hair et al., 2017, pp. 114-115). As can be seen in table 3.3, all constructs had values above 0.5. AVE is however not a good measure for a single item construct, as the outer loading of the item is fixed at 1.00, which explains the value of team size in the table.

Constructs	Average variance extracted
Team size	1.000
Expertise	0.540
Customer involvement	0.536
Organizational culture	0.580
Complexity in the environment	0.614
Project planning	0.589
Degree of agility	0.558

Table 3.3: Average variance extracted (AVE)

Discriminant validity is established when a construct is considered to be unique, meaning that it represents a phenomenon that is not considered by other constructs in the model. To assess discriminant validity, several approaches can be applied. The first approach is to analyze the cross loadings of the items. For discriminant validity to be present, items should have the highest loadings on their corresponding construct (Hair et al., 2017, p. 115). As can be seen in the table in Appendix F, the outer loadings are higher than the cross loadings, meaning that all items have the highest value on their corresponding construct.

The second approach for assessing discriminant validity is the Fornell-Larcker criterion. This approach compares the latent variable correlations with the square root value of the AVE. For this approach, the square root of the AVE of each construct should be higher than its correlation with any of the other constructs (Hair et al., 2017, p. 115-116). As seen in table 3.4, its evident that the Fornell-Larcker criterion is fulfilled.

	Complexity in the environment	Customer involvement	Degree of agility	Expertise	Organizational culture	Project planning	Team size
Complexity in the environment	**0.784**						
Customer involvement	0.016	**0.732**					
Degree of agility	-0.307	0.481	**0.747**				
Expertise	-0.089	0.199	0.200	**0.735**			
Organizational culture	-0.132	0.388	0.520	0.227	**0.762**		
Project planning	-0.003	0.377	0.493	0.270	0.354	**0.767**	
Team size	0.308	0.046	-0.085	-0.092	-0.056	0.114	**1.000**

Table 3.4: The Fornell-Larcker criterion

To further assess the discriminant validity, a third approach is to evaluate the Heterotrait-Monotrait ratio (HTMT) of the correlations. The HTMT ratio provides an estimate of the true correlation between two constructs, had they been perfectly measured. An HTMT value should not exceed 0.9, as values above this criterion indicate low discriminant validity (Hair et al., 2017, p. 118-119). In this research, all the HTMT values were below 0.90, which proves that discriminant validity is present. A table with the HTMT values can be found in Appendix G.

Based on the assessment of the composite reliability, convergent validity and discriminant validity, it is evident that the validity and reliability of the measurement models have been established.

3.3.6 Evaluation of the structural model

Before any further analysis are done, it is important to assess the structural model for collinearity issues. To assess if collinearity is a problem, the variance inflation factor (VIF) has to be examined. According to Hair et al. (2017), a potential collinearity problem may occur if the VIF values are 5 or higher (Hair et al., 2017, p. 190-191, 143). As seen in table 3.5, all VIF values related to the dependent variable "degree of agility" is below 5, indicating that collinearity is not a problem in this research.

Constructs	VIF values
Team size	1.137
Expertise	1.125
Customer involvement	1.289
Organizational culture	1.300
Complexity in the environment	1.127
Project planning	1.310

Table 3.5: VIF values related to the dependent variable

To assess whether theory and concepts of the path model is empirically supported, it is crucial to analyze the key results of the structural model. In the following section, the hypothesized relationships will be examined by exploring the path coefficients of the structural model, as well as the coefficient of determination (R^2), the effect size (f^2), blindfolding and predictive relevance (Q^2), and the effect size (q^2) (Hair et al., 2017, p. 190-192).

4. Results

In this section the evaluation of the hypothesized relationships and the results of the web-based survey will be presented. The effects of the control variables will be considered and assessed, before further testing and evaluations of the hypothesized model are conducted.

4.1 Descriptive statistics

Based on Sherehiy and Karwowski (2014), an analysis of participants and demographic characteristics should be considered first in the analysis (Sherehiy & Karwowski, 2014, p. 468). The survey for this study was distributed a total number of 408 times. A total of 131 respondents opened the questionnaire, whereas only 97 completed the whole survey. This yields a response rate of 23.8 %, which is below the acceptable rate of 30 % (Sekaran & Bougie, 2016, p. 143). However, a response rate of 23.8% can still be justified, as questionnaires typically have low response rates. The completion rate was, however, relatively high, where 75% of the respondents who opened and answered at least one question, completed the whole survey. Sherehiy and Karwowski (2014) mention gender, age, working position and work experience as important demographic factors, and these are thus included and analyzed in table 4.1. Factors including educational level and industry sector was also included, as these are based on Sherehiy and Karwowski (2014) and Stankovic et al. (2013). The table of demographic characteristics are based on Bretones and Gonzalez (2011) (Bretones & Gonzalez, 2011, p. 277).

Variable	n	%	Variable	n	%
Gender			**Educational level**		
Female	43	44 %	Primary school	0	0 %
Male	55	56 %	Secondary school	2	2 %
			Undergraduate	20	20 %
Age			Graduate	75	77 %
≤30	16	16 %	Postgraduate	1	1 %
31-40	25	26 %			
41-50	40	41 %	**Sector**		
51-60	15	15 %	Agricultural, mining and fishing	1	1 %
≥60	2	2 %	Manufacturing (incl. construction and oil & gas)	9	9 %
			Information and communication	1	1 %
Position			Software and IT	40	41 %
Project leader	63	64 %	Financial services, insurance, real estate	15	15 %
Team member	33	34 %	Retail, transport, hospitality, tourism	2	2 %
Other	2	2 %	Public sector, education and health	17	18 %
			Other	13	13 %

Table 4.1: Demographic characteristics

From table 4.1, it is evident that the share of female and male participants was relatively equal, and the majority of the respondents were within the 41-50 years age group. A large number of the respondents were project leaders, constituting 64% of the total respondents. Further, 77 % of the respondents were on the graduate level, meaning they have a master's degree. Most of the participants were also within the software and IT industry, with 41%. The category "other" within the industry sector consists of mostly architectural companies.

Sheffield and Lemetayer (2013) further suggest that the respondents work experience and company size should be addressed (Sheffield & Lemetayer, 2013, p. 467). For this reason, the respondents general work experience has been considered, as well as their experience with project work, and the percentage of total working hours used on project work. The size of the organizations where the respondents worked, were measured by the number of people in full time equivalence at their respective workplace.

As can be seen in table 4.2, the majority of the respondents used a high percentage of their total working hours on project work.

Variables	Mean	Standard deviation
Years of work experience	17.9	11.3
Years of experience with project work	13.4	10.2
Percentage used on project work	81.9%	22.3
Size of organization (full time equivalence)	2118	5754

Table 4.2: Descriptive statistics regarding work experience related to project work

4.2 The relationship between the dependent variable and the control variables

In this section, the most relevant control variables will be analyzed in order to examine their effect on the dependent variable, degree of agility. This examination was conducted in Excel, where the mean value for each respondent's answers regarding degree of agility were calculated, and then examined in relation to the selected control variable. The utilized formula in Excel made it possible to separate the results of the different alternatives of each control variable, in order to examine the degree of agility for the desired alternative. The

degree of agility was measured on a 5-point Likert scale, where the values 1 (strongly disagree) and 5 (strongly agree) indicate a lower and higher degree of agility, respectively.

As written in section 2.2.3, the agile methods in project work seem to be most prevalent in the Software and IT industry. For this reason, it is interesting to examine the degree of agility across different industries. Figure 4.1 provide an overview of agility in projects for each industry, based on the respondents' perceptions. Evidently, people working in the "manufacturing industry (construction & oil and gas included)" and the "retail, transport, hospitality and tourism" industry reported high levels of agility with mean values of 3.92 and 4.00 respectively. The Software and IT industry also showed a relatively high level of agility (3.70). People working in the Information and communication industry did however report a low level of agility, with a mean value of 2.00. The reason for this might be that there was only one respondent reportedly working within "information and communication", meaning the result is not representative for this particular industry.

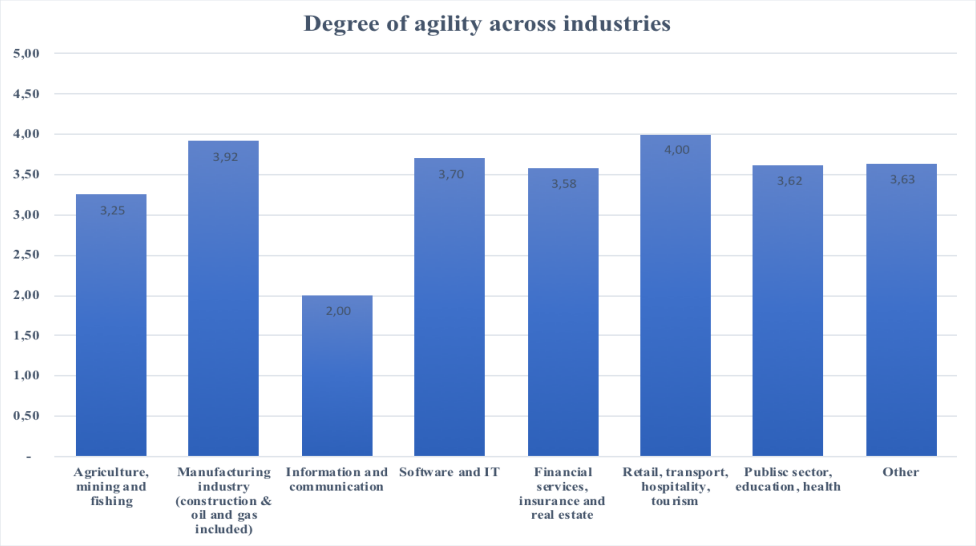


Figure 4.1: Degree of agility across industries

When looking into the respondents' experience with project work, those with 5 or less years of experience had the highest perceived level of agility (3.78) in projects. The respondents with 6-10, 11-15, 16-20, and more than 20 years of experience had a similar perceived level of agility, with a mean value of 3.63. Based on the data analysis, people with less experience in project work seem to be recent graduates, meaning they might work with projects that require implementation of more up to date methods. As the agile approach is relatively new,

this might explain why respondents with less experience perceive a slightly higher degree of agility in project work.

The control variable company size was measured by the number of people in full time equivalence in the respondents' workplace. As can be seen in figure 4.2, there is a higher perceived level of agility for small (<250) and medium sized companies (<500). However, the perceived level of agility seems to be higher for companies with more than 1000 employees. This might be due to a possible misinterpretation of the question in the survey, where respondents reported number of employees for the entire organization instead of at their particular workplace. This can be seen as a limitation and a disadvantage of a web-based survey, and will be further discussed in section 6.2.

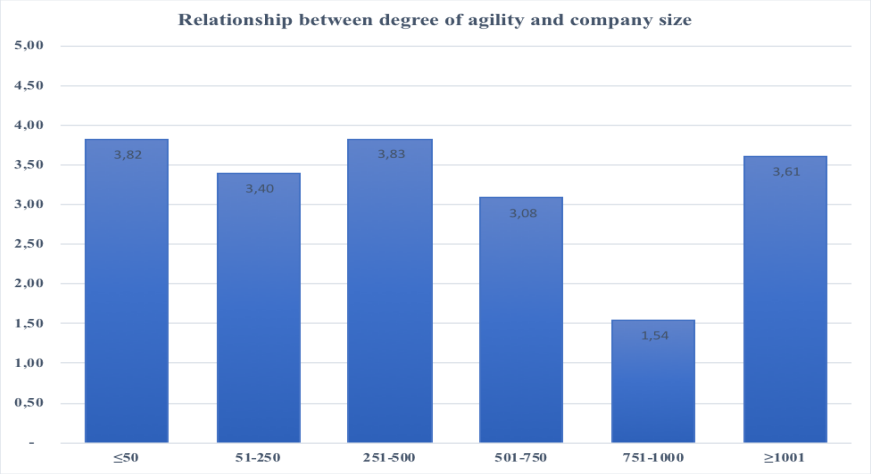


Figure 4.2: Relationship between degree of agility and people in full time equivalence

4.3 The relationship between the independent variables and the control variables

In this section, the most relevant control variables will be analyzed in order to examine their effect on the independent variables, team size, customer involvement, organizational culture, complexity in the environment and project planning. The same procedure as in section 4.2 was executed in Excel. Most of these variables were also measured using a 5-point Likert scale, where the value 1 (strongly disagree) indicates a low level of agility, whereas the value 5 (strongly agree) indicates a high level of agility. Team size was however measured using a single item construct, and a Likert scale was not used for this variable. For this reason, we looked into the mean team sizes for the different categories within the control variables.

As seen in figure 4.3, the “software and IT” industry had the highest level of customer involvement (4.35). Customer involvement was generally high across all industries, except for the “information and communication” industry (2.00). The highest level of organizational culture was found in the “information and communication” industry (4.25), while the lowest was found in the “retail, transport, hospitality and tourism” industry (3.00). Organizational culture was generally high across all industries. The highest level of complexity in the environment was found in the “information and communication” sector (4.00). The level of complexity in the environment was generally lower across all industries, with the lowest value of 2.69 in the “other” sector. This category mainly consists of architectural companies. Project planning had the highest value in the “software and IT industry” (3.93), with relatively similar values across the other industries. However, in the “information and communication” industry, the value was low (2.67).

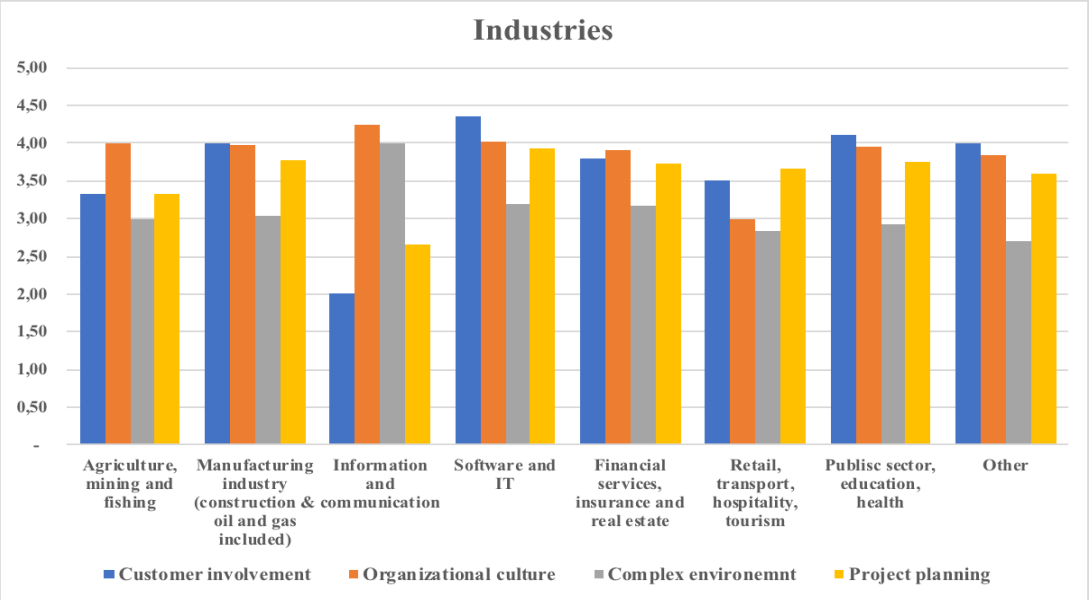


Figure 4.3: Relationship between the independent variables and industries

As previously mentioned, the independent variable team size was analyzed using the mean values across industries. For the “manufacturing industry” and “Software and IT” the average number of team members were 10 people, which coincide with the high values of the degree of agility for these industries, and that theory suggest agile methods are associated with smaller teams (section 2.5.2). As can be seen in figure 4.4, all industries operate with small teams, ranging from 3 to 14 team members.

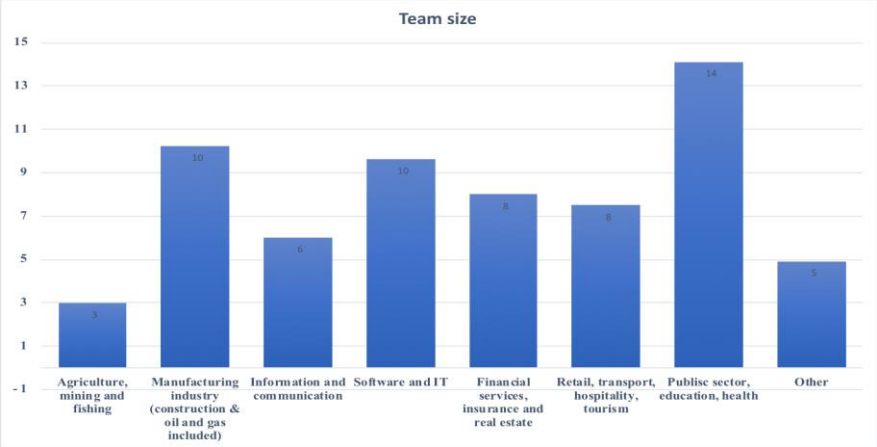


Figure 4.4: Team size across industries

When looking at the respondents' level of education, all respondents, despite their educational level, reported high perceived values of customer involvement, organizational culture and project planning, with values close to 4 or above. For complexity in the environment on the other hand, the perceived values are lower, and closer to 3. This indicates that the control variable "position" has little affect on the independent variables. When looking at team size, it appears that people with higher education seem to work on smaller project teams.

4.4 Testing the hypothesized model

In this section the relationship between the dependent and the independent variables will be evaluated, as well as the effect of the moderating variable. To go through with the assessment, the hypothesized relationships between the constructs, represented by the path coefficients, will be analyzed. Further, the coefficient of determination (R^2) will be analyzed to measure the predictive accuracy of the model. To complete the evaluation, the effect size (f^2), blindfolding and predictive relevance (Q^2), and the effect size (q^2) will be explored (Hair et al., 2017, p. 192,195).

At first, the direct effects of the hypothesized model will be analyzed, meaning that the moderating variable and its effect will be excluded (Hair et al., 2017, p. 258). The indirect effect, as well as the direct effects will be assessed in section 4.4.2, meaning the effect of the moderating variable will be considered.

4.4.1 Testing the direct effects in the model

As the aim of this research was to explore factors that have an effect on the degree of agility in projects, it was expedient to first examine each relationship between the dependent and independent variables exclusively. In this section, only the relationship between the independent variables complexity in the environment, and project planning, and the dependent variable, degree of agility, will be presented, before analyzing the total effect of all the independent variables on the dependent variable.

To commence with the analysis of the relationships between the variables, the path coefficients were considered. The path coefficients have standardized values between -1 and +1. Values close to +1 indicates a strong positive relationship between the variables, whereas values close to -1 indicates the opposite, meaning a strong negative relationship. Low values closer to 0 indicate a weaker relationship between the variables (Hair et al., 2017, p. 195). The coefficient of determination (R^2), which is the squared correlation of the actual and predicted values, was also assessed. The coefficient constitutes the joint effects of the exogenous latent variable on the endogenous latent variable. The R^2 values lies between 0 and 1, where higher values imply higher predictive accuracy. As a rule of thumb, a value of 0.75 is considered as substantial, 0.5 is considered to be moderate, whereas values closer to 0.25 are considered as weak (Hair et al., 2017, p. 198-199).

The relationship between complexity in the environment and degree of agility has a path coefficient of -0.313, indicating that the relationship is negative, and somewhere between weak and moderate, as shown in figure 4.5. This result does, however, contradict the initial assumption that more complexity in the environment is positively related to the degree of agility in projects. This find will be further discussed in section 5. The R^2, with a value of 0.098, is considered very weak.

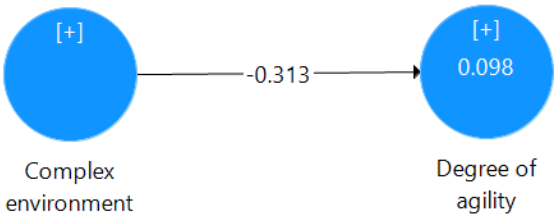


Figure 4.5: Relationship between complexity in the environment and degree of agility

The relationship between project planning and degree of agility has a path coefficient of 0.496, which indicates a moderate, positive effect. The R^2 has a value of 0.246, which is also considered as weak. The relationship is shown in figure 4.6.

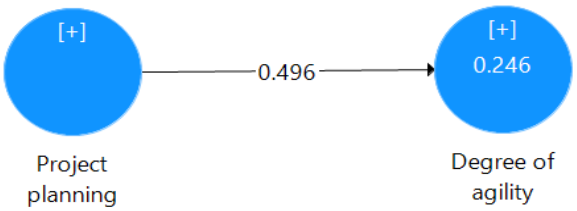


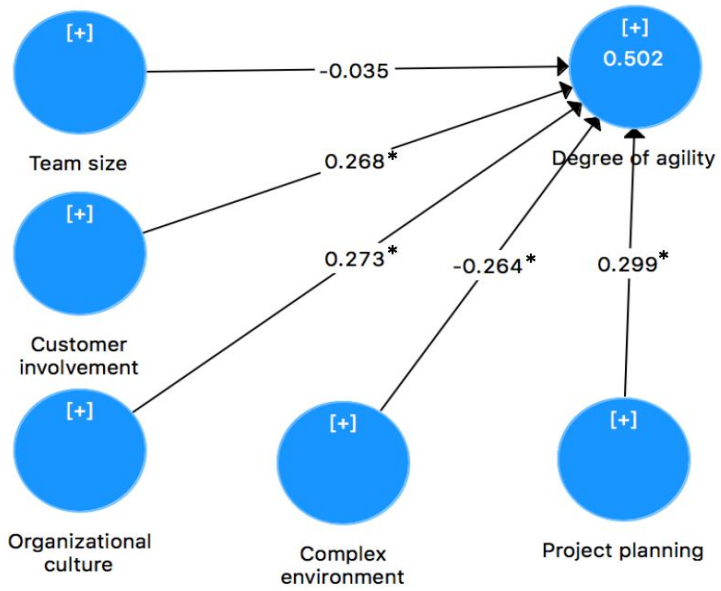
Figure 4.6: Relationship between project planning and degree of agility

The individual direct effect of two of the independent variables have now been presented, in order to examine the change in the relationships when the total effect of the variables is included. The total joint effect of the independent variables is shown in figure 4.7. An interesting observation is that the path coefficient in all relationships have decreased, meaning that the joint effect of the variables weakens all relationships between the independent and dependent variables. Complexity in the environment still has a negative relationship with the dependent variable, however, the path coefficient has slightly decreased (-0.264). Project planning still have a positive relationship with the degree of agility, however, the value of the path coefficient is about halved (0.299). The same applies for the remaining independent variables. Customer involvement, and organizational culture both have a positive affect on the dependent variable, while the relationship between team size and the dependent variable is negative. The direction of the relationships for these variables did not change when the total affect was assessed.

According to Hair et al. (2017), path coefficients can be explicated relative to one another, meaning that path coefficients with higher values, have a greater effect on the dependent variable (Hair et al., 2017, p. 197). As can be seen in figure 4.7, project planning has a stronger effect on degree of agility than the other independent variables, with a value of 0.299.

However, the value of the coefficient of determination (R^2) has increased significantly. This indicates that the combined effect of all the variables yields a higher R^2 value, meaning a higher level of predictive accuracy. One explanation for this is that the more paths pointing

towards the dependent variable, the higher the R^2 value can get. It is important to note that the R^2 value depends mainly on the model complexity and the research discipline (Hair et al., 2017, p. 199).



*** Significant at p<0.05**

Figure 4.7: Path model of the hypothesized relationships, excl. the moderating variable

To further assess the structural model, the effect size (f^2) should be examined. The effect size (f^2) is the change in R^2 value when a specific construct is excluded from the model, to assess the effect on the dependent variable. The general guidelines suggested by Hair et al. (2017), are that values representing small, medium, and large effect are 0.02, 0.15, and 0.35 respectively. Values closer to 0 indicates that there is no effect (Hair et al., 2017, p. 201). As can be seen in table 4.3, team size appears to have no effect on the dependent variable. The other four independent variables, customer involvement, organizational culture, complexity in the environment and project planning, however, all seem to have a medium effect on the dependent variable, degree of agility.

Variables	Effect sizes f^2	Effects of the independent variable
Excluding team size	0.002	No effect
Excluding customer involvement	0.113	Medium
Excluding organizational culture	0.116	Medium
Excluding complex environment	0.124	Medium
Excluding project planning	0.143	Medium

Table 4.3: Effect size (f^2)

Further, Stone-Geisser's Q^2 value should be assessed. Q^2 is a measure of the model's predictive relevance. To assess Q^2, a blindfolding procedure must be conducted. Blindfolding is considered an iterative approach, where each data point is excluded in order to re-estimate the model. Q^2 is further measured by the difference between the omitted and predicted data points. Q^2 values above 0 indicates that the model has predictive relevance for the dependent variable (Hair et al., 2017, pp. 202-207). When calculating the Q^2 value, an omission distance (D) must be determined. The omission distance should, according to Apel & Wold and Hair, Sarstedt & Ringle, lay between 5 and 10. It is also crucial that the omission distance (D) is not an integer (Hair et al., 2017, pp. 203-204). When conducting the blindfolding in SmartPLS 3, an omission distance of 8 was chosen, as this was in the middle of the interval, and since 7 was an integer. After running the blindfolding, the calculated Q^2 value showed 0.23, which indicates that our model has predictive relevance. Further, the effect size (q^2) should be assessed. However, this is only relevant when a model has more than one endogenous variable, and is thus not relevant in our research (Hair et al., 2017, pp. 207-208).

The final step in the assessment of the structural model is to examine the significance of the relationships in the model. This can be assessed using t-values, p-values and bootstrap confidence intervals (Hair et al., 2017, p. 197). To go through with these assessments, a bootstrapping procedure was conducted in SmartPLS 3. As all the hypotheses are directional, a one-tailed test was chosen (Ruxton & Neuhäusser, 2010, pp. 115-116). With a chosen significance level of 5%, the p-values had to be smaller than 0.05, whereas the t-values had to be larger than 1.671 (Hair et al., 2017, p. 196;Sekaran & Bougie, 2016, p. 382). The bootstrap confidence interval was included, as it yields information on the stability of a coefficient estimate (Hair et al., 2017, p. 155).

To address whether the hypotheses are accepted or rejected, two types of errors need to be considered, namely type I error and type II error. Type I error is also referred to as alpha (α) and is *"the probability of rejecting the null hypothesis when it is actually true"*. This probability is the significance level of 5% chosen for this research. Type II error is referred to as beta (β), and is *"the probability of failing to reject the null hypothesis given the alternate hypothesis is actually true"* (Sekaran & Bougie, 2016, p. 301).

As can be seen in table 4.4, the relationship between the independent variables customer involvement, organizational culture, complexity in the environment and project planning, and

the dependent variable degree of agility, proves to be significant. Team size is however not significant.

	Confidence level 95%	t-Value	p-Value	Significance P<0.05, t>1.671
Team size	[-0.170, 0.102]	0.423	0.336	Not significant
Customer involvement	[0.151, 0.431]	3.050	0.001	Significant
Organizational culture	[0.073, 0.428]	2.572	0.008	Significant
Complex environment	[-0.407, -0.129]	2.808	0.001	Significant
Project planning	[0.149, 0.424]	3.374	0.000	Significant

Table 4.4: Analysis of the significance of the direct effects in the model

In this section, the direct effects of the independent variables on the dependent variable degree of agility, have been tested. The results show that the path coefficients have weak to moderate effects on the dependent variable. Further, all variables except for team size also have medium effects on the dependent variable, when analyzing the effect size. Results also proved that the model has predictive accuracy and relevance, and that all the independent variables, except for team size, were significant.

4.4.2 Testing the direct and moderating effects in the model

In this section the moderating variable expertise will be included in the analysis, to examine whether the relationships in the model will change. In addition, final tests will be conducted in order to conclude if the hypothesis for this research will be accepted or rejected. To test the direct and moderating effects simultaneously in the model, an orthogonalizing approach was used in SmartPLS 3, as this was suggested by Hair et al. (2017).

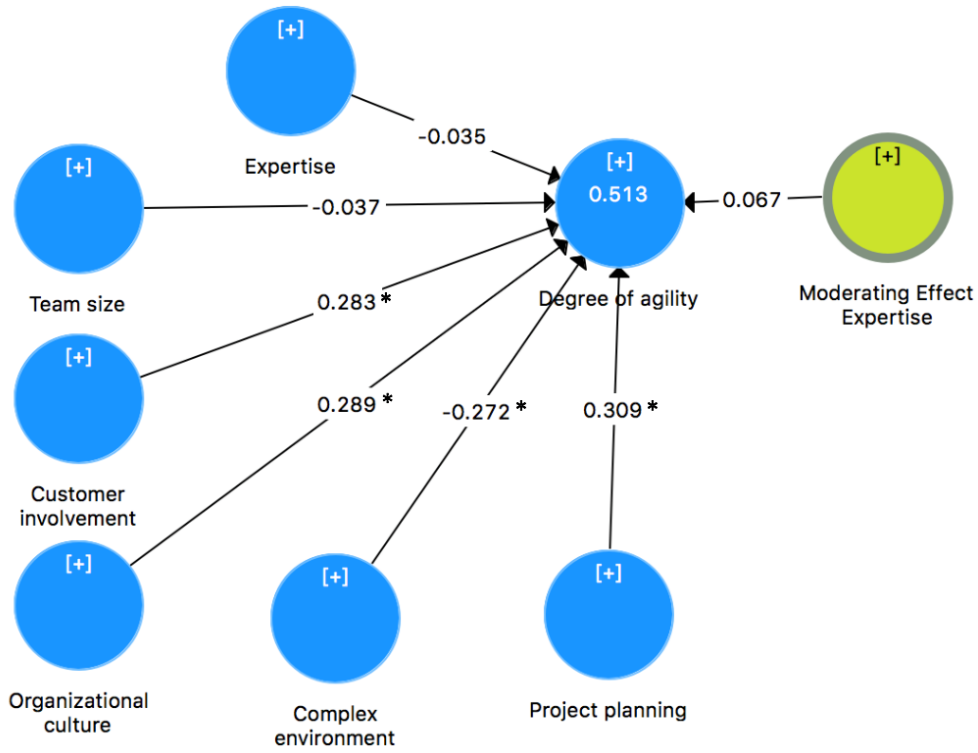
The same procedure as in section 4.4.1 was executed, but here the moderating variable was included. This means that the path coefficients, the coefficient of determination (R^2), the effect size (f^2) and predictive relevance (Q^2) will be assessed once more (Hair et al., 2017, p.255).

When the results from a moderation analysis are to be analyzed, the primary interest is to assess the significance of the interaction term (Hair et al., 2017, p. 256). As seen in figure 4.8,

the path coefficient of the moderating effect is considered as weak, with a value of 0.067. This indicates that the moderating variable expertise has little effect on the relationship between the independent variable team size and the dependent variable degree of agility. Further, it is interesting to examine whether the moderating variable has an affect on the relationship between the other independent variables in the model.

Compared with figure 4.7, where the moderating effect was excluded, it appears from figure 4.8 that the moderating variable has had a slightly strengthening effect on the relationship between all the independent variables. Team size and complexity in the environment still have a negative relationship with the dependent variable, which still contradict previous assumptions of the variables having positive effects on the degree of agility in projects. The path coefficient for team size has not increased much, and is still considered as weak, with a value of 0.037. For complexity, the path coefficient has increased to -0.272, indicating that it has a weak to moderate effect. Customer involvement, organizational culture and project planning still have a positive relationship with the dependent variable, and the value of these path coefficients have increased to 0.283, 0.289 and 0.309, respectively. The strength of these relationships is still considered between weak and moderate. Project planning is still the variable that have the greatest effect on the dependent variable, if the path coefficients are compared relative to one another (Hair et al.,2017, p. 197).

The R^2 value increases from 0.502 to 0.513 when the moderating variable is included. This indicates that the moderating variable increases the predictive accuracy of the model, meaning that more of the variance in the dependent variable, degree of agility, is explained (Hair et al., 2017, p. 198). The R^2 value is still considered as moderate.



*** Significant at p<0.05**

Figure 4.8: Path model and the hypothesized relationships, incl. moderating variable

When the moderating variable expertise is included, the effect size f^2, of the variables seems to slightly increase. The independent variables customer involvement, organizational culture, complex environment, and project planning seems to have medium effect, meaning the difference after adding the moderator is almost insignificant. As for team size, the effect size is still zero, and the same goes for the indirect effect of the moderating variable.

Variables	Effect sizes f^2	Effects of the independent variable
Excluding team size	0.002	No effect
Excluding expertise	*0.002*	*No effect*
Excluding customer involvement	0.127	Medium
Excluding organizational culture	0.130	Medium
Excluding complex environment	0.134	Medium
Excluding project planning	0.149	Medium

Table 4.5: Effect size (f^2)

To assess the Q^2 value of the model when the moderating variable was included, a blindfolding procedure was once again conducted. As previously mentioned, Q^2 values above 0 indicates that the model has predictive relevance for the dependent variable (Hair et al.,

2017, pp. 202-207). When conducting the blindfolding in SmartPLS 3, an omission distance of 8 was chosen also this time. The calculated Q^2 value showed 0.232, which indicates that our model still has predictive relevance.

The significance of the independent variables was assessed by analyzing the t- and p-values of the variables by conducting the bootstrapping procedure, which is also shown in section 4.4.1. In this section however, the moderating variable will be taken into account. As shown in table 4.6 the difference is almost unnoticeable when both the direct and indirect effects are included. The independent variables customer involvement, organizational culture, complex environment, and project planning are significant, meaning they are all within the arranged t- and p-values. Team size and the moderating variable expertise are however not significant. As the moderating effect is not significant, no further analysis will be conducted regarding this variable.

	Confidence level 95%	**t-Value**	**p-Value**	**Significance P<0.05, t>1.671**
Team size	[-0.164, 0.121]	0.434	0.332	Not significant
Expertise	*[-0.157, 0.135]*	*0.388*	*0.349*	*Not significant*
Customer involvement	[0.162, 0.444]	3.161	0.001	Significant
Organizational culture	[0.099, 0.444]	2.776	0.003	Significant
Complex environment	[-0.409, -0.143]	3.179	0.001	Significant
Project planning	[0.155, 0.427]	3.755	0.000	Significant

Table 4.6: Analysis of the significance of the direct and indirect effects in the model

Based on the examination of the data, tests conducted to detect the path coefficients, predictive accuracy and relevance, and the significance of the independent and moderating variables, conclusions regarding the hypotheses are displayed in table 4.7. As can be seen, hypothesis 3, 4 and 6, representing customer involvement, organizational culture, and project planning affecting the degree of agility in projects, respectively, were supported. Hypothesis 1, 2, and 5 representing team size, expertise, and complexity in the environment respectively, were rejected. Even though hypothesis 5 regarding complexity in the environment was proven to be significant, we have chosen to reject the hypothesis as the direction of the relationship is the opposite of the initial assumption. Complexity in the environment was,

based on literature conducted by among others Vazquez-Bustelo et al. (2007), assumed to be positively related to the degree of agility in projects. Results, however, showed that this relationship was negative. For this reason, the hypothesis was rejected for this research.

Hypothesis	Supported or rejected
H_1 : A small team size is positively related to the degree of agility in projects.	**Rejected**
H_2 : Expertise among team members has a positive moderating affect on the relationship between a small team size, and the degree of agility in projects	**Rejected**
H_3 : Customer involvement is positively related to the degree of agility in projects	**Supported**
H_4 : Organizational culture has a positive affect on the degree of agility in projects	**Supported**
H_5 : Complex environments, with high levels of dynamism, are positively related to the adoption of agile management methods, and thus the degree of agility in projects	**Rejected**
H_6 : Less upfront project planning is positively related to the degree of agility in projects	**Supported**

Table 4.7: Hypothesis and results

4.5 Multigroup analysis (MGA)

In this section a multi group analysis will be conducted, to assess if heterogeneity is present in the data. It is important to address heterogeneity, as it can affect the validity of PLS-SEM results, and because incorrect conclusions can occur if heterogeneity is disregarded (Hair, Hult, Ringle & Sarstedt, 2014, p. 244). The differences between the path coefficients and the p-values are thus analyzed to identify if they are significant.

When conducting the multigroup analysis in SmartPLS 3, the control variable “position” was chosen, as this was the most relevant for this research. The results from the multigroup analysis can be seen in table 4.8. The R^2 value shows a slightly higher predictive power for “team member”(0.643) than for “project leader” (0.538). However, both have moderate predictive accuracy. The path coefficient differences all have low values, where the highest value is 0.184 for the independent variable team size. As all the path coefficient differences are relatively close to zero, they are not considered to be statistically different. P-values should be below 0.05, as the significance level determined for this research is 5% (Hair et al.,

2017, p. 196). As shown in table 4.8, p-values are above 0.05 for all the variables, meaning the differences are not statistically significant.

	Project leader		Team member		Path coefficient difference	p-value
	Path coefficient	R^2	Path coefficient	R^2		
Complex environment → Degree of agility	-0.318	0.538	-0.315	0.643	***0.003***	***0.494***
Customer involvement → Degree of agility	0.378		0.218		***0.160***	***0.231***
Expertise → Degree of agility	-0.122		0.056		***0.179***	***0.182***
Moderating effect Expertise → Degree of agility	0.060		-0.095		***0.155***	***0.299***
Organizational culture → Degree of agility	0.285		0.207		***0.078***	***0.364***
Project planning → Degree of agility	0.241		0.420		***0.179***	***0.186***
Team size → Degree of agility	-0.093		0.091		***0.184***	***0.168***

Table 4.8: Results from the multigroup analysis with project position as control variable

5. Discussion

The aim of this research was to examine factors that have an affect on the degree of agility in projects. Agile project management methods have become prevalent in recent years, and a lot of research on this topic has been conducted. Researchers tend to emphasize different factors regarding successful implementation of agile methods, resulting in divergent interpretations. However, several recurring factors can, nevertheless, be found in much of the conducted research. We therefore believe it is essential to generate a collective understanding of agile methods, and to explore the recurring factors that might contribute to a higher degree of agility in project.

To go through with this research, we established a set of variables based on the recurring factors derived from research on agile project management methods. However, previous research tend to focus on the approach as a whole, meaning how to adopt the agile methods. Further, research suggest combining elements from the traditional and agile approach, meaning applying the agile methods to some degree, however, there are limited research on the "degree" of agility (Abrahamson et al., 2009, pp. 281-282). This study presents a different perspective on the agile methods, and is further limited to "projects". Our contribution is thus

to present factors that might increase the degree of agility in projects, meaning to apply the method to some degree rather than as a whole. As mentioned in section 2.4, it might be challenging for companies to be completely agile in all aspects, meaning that being agile might be a matter of degree rather than binarity.

This section will provide a discussion of the results from this research, in relation to the studied literature on agile project management methods presented in section 2.

5.1 Discussion of descriptive results

In this section the effects of the most relevant control variables will be discussed. When conducting the MGA in SmartPLS 3, the only included variable was the position within the project team. The control variables educational level and industry do, however, also show interesting finds.

Literature states that the position (role) of the project leader and team members change when agility is enforced. For a traditional approach, the project leader will have more responsibilities than the team members, whereas with an agile approach, the "role" of the project leader is to provide adaptive leadership, while the teams are more self-organizing (Hoda & Murugesan, 2016, pp. 245, 247). Due to these changes, it was interesting to see whether project leaders and team members had the same perceptions regarding agility, or if there were differences. The results from the MGA analysis showed that there were no significant differences. This also coincide with the finds from section 4.2, where it is evident that project leaders and team members have similar perception regarding degree of agility.

Literature suggest that agile teams tend to be smaller, consisting of more competent people (Lindvall et al., 2002, p. 203). Even though the hypothesis regarding "expertise" was rejected, an interesting observation was that the respondents with a higher educational level tended to work in smaller project teams than the respondents with a lower level of education. This observation corresponds to the studied literature in section 2.5.2 on expertise and project teams (Lindvall et al., 2002, p. 203). The rejection of the hypothesis might thus be due to measurement errors. This will however be discussed further in section 6.2.

Further, previous research show that the agile approach has been most prevalent in the "software and IT" industry, as presented in section 2.2.4. For this reason, it was interesting to

examine the perceived degree of agility across different industries. Results showed that all industries, except for the "agriculture, mining and fishing" industry and the "information and communication" industry, had high values regarding the degree of agility, with values varying between 3.5 and 4. This substantiates the presumption that several organizations can be agile to some degree, and that agile methods can be applied in different industries, other than the "software and IT" industry. Further, the "Information and communication" industry exhibited the lowest degree of agility. The agile management methods were assumed to be more prevalent in this industry, since it is exposed to rapid changes, and contain innovative projects. We observed that there was only one respondent reportedly working within "information and communication", which might have resulted in low values of agility. The sample size for this industry specifically, is thus not representative and the finds cannot be generalized.

5.2 Theoretical contribution

The main interest in this research was to test how the independent variables affected the degree of agility in projects. As there are limited research on this particular topic, this is the main contribution to research. This section will present the results from the hypothesized model, in relation to the studied literature provided in section 2.5.1-2.5.6.

The first hypothesis concerned the relationship between a small project team and the degree of agility in projects. This relationship is mentioned in several studies, and, among others, Lalsing et al. (2012), Cao and Chow (2008) and Bustamante and Sawhney (2011) state that agile methods are more successful with smaller project teams than larger teams. There are, however, contradicting theories on the size of the project team when agile methods are applied (Chow & Cao, 2008, p. 963; Lalsing, Kishnah & Pudaruth, 2012, p.117;Bustamante & Sawhney, 2011). It was thus interesting to examine this relationship. Although the results showed that most of the respondents worked in smaller project teams, the hypothesis was rejected. An explanation for this might be that the agile methods can be applied to larger project teams as well, which is also mentioned in section 2.5.2, meaning that the size of the team does not have an impact on the degree of agility in projects.

Hypothesis 2 suggested that the expertise of the project team had a moderating effect on the relationship between small team sizes and the degree of agility in projects. Literature suggest that organizations using agile management methods, tend to employ fewer but more competent people on a project team (Lindvall et al., 2002, p. 203). This relationship was however rejected. Despite the rejection of this hypothesis, the results showed that respondents with higher levels of education had a tendency to work in smaller project teams. Thus, to make any final conclusions on this topic, the relationship should be further investigated.

Furthermore, the third hypothesis stated that customer involvement had an impact on the degree of agility in projects. This is consistent with the finds in Misra, Kumar, and Kumar (2009), where customer commitment, customer collaboration, and customer satisfaction are important factors regarding the agile management methods. Further, other researchers suggest that customer feedback can help improve the progress of the project (Conforto et al., 2014). The hypothesis was supported, indicating that customer involvement affects the degree of agility in projects.

Hypothesis 4 made the assumption that organizational culture had a positive effect on the degree of agility in projects, and this hypothesis was supported. Several authors have previously supported this claim, and this find is thus consistent with existing literature. Research conducted by Strode et al. (2009) found that the degree to which the agile methods are implemented in an organization is affected by the organizational culture (Strode et al., 2009, p. 2-3). Sheffield and Lemetayer (2012) further found that agile organizational culture is based on, among other things, good relationships between team members, shared responsibilities and willingness to cooperate (Sheffield & Lemetayer, 2012, p. 461). The results from this research proved that there were high levels of cooperation and shared responsibility in the respondents' last completed project. Based on Qumer and Henderson-Sellers' (2008) 4-DAT approach, these finds indicate that most of the respondents worked in organizations with cooperative cultures (Qumer & Henderson-Sellers, 2008, p. 1901).

Further, hypothesis 5 implied that complex environments, with high levels of dynamism, were positively related to the adoption of the agile methods, and thus the degree of agility in projects, and this hypothesis was rejected. Despite the significance of the construct, the

direction of the relationship was negative, and thus contradicting the initial assumption. This find is thus inconsistent with existing literature, such as research conducted by Vazquez-Bustelo et al. (2007). According to this research, firms that need to adapt to high levels of dynamism, complexity, and unpredictable changes in the environment, should exhibit high levels of agility (Vazquez-Bustelo et al., 2007, pp. 1308, 1312). With a more dynamic project environment, results from this research showed that the industry that experienced most uncertainty and changes from the environment was the "information and communication" industry. However, this industry also reported the lowest levels of agility. As there was only one respondent who reportedly worked within the "information and communication" industry, the results are thus not representative for the population of this industry.

Finally, hypothesis 6 suggested that less upfront planning was positively related with the degree of agility in projects. This hypothesis was also supported. Research conducted by among others Conforto et al. (2014) and Serrador and Pinto (2015) state that a more uncertain and dynamic project environment makes it more challenging to plan an entire project in advance (Conforto et al., 2014, p. 27-29; Serrador & Pinto, 2015, p. 1041-1042). Conforto et al. (2014) further state that several project managers tend to unconsciously utilize an iterative planning approach to a certain degree (Conforto et al., 2014, p. 27-28). An interesting find in this research was that most of the respondents reported high values related to project planning. This indicate that during the respondents' last completed project, the plan for the project was gradually constructed, adjusted according to customer feedback and adaptable to changes from the environment. This was the case across all industries, except for the "information and communication" industry. This indicates that there is consistency between the finds in this research and previous literature.

This section showed that the hypotheses regarding the independent variables customer involvement, organizational culture, and project planning all had an affect on the degree of agility in projects. These finds are consistent with research conducted by Qumer & Henderson-Sellers (2008), Chow & Cao (2008), Conforto et al. (2014), Lindvall et al. (2002), and Lalsing et al. (2013). The hypotheses related to the independent variables team size and complexity in the environment, and the moderating variable expertise did, however, not prove to have an affect. Research conducted by Lalsing et al. (2002), Chow & Cao (2008), and Bustamante & Sawhney (2011) suggest that agile project management is more successful with smaller teams. This, however, proved to be insignificant in regard to the degree of

agility in the respondents' last completed project. The impact of expertise on the relationship between a small team size and the degree of agility in projects might need further investigation. This because the analysis of the control variable level of education was consistent with previous literature, even though the hypothesis was rejected. The hypothesis related to the complexity in the environment was rejected, as the relationship had the opposite direction than what was initially predicted.

The use of projects in organizations have increased gradually throughout the years, and for this reason project management methods have become significantly important. This research contributes by, firstly, providing a different perspective on agile methods, meaning the degree of agility, rather than the method as a whole. Further, this research is limited to the degree of agility in "projects", as previous research have mainly focused on agile methods in general or on the organizational level. This research thus presents a different way of managing projects, where the agile methods can be implemented to some degree, by implementing a set of factors that have proven to have an affect on the degree of agility in projects. As mentioned earlier in this thesis, it might be convenient to combine the traditional and the agile approach. However, managers might find it difficult to identify the proper elements to choose for their respective projects (Qumer & Henderson-Sellers, 2008, p. 1899). This thesis contributes by providing knowledge on factors that can increase the degree of agility in projects, and thus, assist managers with their decisions. Even though this research is limited to projects, the results can be applied on an organizational level as well. This because customer involvement, organizational culture, and less upfront planning is based on general characteristics of the agile approach.

5.3 Managerial implications

This research has three specific implications for practitioners. First, as customer involvement has proven to affect the degree of agility in projects, practitioners should ensure that customers are involved throughout the duration of the project, and provide feedback. This to assist the revision and improvement of the project plan, so that necessary changes can be made in order to increase customer satisfaction. Second, to what degree the agile management methods are implemented in a project is affected by the organizational culture. Practitioners should thus ensure that the culture in the organization is compatible with the implementation of the agile approach, and the changes that it brings. For instance, a decentralized structure, where team members have shared responsibilities and share the same

objectives, is more susceptible with the agile approach. Third, as less upfront planning is positively related to the degree of agility in projects, practitioners should attempt to implement a more iterative planning approach. This way, the plan for the project can be more flexible, and adaptable to changes from the environment. In summary, this research provides guidance, by illuminating important factors related to agility, which might assist practitioners with the implementation of the agile approach to some degree.

6. Conclusion

In this section the conclusion regarding this study will be provided. Further, limitations will be considered, before suggestions for future research will be presented.

6.1 Conclusion and contributions

The aim of this research was to examine factors that affect the degree of agility in projects. Previous research conducted on agile methods have focused on the approach as a whole, meaning how to adopt the agile methods in organizations or in projects. As there are limited research on the "degree" of agility in projects, this research presents a different perspective on the agile management methods.

To go through with this research, agility characterizations and relevant critical success factors that might increase the agility in projects were considered and assessed. The agility characterizations were based on the second dimension of Qumer and Henderson-Sellers' (2008) 4-DAT approach. Further, the critical success factors were mainly based on literature and research conducted by Chow & Cao (2008), Lindvall et al., (2002), and Conforto et al., (2014). A complete list of the used constructs and their respective sources can be found in table 3.1. The chosen factors for this research, were the recurring factors found in the studied literature. These factors can also be found in the 4-DAT approach in Qumer and Henderson-Sellers (2008), as much research on agile project management is based on "The Agile Manifesto" (2001).

When analyzing the results, we found that customer involvement, organizational culture and project planning all had a positive affect on the degree of agility in projects. These finds are consistent with the studied literature on agile project management, as they suggest that these factors are related to the implementation of the agile approach. However, the size of the team

did not appear to have an impact on the degree of agility in projects. According to Bustamante & Sawhney (2011), and Chow & Cao (2008), the agile methods are more efficient with a smaller project team. The finds in this research are thus contradicting the finds in previous literature. The hypothesis related to the expertise of the team members was also rejected. According to Lindvall et al., (2002) agile project organizations tend to hire fewer, but more competent people (Lindvall et al., 2002, p. 203). This is, however, not consistent with the finds in this research. Further, the hypothesis related to complexity in the environment was rejected, as the relationship between the variable and the degree of agility in projects was the opposite of what was initially expected. This find is thus contradicting previous literature by among other Vazquez-Bustelo (2007), that suggest that organizations in more complex environments should exhibit higher levels of agility. Further, literature suggest that the agile methods are most prominent within the "software and IT" industry. However, results from this research indicate that there are high levels of agility across all the industries accounted for in this research, except for the "information and communication" industry.

Based on the studied literature, and the finds in this study, our main contribution to research is the provision of a set of factors, that through this research, have proved to affect the degree of agility in projects. Further, this research contributes by focusing on the degree of agility, rather than the agile management methods as whole. Previous research have emphasized the transition from the traditional to the agile approach, meaning a complete adoption of the agile methods. The agile approach has thus been presented as a binary choice. This might however be a problem for organizations, as some might find it challenging to be completely agile in all aspects, and because projects might not necessarily favor a pure methodology (Qumer & Henderson-Sellers, 2008, p. 1899;Sheffield & Lemetayer, 2013, p. 462).
Even though the focus in this research has been on the degree of agility in projects, it should be underlined that the whole organization can be agile as well. The finds in this research might thus be applicable for the entire organization. For instance, the fundamentals of organizational culture can be applied to the project team, but also the organization as whole.

6.2 Limitations

Several limitations were encountered when this research was conducted, and these should be addressed. Firstly, we did not use already validated and established scales, even though this is commonly used in research (Tyssen et al., 2014, p. 381). We rather constructed new questions based on agility indicators and recurring critical success factors from previous

research. This is because there is limited research on the “degree of agility” and previous research highlight the agile approach as a whole. For this reason, it was challenging to create new scales specifically for this research. However, all utilized items proved to be both valid, and reliable.

Secondly, we used a web-based questionnaire, which has many limitations. One of these was the inability to clarify potential misinterpretations regarding the questions. For instance, when the respondents were asked how many people worked at their respective workplace, some reported the number of employees working in the entire organization. This resulted in some extreme values, which had to be adjusted. Further, we also received feedback from some respondents regarding the reference to the respondents “last completed project” in the questionnaire. They reportedly had trouble referring to their last completed project, but as this feedback came in the final stage of the data collection phase, we were not able to make any adjustments.

Further, the respondents were free to complete the questionnaire, which could lead to a low response rate due to decreased incentives. Out of the respondents who opened the questionnaire, about 26% did not finish it, leading to a small sample size for this research. For this reason, it was challenging to generalize the findings, as the sample size was not representative for the whole population.

6.3 Suggestions for future research

In this research we have explored several factors that were assumed to affect the degree of agility in projects. When analyzing the factors separately, they proved to have a moderate affect on the degree of agility in projects. The total affect of all the independent variables on the dependent variable did, on the other hand, indicate moderate to low relationships. However, as the sample size in this research was relatively low, the results cannot be generalized. For this reason, these relationships can be further explored with a larger sample size, in order to generalize the findings.

In this research we tested if team size, expertise, customer involvement, organizational culture, complexity in the environment and project planning had an affect on the degree of agility in projects. For future research, it could be interesting to look into other variables, and

test their affect on the degree of agility in projects. Potential interesting factors to look into could be the size of the project, project type (i.e. innovative) or project success.

When conducting this research, we limited the extent to projects only. It is, however, possible to explore the degree of agility for the entire organization. The finds in this study are based on indicative factors of agility in general, and might therefore also be applied to the entire organization, and not just projects. As organizations might struggle with being agile in all aspects, it can be interesting to investigate the degree of agility in the organization as a whole.

Further, the correlation between complexity in the environment and the degree of agility was assumed to be positive. Results, however, showed that the relationship was negative. This is contradicting the studied literature on this topic. Future researchers can take these assumptions into consideration, and further explore this relationship more in detail.

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Appendices

Appendix A: Questionnaire

WHEN IS IT SUITABLE TO USE AGILE MANAGEMENT METHODS IN PROJECTS, AND TO WHAT EXTENT?

Background of the study
In recent years, it has been suggested that the agile project management methods are more efficient than the traditional approaches when it comes to achieving project success. The agile methods do, in contrast to the traditional approaches, focus less on initial planning, and attempt to uphold a more flexible scope. For organizations operating in more innovative industries, with high volatility, the agile methods have proven to be suitable solutions for project management. However, even though the agile methods are argued to increase the chances of project success, they do not necessarily always prove to be the most suited methods to apply for all organizations.

To this day, several researches have been conducted regarding traditional and agile project management methods separately. However, there are limited researches on combining tools and techniques from both methods. An interesting topic to explore is whether the agile methods can be applied to some degree, or if it is a matter of binarity, meaning that you can only fully apply one method.

The aim of the study
The aim of this study is to explore the main factors that make agile project management suitable, and determine to what extent the agile methods are applied in projects.

This study is conducted by a research team at the School of Business and Law, at the University of Agder.

Duration
The questionnaire should take about 5-7 minutes to complete. Your time and contribution would be very helpful, and much appreciated!

Confidentiality
The data collected in this study is for scientific purposes only. All data is anonymized, and no personal information regarding you or the company you work for will be exposed in any way.

Contact
If you have any questions regarding this study, you are more than welcome to contact us on email:
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Researcher: Shanga Mohammad (Master Student) - shangm15@student.uia.no

[1. Team size]

1. On average, how many people do you normally work with on a project?

_____

*When answering the following questions, please refer to the **last completed project** you worked on.*

2. When working on the project:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
I felt there were too few people on my team	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
I felt there were too many people on my team	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
I think the project would have been more successful with a smaller team	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The team I worked with was located at the same place	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
I had sufficient knowledge to work on the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The people on my team had sufficient knowledge to work on the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The tasks I was assigned were beyond my level of expertise	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

*When answering the following questions, please refer to the **last completed project** you worked on.*

[2. Customer involvement]

3. When working on the project:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
I collaborated closely with customers during the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Customers participated in the startup of the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Customers provided feedback throughout the duration of the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Customer feedback was helpful for the progress of the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Customer feedback was taken into account in the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Customers were satisfied with the outcome of the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

*When answering the following questions, please refer to the **last completed project** you worked on.*

[3. Organizational culture]

4. When working on the project, I felt that:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Decisions were made mainly by the project manager	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Decisions were made through cooperating within the project team	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The project manager and team members shared the same objectives	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
There was good cooperation between the team members	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
There was strong competition between the team members	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
There was shared responsibility between the team members	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Tasks were arranged and appointed to team members	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
It was difficult to interact with my team	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
It was difficult to express my opinion	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
I had an impact on what happened in the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

5. During my last completed project, working in a team made me feel:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
Motivated	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Encouraged	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Included	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Happy	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Enthusiastic	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Empowered	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Stressed	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Frustrated	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
Insignificant	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

*When answering the following questions, please refer to the **last completed project** you worked on.*

[4. Complexity in the environment]

6. When working on the project:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
The project environment was characterized by high uncertainty and risk	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The project was exposed to rapid changes in the environment	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
It was difficult to foresee problems and risks	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The project was innovative and technologically advanced	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The project environment was stable and predictable	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

*When answering the following questions, please refer to the **last completed project** you worked on.*

[5. Project planning]

7. When working on the project:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
The plan for the project was constructed by the project manager	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
I participated in the planning process	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The plan for the project was ready before the project started	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The plan for the project was gradually constructed as the project moved forward	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The plan for the project was adjusted according to customer feedback	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The plan for the project was adaptable to changes from the environment	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

8. When working on the project:

Choose **one or more** alternatives

(1) ❑ There were daily meetings regarding the project

(2) ❑ There were weekly meetings regarding the project

(3) ❑ There were monthly meetings regarding the project

(4) ❑ There were few meetings regarding the project

*When answering the following questions, please refer to the **last completed project** you worked on.*

[6. Agility]

9. When working on the project:

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
We were able to accommodate expected or unexpected changes	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

	Strongly disagree	Disagree	Neither disagree nor agree	Agree	Strongly agree
We were able to react to changes in customer request, and implement solutions accordingly	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The management method used produced quick results	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The management method used was economically efficient	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The management method used economical, but high quality instruments to steer the project	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The management method used a short time span	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑
The management method used, applied prior knowledge and experience to create a learning environment	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑

[7. Background]

10. What kind of position did you have during your <u>last completed project</u>:

(1) ❑ Project manager / Leader

(2) ❑ Project team member

(3) ❑ Other _____

11. Which industry does your firm belong to:

(1) ❑ Agriculture, mining, fishing

(2) ❑ Manufacturing industry (construction & oil and gas included)

(4) ❑ Information and communication

(5) ❑ Software and IT industry

(6) ❑ Financial services, insurance and real estate

(8) ❑ Retail, transport, hospitality, tourism

(9) ❑ Public sector, education, health

(7) ❑ Other _____

12. What is the number of people in full time equivalence in your company?

_____

13. Age? (in numbers)

_____

14. Gender?

(1) ❑ Female

(2) ❑ Male

15. What is your level of education?

(1) ❑ Primary school

(2) ❑ Secondary school

(3) ❑ Undergraduate (bachelor's degree)

(4) ❑ Graduate (master's degree)

(5) ❑ Postgraduate (Ph.D.)

16. For how many years have you been working?

_____

17. How many years of experience do you have with project work?

_____

18. Based on your total working hours, what is the percentage used on project work?

_____

Thank you very much for your participation!

Appendix B: NSD – results from notification test

Result of Notification Test: Not Subject to Notification

You have indicated that neither directly or indirectly identifiable personal data will be registered in the project.

If no personal data is to be registered, the project will not be subject to notification, and you will not have to submit a notification form.

Please note that this is a guidance based on information that you have given in the notification test and not a formal confirmation.

For your information: *In order for a project not to be subject to notification, we presuppose that all information processed using electronic equipment in the project remains anonymous.*

Anonymous information is defined as information that cannot identify individuals in the data set in any of the following ways:

- *directly, through uniquely identifiable characteristic (such as name, social security number, email address, etc.)*
- *indirectly, through a combination of background variables (such as residence/institution, gender, age, etc.)*
- *through a list of names referring to an encryption formula or code, or*
- *through recognizable faces on photographs or video recordings.*

Furthermore, we presuppose that names/consent forms are not linked to sensitive personal data.

Kind regards,
NSD Data Protection

NSD – Norsk senter for forskningsdata AS Harald Hårfagres gate 29 Tel: +47-55 58 21 17 nsd@nsd.no Org.nr. 985 321 884
NSD – Norwegian Centre for Research Data NO-5007 Bergen, NORWAY Faks: +47-55 58 96 50 www.nsd.no

Appendix C: Constructs and their respective items

Construct	Indicator	Items
Team size	1.1.	On average, how many people do you normally work with on a project?
Expertise	2.5.	I had sufficient knowledge to work on a project
	2.6.	The people on my team had sufficient knowledge to work on the project
	2.7.	*The tasks I was assigned, were beyond my level of expertise*
Customer involvement	3.1.	I collaborated closely with customers during the project
	3.2.	Customers participated in the startup of the project
	3.3.	Customers provided feedback throughout the duration of the project
	3.4.	Customer feedback was helpful for the progress of the project
	3.5.	Customer feedback was taken into account in the project
	3.6.	Customers were satisfied with the outcome of the project
Organizational culture	*4.1.*	*Decisions were made mainly by the project manager*
	4.2.	Decisions were made through cooperation within the project team
	4.3.	The project manager and team members shared the same objectives
	4.4.	There was good cooperation between team members
	4.5.	*There was strong competition between team members*
	4.6.	There was shared responsibilities between team members
	4.7.	*Tasks were arranged and appointed to team members*
	4.8.	*It was difficult to interact with my team*
	4.9.	*It was difficult to express my opinion*
	4.10.	*I had an impact on what happened in the project*
Complexity in the environment	6.1.	The project environment was characterized by high uncertainty and risk
	6.2.	The project was exposed to rapid changes in the environment
	6.3.	It was difficult to foresee problems and risks

	6.4.	*The project was innovative and technologically advanced*
	6.5.	*The project environment was stable and predictable*
Project planning	*7.1.*	*The plan for the project was constructed by the project manager*
	7.2.	*I participated in the planning process*
	7.3	*The plan for the project was ready before the project started*
	7.4.	The plan for the project was gradually constructed as the project moved forward
	7.5.	The plan for the project was adjusted according to customer feedback
	7.6.	The plan for the project was adaptable to changes from the environment
Degree of agility	9.1.	We were able to accommodate expected or unexpected changes
	9.2.	We were able to react to changes in customer request, and implement solutions accordingly
	9.3.	The management method used produced quick results
	9.4.	The management method used was economically efficient
	9.5.	*The management method used economical, but high quality instruments to steer the project*
	9.6.	*The management method used a short time span*
	9.7.	*The management method used, applied prior knowledge and experience to create a learning environment*

*Items written in grey cursive, were excluded due to low loadings.

Appendix D: Table of skewness and kurtosis

Items	Skewness	Kurtosis
1.1.	2.168	5.164
2.5.	-0.832	0.956
2.6.	-1.183	1.630
3.1.	-1.387	1.904
3.2.	-1.230	1.811
3.3.	-1.202	1.921
3.4.	-1.220	1.511
3.5.	-1.380	3.473
3.6.	-0.654	0.372
4.2.	-1.506	6.430
4.3.	-0.819	1.457
4.4.	-1.359	2.757
4.6.	-0.727	0.676
6.1.	0.028	-0.982
6.2.	-0.204	-0.969
6.3.	-0.307	-1.128
7.4.	-0.869	0.167
7.5.	-1.065	1.364
7.6.	-0.713	0.785
9.1	-0.653	1.356
9.2.	-1.117	2.073
9.3.	-0.349	-0.086
9.4.	-0.274	-0.131

Appendix E: Table of outer loadings

	Complexity in the environment	Customer involvement	Degree of agility	Expertise	Organizational culture	Project planning	Team size
1.1							1.000
2.5				0.583			
2.6				0.860			
3.1		0.664					
3.2		0.558					
3.3		0.765					
3.4		0.795					
3.5		0.808					
3.6		0.772					
4.2					0.655		
4.3					0.791		
4.4					0.828		
4.6					0.761		
6.1	0.783						
6.2	0.753						
6.3	0.813						
7.4						0.727	
7.5						0.794	
7.6						0.779	
9.1			0.834				
9.2			0.688				
9.3			0.840				
9.4			0.597				

Appendix F: Table of cross loadings

	Complex environments	Customer involvement	Degree of agility	Expertise	Organizational culture	Project planning	Team size
1.1	0.308	0.046	-0.085	-0.092	-0.056	0.114	**1.000**
2.5	-0.178	0.063	0.111	**0.583**	0.068	0.136	0.057
2.6	0.002	0.204	0.176	**0.860**	0.236	0.246	-0.149
3.1	0.022	**0.664**	0.189	0.133	0.215	0.210	0.098
3.2	-0.072	**0.558**	0.142	0.078	0.059	0.042	0.165
3.3	0.178	**0.765**	0.276	0.157	0.125	0.239	0.133
3.4	0.131	**0.795**	0.349	0.152	0.284	0.453	0.049
3.5	0.057	**0.802**	0.370	0.212	0.354	0.366	0.068
3.6	-0.143	**0.772**	0.535	0.128	0.433	0.233	-0.104
4.2	-0.024	0.259	0.386	0.06	**0.655**	0.227	-0.088
4.3	-0.180	0.301	0.454	0.226	**0.791**	0.342	-0.049
4.4	-0.106	0.341	0.384	0.223	**0.828**	0.239	-0.030
4.6	-0.075	0.276	0.339	0.233	**0.761**	0.254	0.004
6.1	**0.783**	-0.124	-0.228	-0.046	-0.182	0.058	0.323
6.2	**0.753**	0.118	-0.218	0.073	-0.108	0.010	0.121
6.3	**0.813**	0.042	-0.272	-0.205	-0.034	-0.062	0.270
7.4	0.102	0.152	0.345	0.172	0.128	**0.727**	0.106
7.5	-0.044	0.406	0.384	0.179	0.274	**0.794**	0.005
7.6	-0.051	0.296	0.403	0.264	0.394	**0.779**	0.152
9.1	-0.316	0.366	**0.834**	0.123	0.582	0.401	-0.120
9.2	-0.172	0.496	**0.688**	0.064	0.272	0.346	-0.023
9.3	-0.215	0.303	**0.840**	0.188	0.384	0.360	-0.058
9.4	-0.187	0.264	**0.597**	0.255	0.243	0.366	-0.033

Appendix G: Table of HTMT values

	Complexity in the environment	Customer involvement	Degree of agility	Expertise	Organizational culture	Project planning	Team size
Complexity in the environment							
Customer involvement	0.224						
Degree of agility	0.419	0.533					
Expertise	0.524	0.546	0.615				
Organizational culture	0.251	0.426	0.664	0.791			
Project planning	0.130	0.520	0.719	0.792	0.486		
Team size	0.366	0.151	0.092	0.349	0.065	0.041	

Appendix H: Reflection paper – Anine Andresen

The purpose of this reflection paper is to reflect over the knowledge I have gained over the course of this master program, mainly by relating the master thesis to three broad themes; international, innovation and responsibility. The reflection paper is a part of the master thesis related to Business and Administration at the School of Business and Law, at the University of Agder. This paper will commence by a short description of the chosen topic for the master thesis, before the main results and conclusions will be presented. Further, the findings will be related to the three core areas internationalization, innovation and responsibility, before concluding remarks will be provided.

The main topic of our master thesis was "Agile project management: The degree of agility in projects", and in this research we wanted to quantitively explore factor that affect the degree of agility in projects. Agile project management methods have been prevalent in recent years, as a response to more volatile environments, and changing technologies and business requirements. Over the past decade, the research on agile project management methods have become quite extensive. The main focus has, however, been on the agile management approach as a whole. Some researchers have suggested combining elements from the traditional and agile management approach, meaning applying agile methods to some degree, as a response to organizations and projects having difficulties with being completely agile (Qumer & Henderson-Sellers, 2008; Abrahamson et al., 2009). There are, however, limited research on the "degree of agility", which is why this topic was highly relevant. Our research was limited to projects.

To go through with our research, we utilized an online questionnaire to collect the necessary data. The items in the questionnaire were based on recurring critical success factors related to agility in previous literature, as well as Qumer and Henderson-Sellers (2008) agility characterization. For this research, we wanted to explore if the variables team size, customer involvement, organizational culture, complexity in the environment and less upfront project planning had an affect on the degree of agility in projects. The moderating effect of expertise among team members was also included. The questionnaire was distributed to several project organizations across the Nordic countries, as well as several companies and project managers in Norway. The analysis for this research was thus based on the 98 respondents who completed the questionnaire. The data was analyzed by utilizing PLS-SEM. The results of the

analysis proved that the variables customer involvement, organizational culture and less upfront project planning had an affect on the degree of agility in project. These finds were consistent with the finds in previous literature. The remaining variables team size, complexity in the environment and expertise did, however, appear not to have an affect on the degree of agility in projects, and these finds thus contradict previous literature on this topic. In summary, our research contributes by presenting a new perspective on agile management methods, by identifying factors that have an affect on the degree of agility in projects.

The topic of this research can be related to international trends in various ways. Organizations all over the world have become more project based throughout the years, as a way to achieve their business goals more economically (Blomquist & Müller, 2006, p. 52). The increased use of projects in organizations can thus be seen as a trend. Further, the increased use of projects has led to a greater focus on utilizing the proper management method, in order to execute projects more efficiently (Jerbrant, 2013, p. 365-366). This is also highly relevant as the environment have become more volatile. The agile project management methods provide a more flexible scope than the traditional approach, which is an important feature in more dynamic project environments. However, as previously stated, some organizations and projects might have difficulties with being completely agile. Further, project managers might find it challenging to select which elements to choose, when they try to adopt the agile methods to some degree (Qumer & Henderson-Sellers, 2008, p. 1899). This research can thus be used as a general guidance for project managers, to help them assess which elements to choose, if they want to adapt a more flexible approach to project management. Further, as there have been a global change in project environments, the agile methods to managing projects have gained international attention, and is a frequently researched topic. When the online questionnaire was distributed, several companies and organizations in the Nordic countries were contacted, and asked to participate and help distribute the survey further. As many found the research topic interesting, they agreed to help us. As some also asked for a summary of the study, it proves that there are both domestic and international interest in the research topic.

The topic in our research can also be related to innovation. As stated in the thesis, and also earlier in the reflection note, researchers have suggested combining elements from the traditional and agile management approach, as a solution to projects or organizations having difficulties with being completely agile (Qumer & Henderson-Sellers, 2008, p. 1899). There

is, however, limited research on this matter. Based on this, one can say that there is a research gap related to the adoption of agile management methods to some degree. This is further supported, as much research on agile methods have presented the adoption of the agile approach as a binary choice, meaning an all-or-nothing approach (Greenfield & Short, 2004, p. 123). This research thus attempts to present a new perspective on the adoption agile management methods, by exploring factors that affect the degree of agility in projects.

Finally, the topic in this research can also be related to responsibility. In general, project managers have a certain responsibility related to the implementation of the most efficient and economical management method when working on projects. As previously stated, the utilization of the proper management method is especially important, as the use of projects in organizations have increased (Jerbrant, 2013, p. 365-366). For agile project management methods, that have a more decentralized structure, the responsibility extends to the project team as well. This is because agile management methods have a greater focus on more self-management, and shared responsibility among team members in projects. If these responsibilities are not upheld, it can affect the entire organization, both economically and timewise.

To summarize, the increased use of projects in organizations can be seen as an international trend, which has led to a greater focus on utilizing the proper management method in projects. Our master thesis attempts to present a new perspective on agile management methods, by presenting factors that affect the degree of agility in projects. Further, as agile management methods have a more decentralized structure, the responsibility related to the execution of projects is shared between the project manager and team members.

The process of writing this master thesis has been very interesting and educational, but also challenging. I have gained a lot of knowledge regarding agile project management, partial least squares structural equation modelling (PLS-SEM), which was utilized to analyze the results, while I have also been able to reflect over how our master thesis can be related to broader themes such as internationalization, innovation and responsibility. When writing this thesis, the two courses in the master and bachelor program related to research methods in business have been very helpful. These courses did, among other things, provide guidance related to the creation of the questionnaire, sampling and distribution, and to assess the validity and reliability of the measurement models.

References for the reflection paper:

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Appendix I: Reflection paper – Shanga Mohammad

The School of Business and Law, at the University of Agder, requires that candidates writing their master thesis also write a reflection paper. The reflection paper is written, to present academic knowledge obtained through the masters' program, in addition to learning generated by writing the master thesis. First, a summary of the main theme, findings, and conclusions of this research will be provided, before the main theme is presented in relation to three broad topics, namely, international, innovation, and responsibility.

The main theme of this research was "Agile Project Management: The degree of Agility in Projects". Further, the purpose of the research was to explore factors that affect the degree of agility in projects. For the past decade, research on agile management methods have emphasized topics, such as the transition from the traditional to the agile approach, and critical success factors related to agile methods (Qumer & Henderson-Sellers, 2008; Chow & Cao, 2008). Based on previous research, it seems that the implementation of the agile management methods appears to be a binary choice, meaning an all-or-nothing approach (Greenfield & Short, 2004, p.123). However, a project might not lean towards only one methodology (Sheffield & Lemétayer, 2012, p. 462). For this reason, it was interesting to explore the degree of agility, rather than the agile management approach as a whole. This research was further limited to projects, as the use of projects have increased significantly throughout the years (Jerbrant, 2013, p.365). The following factors; a small team size, customer involvement, organizational culture, complexity in the environment, and project planning were assumed to have positive affects on the degree of agility in projects. Further, a moderating variable, expertise, was assumed to affect the relationship between a small team size and the degree of agility in projects (Chow & Cao, 2008; Qumer & Henderson-Sellers, 2008).

To explore the hypothesized relationships, a quantitative method was chosen by utilizing a web-based questionnaire, which was distributed to several project organizations in the Nordic countries. The final analysis was conducted in PLS-SEM based on 98 respondents' answers. Results showed that the independent variables customer involvement, organizational culture, and project planning all had positive effects on the degree of agility in projects. The independent variables team size, and complexity in the environment, as well as the moderating variable, expertise, proved to have no effect on the degree of agility in projects.

As the sample size for this research was very low, further research was recommended in order to investigate these relationships further. This research contributed by, among other things, providing a different perspective on the agile management methods, namely the degree of agility. It further highlighted some important factors that affect the degree of agility in project. This can assist managers choose the proper elements when combining agile and plan-driven methods, for their projects (Qumer & Henderson-Sellers, 2008, p.1899).

The theme of this research relates to broader international trend by underlining relevant topics in the business environment. Firstly, it highlights the concept of project management, as it has become a highly relevant topic on a global level. This because organizations have become more project based. The projectification of the society, and projects being used as a part of modern and organic organizational model, have grown tremendously throughout the years (Jerbrant, 2013, p.365-366). Secondly, as markets have become more volatile due to rapid changes in the environment, illuminating more efficient approaches to managing projects is highly important and internationally appreciated. As the traditional, plan-based approach loses its efficiency for such environments, more adaptable and flexible approaches are needed. The agile management methods thus has emerged as a response to these changes (Abrahamsson, Conboy & Wang, 2009, p. 281; Hoda & Murugesan, 2016, p. 245). For this reason, agile project management methods in general, and the degree of agility in projects, relates to broader international trend.

The research topic also relates to innovation by providing knowledge on a more efficient approach to managing complex and innovative projects. Innovation can be translated to creation of new solutions or ideas. For this research, we did not choose a specific organization or industry, it is therefore challenging to identify any gaps. However, the topic relates to innovation by considering a management approach that is commonly used for innovative, and technologically advanced projects. The rapid changes in the global economy, technology, and society, have led to increased complexity for project environments. These fundamental changes called for a more flexible, and efficient solutions to managing projects, as traditional approaches do not match with these changes (Augustine, Payne Sencindiver & Woodcock, 3005, p.85). Agile project management is stated to impact project success, as it can reduce costs and improve productivity, quality, and the business satisfaction (Mishra & Mishra, 2011, p 549). It is further, characterized by its flexibility to adapt to changes in the environment, which can lead to more efficiency for project management. Agile project

management approach is thus related to innovation, since it emerged as a response to satisfy the need for a more efficient management approach, due to highly innovative and technologically advanced projects (Abrahamsson et al., 2009, p 281). Moreover, Agile management methods was initially created to correspond to the complexity of software and IT projects, which is a globally relevant topic, considering increased digitalization which can foster innovation in the global economy, and society.

Further, the topic can be linked to the theme of responsibility. For this research responsibility can be discussed in relation to organizations, project leaders, and project team members. Firstly, organizations can implement an organizational culture that is compatible with the agile management approach. Research suggest that, for the agile approach, an adhocratic and decentralized structure is preferred. Further, the organizational culture should consist of cooperation between employees, who all share the same objectives (Strode, Huff & Tretiakov, 2009, p. 2-3). This makes the organization responsible for implementing the right organizational culture, in order to correspond to the implementation of the agile approach. At the group and individual level, team leaders, and team members are responsible for seeking out to implement the most efficient and suitable management methods. This to increase the productivity, quality, and business satisfaction for a project. They are also responsible for ensuring good cooperation, communication, engagement, and also taking responsibility when working on a project (Sheffield & Lemétayer, 2012, p.461). Further, when a project does not favor a pure methodology, managers might seek out to combine some elements from the traditional and the agile management methods (Qumer & Henderson-Sellers, 2008, p. 1899). For this reason, managers are responsible for identifying and implementing factors that affect the degree of agility in their projects.

As discussed, the theme of this research relates to three broad topics, namely international, innovation, and responsibility. The increased use of projects in organizations, have led to greater focus on more efficient management approaches, one of them being agile management methods. This has become an international trend, which can also support innovation. Further, organizations, managers, and employees are responsible for the implementation of the agile methods. The finds in this research were interesting as some of the hypothesized relationships proved to be true, while others were rejected. However, further investigation should be conducted with a larger sample size, in order to provide any final statements regarding these relationships. Working on this research, has been incredibly

educational and challenging. It has been a tough, yet exciting journey to get more in-depth understanding on topics that I find interesting. This thesis provided me with the opportunity to show my existing knowledge regarding research methods and analysis, and to further improve my skills in this area. Further, I wrote my thesis with Anine Andresen, and the team work consisted of incredibly good cooperation, excitement, and high degree of learning. To summarize, I have not only generated knowledge on agile management methods, but also used the knowledge that I have obtained throughout the masters' program. I also had the opportunity to cooperate with someone that shared the same interest as me for this research. For these reasons, I would like to express my gratitude to the School of Business and Law, at the University of Agder, for providing me with this opportunity.

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